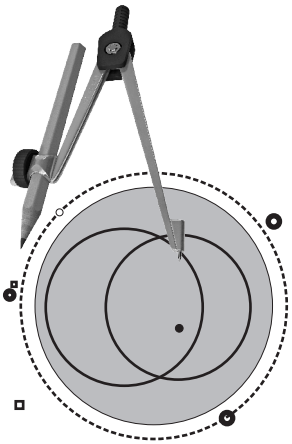
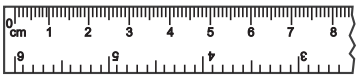
Progress With Maths

Teachers Manual





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1. Integers

Exercise 1.1

1. (a) Here the difference of 6000 and 3000

$= 6000 - 3000 = 3000$

Now, we put the sign of 6000 (greater of 6000 and 3000) ahead of the difference.

$$\begin{array}{r} 6000 \\ -\,3000 \\ \hline 3000 \end{array}$$

Hence, the sum of $(-6000) + 3000 = \mathbf{-3000}$ **Ans.**

(b) Here, the difference of 33 and $9 = 33 - 9 = 24$

Hence, the sum of 33 and $-9 = \mathbf{24}$ **Ans.**

(c) Here, the difference of 22 and $23 = 23 - 22 = 1$

Now, we put the sign of 23 (greater of 23 and 22) ahead of the difference.

$$\begin{array}{r} 23 \\ -\,22 \\ \hline 1 \end{array}$$

Hence, the sum of 22 and $-23 = \mathbf{-1}$ **Ans.**

(d) Here both the integers are negative. Thus we will add 612 and 487 (without considering the signs) to get 1099, then we put the common sign $(-)$ ahead of the sum. Thus we get -1099.

$$\begin{array}{r} 612 \\ +\,487 \\ \hline 1099 \end{array}$$

Hence, the sum of -612 and $-487 = \mathbf{-1099}$ **Ans.**

(e) Here, the difference of 325 and $36 = 325 - 36 = 289$

$$\begin{array}{r} 325 \\ -\,36 \\ \hline 289 \end{array}$$

Hence, the sum of 325 of $-36 = \mathbf{289}$ **Ans.**

(f) Here the difference of 82 and $12 = 82 - 12 = 70$

Now, we put the sign of 82 (greater of 82 and 12) ahead of the difference.

$$\begin{array}{r} 82 \\ -\,12 \\ \hline 70 \end{array}$$

Hence, the sum of -12 and $82 = \mathbf{70}$ **Ans.**

(g) Here, the difference of 39 and $35 = 39 - 35 = 4$

Now, we put the sign of 39 (greater of 39 and 35) ahead of the difference.

$$\begin{array}{r} 39 \\ -\,35 \\ \hline 4 \end{array}$$

Hence, the sum of -39 and $35 = \mathbf{-4}$ **Ans.**

(h) Using the above rule we get,

$$\begin{array}{r} 425 \\ -\,36 \\ \hline 389 \end{array}$$

Hence, the sum of 425 and $-36 = \mathbf{389}$ **Ans.**

(i) Here, the difference of 50 and $37 = 50 - 37 = 13$

Now, we put the sign of 50 (greater of 50 and 37) ahead of the difference.

$$\begin{array}{r} 50 \\ -\,37 \\ \hline 13 \end{array}$$

Hence, the sum of -50 and $37 = \mathbf{-13}$ **Ans.**

(j) Here the difference of 37 and $32 = 37 - 32 = 5$

Now, we put the sign 37 (greater of 37 and 32) ahead of the difference.

$$\begin{array}{r} 37 \\ -\,32 \\ \hline 5 \end{array}$$

Hence, the sum of -37 and $32 = \mathbf{-5}$ **Ans.**

(k) Here, the difference of 380 and $15 = 380 - 15 = 365$

Now, we put the sign of 380 (greater of 380 and 50) ahead of the difference.

$$\begin{array}{r} 380 \\ -\,15 \\ \hline 365 \end{array}$$

Hence, the sum of 380 and $-15 = \mathbf{365}$ **Ans.**

(l) Here, both the integers are negative. Thus, we will add 77 and 88 (without considering the signs) to get 165, then we put the common sign $(-)$ ahead of the sum. Thus, we get -165.

Therefore,
$$\begin{array}{r} 77 \\ +\,88 \\ \hline 165 \end{array}$$

Hence, the sum of -77 and $-88 = \mathbf{-165}$ **Ans.**

2. (a) $12 + [(-13) + 14] = [12 + (-13)] + 14 =$ **Associative property** **Ans.**

(b) $(-25) + (-65) = (-65) + (-25) =$ **Commutative property** **Ans.**

(c) $(-13) + (-14) = -27$ (integer) = **Closure property** **Ans.**

(d) $(-6) + (-8) = (-8) + (-6) =$ **Commutative property** **Ans.**

(e) $21 + (22 + 23) = (21 + 22) + 23 =$ **Associative property** **Ans.**

(f) $6 + 0 = 6 =$ **Additive identity** **Ans.**

(g) $(-40) + 0 = -40 =$ **Additive identity** **Ans.**

(h) $37 + (-38) = (-38) + 37 =$ **Commutative property** **Ans.**

3. If by adding a number to an integer, we get additive identity (0), for any integer a, a and $(-a)$ are additive inverse of each other.

(a) Additive inverse of $6 = \mathbf{-6}$ **Ans.**

(b) Additive inverse of $13 = \mathbf{-13}$ **Ans.**

(c) Additive inverse of $-35 = \mathbf{35}$ **Ans.**

(d) Additive inverse of $-79 = \mathbf{79}$ **Ans.**

(e) Additive inverse of $10 = \mathbf{-10}$ **Ans.**

(f) Additive increase of $622 = \mathbf{-622}$ **Ans.**

(g) Additive inverse of $782 = \mathbf{-782}$ **Ans.**

(h) Additive inverse of $921 = \mathbf{-921}$ **Ans.**

4. We have,

(a) 0 from $80 = 80 - 0 = \mathbf{80}$ **Ans.**

(b) 400 from $0 = 0 - (400) = \mathbf{-400}$ **Ans.**

(c) (-51) from $72 = 72 - (-51) = 72 + 51 = \mathbf{123}$ **Ans.**

(d) (-800) from $300 = 300 - (-800) = 300 + 800 = \mathbf{1100}$ **Ans.**

(e) 80 from $-60 = -60 - (80) = -60 - 80 = \mathbf{-140}$ **Ans.**

(f) 12 from $52 = 52 - 12 = \mathbf{40}$ **Ans.**

(g) (-20) from $(-31) = (-31) - (-20) = -31 + 20 = \mathbf{-11}$ **Ans.**

(h) (-650) from$(-250) = -250 - (-650) = -250 + 650 = \mathbf{400}$ **Ans.**

(i) -300 from $200 = 200 - (-300) = 200 + 300 = \mathbf{500}$ **Ans.**

(j) 34 from $(-5) = -5 - (34) = -5 - 34 = \mathbf{-39}$ **Ans.**

(k) 82 from $87 = 87 - (82) = 87 - 82 = \mathbf{5}$ **Ans.**

(l) 950 from $5 = 5 - (950) = 5 - 950 = \mathbf{-945}$ **Ans.**

5. Given $a = 22,\ b = 25,\ c = 30$

(a) **Closure property for addition** : If a and b are any two integers, then $a + b$ is also an integer.

Check : $a + b =$ integer

$22 + 25 = 47$ (integer) **[$\because$ $a = 22$ and $b = 25$]** **Ans.**

(b) **Closure property for subtraction** : If a and b are any two integers, then $(a - b)$ is also an integer.

Check : $a - b =$ integer

$22 - 25 = -3$ (integer)**[$\because$ $a = 22$ and $b = 25$]** **Ans.**

(c) **Commutativity for addition** : If a and b are two integers, then $a + b = b + a$

Check : $22 + 25 = 25 + 22$ **[$\because$ $a = 22$ and $b = 25$]**

Now, $a + b = 22 + 25 = 47$

and $b + a = 25 + 22 = 47$ both are equal. **Ans.**

(d) **Commutativity for subtraction** : If a and b are two integers, then $a - b \neq b - a$

Check : $a - b = 22 - 25 = 22 + (-25) = -3$

and $b - a = 25 - 22 = 25 + (-22) = 3$

$\therefore$ $\mathbf{a - b \neq b - a}$

Hence, we can say that the commutative property does not hold in subtraction of integers. **Ans.**

(e) **Associativity for addition** : If a, b and c are three integers,

then $(a+b)+c=a+(b+c)$

Check : $(22+25)+30=22+(25+30)$

Now, $(a+b)+c=(22+25)+30=47+30=77$

and $a+(b+c)=22+(25+30)=22+55=77$

(Both are equal.)

Hence, $\boldsymbol{(a+b)+c=a+(b+c)}$ **Ans.**

6. Here, the difference of 40 and $35=40-35=5$

Now, we put the sign of 40 (greater of 40 and 35) ahead of the difference.

$$\begin{array}{r} 40 \\ -35 \\ \hline 5 \end{array}$$

Hence, the sum of 35 and $-40=-5$ **Ans.**

Now, we subtract -5 from $6=6-(-5)=6+5=$ **11** **Ans.**

7. Here, the difference of 300 and $300=300-300=0$

$=300+(-300)=300-300=0$

Hence, the sum of 300 and $-300=$ **0** **Ans.**

Now, we subtract 400 from $0=0-(400)=$ **-400** **Ans.**

8. Here, the difference of 450 and $200=450-200=250$

Now, we put the sign of 450 (greater of 450 and 200) ahead of the difference.

$$\begin{array}{r} 450 \\ -200 \\ \hline 250 \end{array}$$

Hence, the sum of 450 and $-200=$ **250** **Ans.**

Now, the sum of -450 and 200.

Using the above rule, we get

$$\begin{array}{r} 450 \\ -200 \\ \hline 250 \end{array}$$

Hence, the sum of -450 and $200=$ **-250** **Ans.**

Here, we see that the sum of 450 and (-200) is greater.

Now, $250-(-250)=250+250=500$

Hence, the sum of 450 and (-200) is greater = **500** **Ans.**

9. The sum of two integers $=0$

$\because$ One integer $=35$

$\therefore$ Second integer $=0-(35)=0-35=-35$

Hence, **the second integer is** -35. **Ans.**

10. (a) The sum of two integers is **negative**. **Ans.**

(b) The sum of two positive integers is **positive**. **Ans.**

(c) The smallest natural number is **1** and the smallest whole number is **0**. **Ans.**

(d) The sum of an integer and its additive inverse is **0**. **Ans.**

(e) The integers on the left of 0 are **negative** integers on the right of 0 are **positive** integers. **Ans.**

Exercise 1.2

1. (a) Here, both integers have different sign.

$\therefore \quad 38 \times (-5) = -38 \times 5 = \mathbf{-190}$ **Ans.**

(b) Here, both integers has same sign.

$\therefore \quad 27 \times 19 = +(27 \times 19) = \mathbf{513}$ **Ans.**

(c) Here, both integers have different sign.

$\therefore \quad -35 \times 45 = -(35 \times 45) = \mathbf{-1575}$ **Ans.**

(d) Here, both integers have same sign.

$\therefore \quad (-49) \times (-49) = 49 \times 49 = \mathbf{2401}$ **Ans.**

(e) Here, both integers have different sign.

$\therefore \quad 62 \times (-2) = -(62 \times 2) = \mathbf{-124}$ **Ans.**

(f) Here, both integers have different sign.

$\therefore \quad 71 \times (-42) = -(71 \times 42) = \mathbf{-2982}$ **Ans.**

(g) Here, both integers have different sign.

$\therefore \quad -28 \times 41 = -(28 \times 41) = \mathbf{-1148}$ **Ans.**

(h) Here, both integers have different sign.

$\therefore \quad 352 \times (-300) = -(352 \times 300) = \mathbf{-105600}$ **Ans.**

2. (a) $22 \times 23 \times 15 = (22 \times 23) \times 15 = 506 \times 15 = \mathbf{7590}$ **Ans.**

(b) $25 \times (-3) \times 22 = -(25 \times 3) \times 22 = -75 \times 22 = \mathbf{-1650}$ **Ans.**

(c) $30 \times (-30) \times (-52) = -(30 \times 30) \times (-52) = -900 \times (-52)$
$= -(900 \times 52) = \mathbf{-46800}$ **Ans.**

(d) $(-30) \times (-40) \times (-50) = -(30 \times 40) \times (-50)$
$= -1200 \times (-50) = (1200 \times 50) = \mathbf{60000}$ **Ans.**

(e) $(-7) \times (-832) \times 0 = 7 \times 832 \times 0 = 5824 \times 0 = \mathbf{0}$ **Ans.**

(f) $402 \times (-250) \times 10 = -(402 \times 250) \times 10$
$= -100500 \times 10 = \mathbf{-1005000}$ **Ans.**

(g) $25 \times 12 \times (-3) = (25 \times 12) \times (-3)$
$= 300 \times (-3) = -(300 \times 3) = \mathbf{-900}$ **Ans.**

(h) $(-8) \times (-382) \times 0 = (8 \times 382) \times 0 = 3056 \times 0 = \mathbf{0}$ **Ans.**

(i) $642 \times 35 \times (-1) = (642 \times 35) \times (-1) = 22470 \times (-1) = \mathbf{-22470}$ **Ans.**

3. (a) $-18\times\left(\frac{-1}{18}\right)=\mathbf{1}$, Multiplication inverse because

$$(-a)\times\frac{-1}{a}=1$$

Ans.

(b) $\mathbf{-15}\times\left(\frac{1}{-15}\right)=1$, Multiplication inverse because

$$(-a)\times\left(\frac{1}{-a}\right)=1$$

Ans.

(c) $(-3)\times 12=12\times\mathbf{(-3)}=$ Commutative property because $a\times b=b\times a$. **Ans.**

(d) $8\times 9=9\times\mathbf{8}$, Commutative property because $a\times b=b\times a$ **Ans.**

(e) $20\times(-30)=(-30)\times\mathbf{20}$, Commutative property because $a\times b=b\times a$ **Ans.**

(f) $(-30)\times 0=\mathbf{0}$, Zero property because $a\times 0=0$ **Ans.**

(g) $809\times 1=\mathbf{809}$, Multiplicative identity because $a\times 1=a$ **Ans.**

(h) $30\times\mathbf{1}=30$, Multiplicative identity because $=a\times 1=a$ **Ans.**

(i) $25\times\mathbf{1}=25$, Multiplicative identity because $a\times 1=a$ **Ans.**

(j) $4000\times 0=\mathbf{0}$, Zero property because $a\times 0=0$ **Ans.**

(k) $3950\times\mathbf{0}=0$, Zero property because $a\times 0=0$ **Ans.**

(l) $4\times[(-5)\times(-6)]=[4\times\mathbf{(-5)}]\times(-6)$, Associative property because $(a\times b)\times c=a\times(b\times c)$ **Ans.**

(m) $6\times[(-4)\times(-7)]=[6\times(-4)]\times\mathbf{(-7)}$, Associative property because $a\times(b\times c)=(a\times b)\times c$ **Ans.**

(n) $3\times(5+3)=(3\times 5)+\mathbf{(3\times 3)}$, Distributive property because $a\times(b+c)=(a\times b)+(a\times c)$ **Ans.**

4. (a) $4250\times 358+4250\times(-300)$

$=4250\times[358+(-300)]$ **[$\because\ a\times b+a\times c=a\times(b+c)$],** distributive property.

$=4250\times 58=246500$

Hence, $4250\times 358+4250\times(-300)=\mathbf{246500}$ **Ans.**

(b) $680\times 78+680\times(-70)$

$=680\times[78+(-70)]$ **[$\because\ a\times b+a\times c=a\times(b+c)$],** distributive property.

$=680\times 8=5440$

Hence, $680 \times 78 + 680 \times (-70) = \mathbf{5440}$ **Ans.**

(c) $(-35) \times [21 + (-3)] = (-35) \times 21 + (-35) \times (-3)$

[$\because a \times (b + c) = a \times b + a \times c$], distributive property

$= -(35 \times 21) + (35 \times 3) = -735 + 105 = -630$

Hence, $(-35) \times [21 + (-3)] = \mathbf{-630}$ **Ans.**

(d) $40 \times [(-15) + (-13)] = 40 \times (-15) + 40 \times (-13)$

[$\because a \times (b + c) = ab + ac$], distributive property

$= -(40 \times 15) + (-40 \times 13) = -600 + (-520) = -1120$

Hence, $40 \times [(-15) + (-13)] = \mathbf{-1120}$ **Ans.**

5. $a \times (b + c) = (a \times b) + (a \times c)$

Put $a = 15$, $b = -16$ and $c = 17$, then

L.H.S. $= a \times (b + c) = 15[(-16) + 17] = 15 \times 1 = 15$

R.H.S. $= (a \times b) + (a \times c) = [15 \times (-16) + (15 \times 17)]$

$= -240 + 255 = \mathbf{15}$

Thus, L.H.S. = R.H.S.,

So, verify $a \times (b + c) = (a \times b) + (a \times c)$ **Proved**

6. (a) Any integer when multiplied 0 gives **0**. **Ans.**

(b) The product of two integers having same sign is always **positive**. **Ans.**

(c) Multiplication of integers is commutative, associative and **distributive** over addition. **Ans.**

(d) The product of an integer and its reciprocal (except for 0) is **1**. **Ans.**

(e) The product of two integers having opposite signs is always **negative**. **Ans.**

Exercise 1.3

1. (a) $35 \div 5 = \dfrac{35}{5} = 7$ Hence, $35 \div 5 = \mathbf{7}$ **Ans.**

(b) $120 \div 8 = \dfrac{120}{8} = 15$ Hence, $120 \div 8 = \mathbf{15}$ **Ans.**

(c) $63 \div (-7) = \dfrac{63}{-7} = -9$ Hence, $63 \div (-7) = \mathbf{-9}$ **Ans.**

(d) $105 \div (-15) = \dfrac{105}{-15} = -7$ Hence, $105 \div (-15) = \mathbf{-7}$ **Ans.**

(e) $(-121) \div 11 = \dfrac{-121}{11} = -11$ Hence, $(-121) \div 11 = \mathbf{-11}$ **Ans.**

(f) $(-480) \div 16 = \dfrac{-480}{16} = -30$ Hence, $(-480) \div 16 = \mathbf{-30}$ **Ans.**

(g) $(-24) \div (-4) = \dfrac{-24}{-4} = 6$ Hence, $(-24) \div (-4) = \mathbf{6}$ **Ans.**

(h) $(-160) \div (-16) = \dfrac{-160}{-16} = 10$ Hence, $(-160) \div (-16) = \mathbf{10}$ **Ans.**

2. (a) Let the required number be x.

$\therefore \quad x \div (-34) = 6$ or $\dfrac{x}{-34} = 6 \Rightarrow x = 6 \times (-34) = -204$

Thus, $\mathbf{-204} \div (-34) = 6$ **Ans.**

(b) Let the required number be x.

$\therefore \quad x \div 22 = -8$ or $\dfrac{x}{22} = -8 \Rightarrow x = 22 \times (-8) = -176$

Thus, $\mathbf{(-176)} \div 22 = -8$ **Ans.**

(c) $21 \div 3 = \dfrac{21}{3} = 7$ Hence, $21 \div 3 = \mathbf{7}$ **Ans.**

(d) Let the required number be x.

$\therefore \quad 91 \div x = -7$ or $\dfrac{91}{x} = -7$ or $x \times (-7) = 91$

(By cross-multiplying)

$$x = \frac{91}{-7} \Rightarrow x = -13$$

Thus, $91 \div \mathbf{(-13)} = -7$ **Ans.**

(e) Let the required number be x.

$\therefore \quad x \times (-1) = 64$ or $-x = 64 \Rightarrow x = -64$

Thus, $\mathbf{-64} \times (-1) = +64$ **Ans.**

(f) Let the required number be x.

$\therefore \quad 172 \div x = -172$ or $\dfrac{172}{x} = -172$ or $-172 \times x = 172$

or $\quad x = \dfrac{172}{-172} \Rightarrow x = -1$

Thus, $172 \div \mathbf{(-1)} = -172$ **Ans.**

3. (a) For any integer a and b, $a \div b$ is also integer. **False**

(b) For any integer a, $a \div a = 1$ **True**

(c) For any integer $1 \div a = a$ **False**

(d) For any integer $0 \div a = 0$, $a \neq 0$ **True**

(e) For any integers, a, b and c, $a \div (b \div c) = (a \div b) \div c$ **False**

Exercise 1.4

1. Let the number be x.

Then, $\frac{x}{-12} = 8 \Rightarrow x = -12 \times 8$ [By cross multiplication]

$x = -(12 \times 8) = -96$

Hence, **the required number is –96.** **Ans.**

2. Let the other integer be x. Then according to given condition,

$x + 34 = -42$

$\Rightarrow$ $x = -42 - 34 = -42 + (-34) = -76$

Hence, **the other integer is –76.** **Ans.**

3. Number of sum in one hit (four) on one ball $= 4$

Number of balls $= 3$

Number of runs Amit score $= 4 \times 3$ run $= 12$ run

Hence, the number of runs made by Amit in three balls $= 12$ **Ans.**

4. Car initial costing = ₹ 430202

Car sold = ₹ 325100

$\therefore$Car fall in price = ₹ 430202 – ₹ 325100 = ₹ **105102** **Ans.**

5. The product of two integers $= -756$, one integer $= 36$

Let the other integer be x.

Then, according to given condition, $36 \times x = -756$

or $36x = -756$

or $x = -\frac{756}{36} = -21$

Hence, **the other integer is –21.** **Ans.**

6. Product of two integers $= 400$, one integer $= -40$

Let the other integer be x. Then according to the given condition,

$-40 \times x = 400$

or $-40x = 400$

or $x = \frac{400}{-40} \Rightarrow x = -10$

Hence, **the other integer is –10.** **Ans.**

Multiple Choice Questions

1. (i) $33+(+37)=33+37=70$

Hence, the answer **(b)** is correct. **Ans.**

(ii) $47+(-36)=47-36=11$

Hence, the answer **(a)** is correct. **Ans.**

(iii) $-36+(-42)=-36-42=-78$

Hence, the answer **(c)** is correct. **Ans.**

(iv) $-87+13=-87+13=-74$

Hence, the answer **(d)** is correct. **Ans.**

(v) $63\times 0=0$, Hence, the answer **(a)** is correct. **Ans.**

(vi) $1\times 107=107$, Hence, the answer **(b)** is correct. **Ans.**

(vii) $345\times 104-345\times 4=345\times(104-4)=345\times 100=34500$

Hence, the answer **(c)** is correct. **Ans.**

(viii) $443\times 87+443\times 13=443\times(87+13)=443\times 100=44300$

Hence, the answer **(a)** is correct. **Ans.**

2. Fractions

Exercise 2.1

1. (a) By cross multiplication $\frac{3}{9}\times\frac{8}{10}$,

we have $3\times 10=30$ and $9\times 8=72$

But $30<72$ Therefore, $\frac{3}{9}<\frac{8}{10}$

Hence, $\mathbf{\frac{3}{9}<\frac{8}{10}}$

(b) By cross multiplication $\frac{12}{30}\times\frac{22}{40}$,

we have $12\times 40=480$ and $30\times 22=660$

But $480<660$ Therefore, $\frac{12}{30}<\frac{22}{40}$

Hence, $\mathbf{\frac{12}{30}<\frac{22}{40}}$ **Ans.**

(c) By cross multiplication $\frac{6}{7}\times\frac{5}{8}$,

we have $6 \times 8 = 48$ and $7 \times 5 = 35$

But $48 > 35$ Therefore, $\frac{6}{7} > \frac{5}{8}$

Hence, $\mathbf{\frac{6}{7} > \frac{5}{8}}$ **Ans.**

(d) By cross multiplication $\frac{21}{22} \times \frac{31}{13}$,

we have $21 \times 13 = 273$ and $22 \times 31 = 682$

But $273 < 682$ Therefore, $\frac{21}{22} < \frac{31}{13}$

Hence, $\mathbf{\frac{21}{22} < \frac{31}{13}}$ **Ans.**

2. (a) L.C.M. of 3, 4 and $6 = 12$

Now, $\frac{2}{3} = \frac{2 \times 4}{3 \times 4} = \frac{8}{12}, \frac{2}{4} = \frac{2 \times 3}{4 \times 3} = \frac{6}{12}$

and $\frac{5}{6} = \frac{5 \times 2}{6 \times 2} = \frac{10}{12}$

Hence, **the like fractions are** $\mathbf{\frac{8}{12}, \frac{6}{12}}$ **and** $\mathbf{\frac{10}{12}}$ **Ans.**

(b) L.C.M. of 5, 9 and $12 = 180$

Now, $\frac{1}{5} = \frac{1 \times 36}{5 \times 36} = \frac{36}{180}, \frac{2}{9} = \frac{2 \times 20}{9 \times 20} = \frac{40}{180}$

$\frac{8}{12} = \frac{8 \times 15}{12 \times 15} = \frac{120}{180}$

Hence, **the like fractions are** $\mathbf{\frac{36}{180}}$, $\mathbf{\frac{40}{180}}$ **and** $\mathbf{\frac{120}{180}}$. **Ans.**

(c) L.C.M. of 3, 4 and $8 = 24$

Now, $\frac{2}{3} = \frac{2 \times 8}{3 \times 8} = \frac{16}{24}, \frac{3}{4} = \frac{3 \times 6}{4 \times 6} = \frac{18}{24}$

$\frac{5}{8} = \frac{5 \times 3}{8 \times 3} = \frac{15}{24}$

Hence, **the like fractions are** $\mathbf{\frac{16}{24}}$, $\mathbf{\frac{18}{24}}$ **and** $\mathbf{\frac{15}{24}}$. **Ans.**

(d) L.C.M. of 13, 26 and $13 = 26$

Now, $\frac{12}{13}=\frac{12\times2}{13\times2}=\frac{24}{26}, \frac{13}{26}=\frac{13\times1}{26\times1}=\frac{13}{26}$

$\frac{4}{13}=\frac{4\times2}{13\times2}=\frac{8}{26}$

Hence, the like fractions are $\frac{24}{26}, \frac{13}{26}$ and $\frac{8}{26}$. **Ans.**

3. (a) The given fractions are $\frac{13}{18}, \frac{17}{18}, \frac{19}{21}$.

$\because$ The denominator are 18, 18 and 21.

$\therefore$ L.C.M. of 18, 18 and $21=126$

Now, we will convert each fraction into equivalent fraction having denominator 126, so that they will become like fractions.

Now, $\frac{13}{18}=\frac{13\times7}{18\times7}=\frac{91}{126}, \frac{17}{18}=\frac{17\times7}{18\times7}=\frac{119}{126}$

and $\frac{19}{21}=\frac{19\times6}{21\times6}=\frac{114}{126}$

Now, we will compare the numerator of like fractions

$$\frac{91}{126}, \frac{119}{126} \text{ and } \frac{114}{126}.$$

Clearly, $119>114>91$

So, $\frac{119}{126}>\frac{114}{126}>\frac{91}{126}$ or $\frac{17}{18}>\frac{19}{21}>\frac{13}{18}$

Hence, the given fractions is descending order are

$$\mathbf{\frac{17}{18}, \frac{19}{21}, \frac{13}{18}.}$$ **Ans.**

(b) The given fractions are $\frac{12}{15}, \frac{17}{45}, \frac{13}{15}$.

$\because$ The denominator are, 15, 45 and 15.

$\therefore$ LCM of 15, 45 and $15=45$

Now, we will convert each fraction into equivalent fraction having denominator 45, so that they will become like fractions.

Now, $\frac{12}{15}=\frac{12\times3}{15\times3}=\frac{36}{45}, \frac{17}{45}=\frac{17\times1}{45\times1}=\frac{17}{45}$

and $\frac{13}{15}=\frac{13\times3}{15\times3}=\frac{39}{45}$

Now, we will compare the numerators of like fractions

$\frac{36}{45},\frac{17}{45},\frac{39}{45}$.

Clearly, $39>36>17$

So, $\frac{39}{45}>\frac{36}{45}>\frac{17}{45}$ or $\frac{13}{15}>\frac{12}{15}>\frac{17}{45}$

Hence, **the given fractions in descending order are $\frac{13}{15},\frac{12}{15},\frac{17}{45}$.**

Ans.

(c) The given fractions are $\frac{2}{17},\frac{3}{85},\frac{6}{34}$.

$\because$ The denominator are 17, 85 and 34.

$\therefore$ LCM of 17, 85 and $34=170$

Now, we will convert each fraction into equivalent fraction having denominator 170, so that they will become like fractions.

Now, $\frac{2}{17}=\frac{2\times10}{17\times10}=\frac{20}{170},\ \frac{3}{85}=\frac{3\times2}{85\times2}=\frac{6}{170}$

and $\frac{6}{34}=\frac{6\times5}{34\times5}=\frac{30}{170}$

Now, we will compare the numerators of like fractions $\frac{20}{170},\frac{6}{170}$ and $\frac{30}{170}$.

Clearly, $30>20>6$

So, $\frac{30}{170}>\frac{20}{170}>\frac{6}{170}$ or $\frac{6}{34}>\frac{2}{17}>\frac{3}{85}$

Hence, **the given fractions in descending order are $\frac{6}{34},\frac{2}{17},\frac{3}{85}$.**

Ans.

(d) The given fractions are $\frac{12}{18},\frac{13}{36},\frac{14}{54}$

$\because$ The denominator are 18, 36 and 54.

$\therefore$ LCM of 18, 36 and $54=108$

Now, we will convert each fraction into equivalent fraction having denominator 108, so that they will become like fractions.

Now, $\frac{12}{18}=\frac{12\times6}{18\times6}=\frac{72}{108}, \frac{13}{36}=\frac{13\times3}{36\times3}=\frac{39}{108}$

and $\frac{14}{54}=\frac{14\times2}{54\times2}=\frac{28}{108}$

Clearly, $72 > 39 > 28$

So, $\frac{72}{108}>\frac{39}{108}>\frac{28}{108}$ or $\frac{12}{18}>\frac{13}{36}>\frac{14}{54}$

Hence, the given fraction is descending order are

$$\mathbf{\frac{12}{18}, \frac{13}{36}, \frac{14}{54}.}$$

Ans.

4. (a) The given fractions are $\frac{3}{5}, \frac{8}{10}, \frac{7}{9}$

$\because$ The denominator are 5, 10 and 9.

$\therefore$ LCM of 5, 10 and $9 = 90$

Now, let us change each of the given fractions into an equivalent fraction having 90 as its denominator.

Now, $\frac{3}{5}=\frac{3\times18}{5\times18}=\frac{54}{90}, \frac{8}{10}=\frac{8\times9}{10\times9}=\frac{72}{90}$ and $\frac{7}{9}=\frac{7\times10}{9\times10}=\frac{70}{90}$

Clearly, $54 < 70 < 72$

So, $\frac{54}{90}<\frac{70}{90}<\frac{72}{90}$ or $\frac{3}{5}<\frac{7}{9}<\frac{8}{10}$

Hence, **the given fraction is ascending order** $\mathbf{\frac{3}{5}, \frac{7}{9}, \frac{8}{10}.}$ **Ans.**

(b) The given fractions are $\frac{12}{18}, \frac{15}{27}, \frac{18}{21}$

$\because$ The denominator are 18, 27 and 21.

$\therefore$ LCM of 18, 27 and $21 = 378$

Now, let us change each of the given fractions into an equivalent fraction having 378 as its denominator.

Now, $\frac{12}{18}=\frac{12\times21}{18\times21}=\frac{252}{378}, \frac{15}{27}=\frac{15\times14}{27\times14}=\frac{210}{378}$

and $\frac{18}{21}=\frac{18\times18}{21\times18}=\frac{324}{378}$

Clearly, $210 < 252 < 324$

So, $\frac{210}{378}<\frac{252}{378}<\frac{324}{378}$ or $\frac{15}{27}<\frac{12}{18}<\frac{18}{21}$

Hence, **the given fractions in ascending order are $\frac{15}{27}, \frac{12}{18}, \frac{18}{21}$.**

Ans.

(c) The given fractions are $\frac{2}{13}, \frac{4}{13}, \frac{1}{13}$

Here, the denominator are same.

Clearly, $1 < 2 < 4$ So, $\frac{1}{13}<\frac{2}{13}<\frac{4}{13}$

Hence, **the given fractions in ascending order are $\frac{1}{13}, \frac{2}{13}, \frac{4}{13}$.**

Ans.

(d) The given fractions are $\frac{6}{17}, \frac{3}{17}, \frac{8}{17}$.

Here, the denominator are same.

Clearly, $3 < 6 < 8$ So, $\frac{3}{17}<\frac{6}{17}<\frac{8}{17}$

Hence, **the given fractions is ascending order are $\frac{3}{17}, \frac{6}{17}, \frac{8}{17}$.**

Ans.

5. (a) LCM of 5, 5 and $12 = 60$

$\therefore \quad \frac{2}{5}+\frac{2}{5}-\frac{6}{12}=\frac{2\times12+2\times12-6\times5}{60}$

$=\frac{24+24-30}{60}=\frac{48-30}{60}=\frac{18}{60}=\frac{18\div6}{60\div6}=\frac{3}{10}$

Hence, $\frac{\mathbf{2}}{\mathbf{5}}+\frac{\mathbf{2}}{\mathbf{5}}-\frac{\mathbf{6}}{\mathbf{12}}=\frac{\mathbf{3}}{\mathbf{10}}$ **Ans.**

(b) $3\frac{8}{9}+4\frac{9}{13}-5\frac{1}{2}=\frac{35}{9}+\frac{61}{13}-\frac{11}{2}$

LCM of 9, 13 and $2 = 234$

$\therefore \quad \frac{35}{9}+\frac{61}{13}-\frac{11}{2}=\frac{35\times26+61\times18-11\times117}{234}$

$= \frac{910+1098-1287}{234} = \frac{2008-1287}{234} = \frac{721}{234} = 3\frac{19}{234}$

Hence, $\mathbf{3\frac{8}{9} + 4\frac{9}{13} - 5\frac{1}{2} = 3\frac{19}{234}}$ **Ans.**

(c) $3\frac{15}{25} + 2\frac{35}{50} - 1\frac{10}{100} = \frac{90}{25} + \frac{135}{50} - \frac{110}{100}$

LCM of 25, 50 and $100 = 100$

$\therefore \frac{90}{25} + \frac{135}{50} - \frac{110}{100} = \frac{90\times4+135\times2-110\times1}{100}$

$= \frac{360+270-110}{100} = \frac{630-110}{100} = \frac{520}{100} = \frac{520\div20}{100\div20} = \frac{26}{5} = 5\frac{1}{5}$

Hence, $\mathbf{3\frac{15}{25} + 2\frac{35}{50} - 1\frac{10}{100} = 5\frac{1}{5}}$ **Ans.**

6. Let x be subtracted.

So, $39 - x = 24\frac{2}{3}$ or $39 - x = \frac{74}{3}$, $-x = \frac{74}{3} - 39$ or $-x = \frac{74-39\times3}{3}$

or $-x = \frac{74-117}{3}$ or $-x = \frac{-43}{3}$ or $x = \frac{43}{3}$ or $x = 14\frac{1}{3}$

Hence, $\mathbf{14\frac{1}{3}}$ **must be subtracted from 39 to get** $\mathbf{24\frac{2}{3}}$**.** **Ans.**

7. Let x be added. So, $6\frac{2}{5} + x = 15$ or $\frac{32}{5} + x = 15$ or $x = 15 - \frac{32}{5}$

or $x = \frac{15\times5-32\times1}{5} = \frac{75-32}{5} = \frac{43}{5} = 8\frac{3}{5}$

Hence, $\mathbf{8\frac{3}{5}}$ **must be added to** $\mathbf{6\frac{2}{5}}$ **to get 15.** **Ans.**

8. Amit got the share of the prize money $= \frac{1}{5}$

Sumit got the share of the prize money $= \frac{2}{9}$

Sumit got the share of more prize money

$= \frac{2}{9} - \frac{1}{5} = \frac{5\times2-1\times9}{45} = \frac{10-9}{45} = \frac{1}{45}$

Hence, **Sumit got the share of more prize money** $= \mathbf{\frac{1}{45}}$**.** **Ans.**

9. Mayur got the part of sugarcan $= \frac{3}{7}$

Prateek got the part of sugarcan $= \frac{4}{9}$

Om got the part of sugar Cane $= 1 - \left(\frac{3}{7} + \frac{4}{9}\right) = 1 - \frac{3}{7} - \frac{4}{9}$

$= \frac{63 - 3\times 9 - 4\times 7}{63} = \frac{63 - 27 - 28}{63} = \frac{63 - 55}{63} = \frac{8}{63}$

Hence, **Om get the part of sugercane $= \frac{8}{63}$.** **Ans.**

10. Match was scheduled for $1\frac{1}{2}$ hour.

Match delayed due to excessive rain $= \frac{3}{4}$ hour

Match finished $= 5$ pm

Match originally scheduled to start $= 5 - 1\frac{1}{2} - \frac{3}{4}$

$= 5 - \frac{3}{2} - \frac{3}{4} = \frac{20 - 6 - 3}{4} = \frac{20 - 9}{4} = \frac{11}{4} = 2\frac{3}{4}$ or 2 : 45 pm

Hence, **match originally scheduled to start at 2 : 45 pm.** **Ans.**

Exercise 2.2

1. (a) We have, $7\frac{3}{5} \times 25 = \frac{38}{5} \times 25 = 38 \times 5 = 190$

Hence, $\mathbf{7\frac{3}{5} \times 25 = 190}$ **Ans.**

(b) We have, $\frac{2}{7} \times \frac{63}{9} = \frac{2\times 63}{63} = 2$

Hence, $\mathbf{\frac{2}{7} \times \frac{63}{9} = 2}$ **Ans.**

(c) We have, $\frac{3}{8} \times \frac{56}{27} = \frac{3\times 56}{8\times 27} = \frac{7}{9}$

Hence, $\mathbf{\frac{3}{8} \times \frac{56}{27} = \frac{7}{9}}$ **Ans.**

(d) We have, $\frac{4}{9} \times \frac{3}{8} = \frac{4\times 3}{9\times 8} = \frac{1}{3\times 2} = \frac{1}{6}$

Hence, $\frac{\mathbf{4}}{\mathbf{9}} \times \frac{\mathbf{3}}{\mathbf{8}} = \frac{\mathbf{1}}{\mathbf{6}}$ **Ans.**

(e) We have, $\frac{2}{3} \times \frac{15}{18} = \frac{2 \times 15}{3 \times 18} = \frac{5}{9}$

Hence, $\frac{\mathbf{2}}{\mathbf{3}} \times \frac{\mathbf{15}}{\mathbf{18}} = \frac{\mathbf{5}}{\mathbf{9}}$ **Ans.**

(f) We have, $\frac{3}{5} \times 10 = \frac{3 \times 10}{5} = 3 \times 2 = 6$

Hence, $\frac{\mathbf{3}}{\mathbf{5}} \times \mathbf{10} = \mathbf{6}$ **Ans.**

(g) We have, $\frac{4}{7} \times 14 = \frac{4 \times 14}{7} = 4 \times 2 = 8$

Hence, $\frac{\mathbf{4}}{\mathbf{7}} \times \mathbf{14} = \mathbf{8}$ **Ans.**

(h) We have, $\frac{5}{8} \times 16 = \frac{5 \times 16}{8} = 5 \times 2 = 10$

Hence, $\frac{\mathbf{5}}{\mathbf{8}} \times \mathbf{16} = \mathbf{10}$ **Ans.**

(i) We have, $2\frac{3}{4} \times 12 = \frac{11}{4} \times 12 = \frac{11 \times 12}{4} = 11 \times 3 = 33$

Hence, $\mathbf{2}\frac{\mathbf{3}}{\mathbf{4}} \times \mathbf{12} = \mathbf{33}$ **Ans.**

(j) We have, $4\frac{1}{3} \times 18 = \frac{13}{3} \times 18 = \frac{13 \times 18}{3} = 13 \times 6 = 78$

Hence, $\mathbf{4}\frac{\mathbf{1}}{\mathbf{3}} \times \mathbf{18} = \mathbf{78}$ **Ans.**

(k) We have, $2\frac{1}{3} \times 3\frac{1}{4} = \frac{7}{3} \times \frac{13}{4} = \frac{7 \times 13}{3 \times 4} = \frac{91}{12} = 7\frac{7}{12}$

Hence, $\mathbf{2}\frac{\mathbf{1}}{\mathbf{3}} \times \mathbf{3}\frac{\mathbf{1}}{\mathbf{4}} = \mathbf{7}\frac{\mathbf{7}}{\mathbf{12}}$ **Ans.**

(l) We have, $8\frac{2}{9} \times 4\frac{4}{5} = \frac{74}{9} \times \frac{24}{5} = \frac{74 \times 24}{9 \times 5} = \frac{74 \times 8}{3 \times 5} = \frac{592}{15}$

$= 39\frac{7}{15}$

Hence, $\mathbf{8}\frac{\mathbf{2}}{\mathbf{9}} \times \mathbf{4}\frac{\mathbf{4}}{\mathbf{5}} = \mathbf{39}\frac{\mathbf{7}}{\mathbf{15}}$ **Ans.**

2. (a) We have, $\frac{2}{6}\times\frac{6}{4}\times\frac{4}{5}=\frac{2\times6\times4}{6\times4\times5}=\frac{2}{5}$

Hence, $\mathbf{\frac{2}{6}\times\frac{6}{4}\times\frac{4}{5}=\frac{2}{5}}$ **Ans.**

(b) We have, $\frac{14}{7}\times\frac{24}{16}\times\frac{15}{18}=\frac{14\times24\times15}{7\times16\times18}=\frac{5}{2}=2\frac{1}{2}$

Hence, $\mathbf{\frac{14}{7}\times\frac{24}{16}\times\frac{15}{18}=2\frac{1}{2}}$ **Ans.**

(c) We have, $\frac{15}{18}\times\frac{32}{25}\times\frac{15}{24}=\frac{15\times32\times15}{18\times25\times24}=\frac{2}{3}$

Hence, $\mathbf{\frac{15}{18}\times\frac{32}{25}\times\frac{15}{24}=\frac{2}{3}}$ **Ans.**

(d) We have, $5\frac{5}{6}\times\frac{22}{28}\times\frac{36}{62}=\frac{35}{6}\times\frac{22}{28}\times\frac{36}{62}=\frac{165}{62}=2\frac{41}{62}$

Hence, $\mathbf{5\frac{5}{6}\times\frac{22}{28}\times\frac{36}{62}=2\frac{41}{62}}$ **Ans.**

(e) We have, $3\frac{2}{3}\times\frac{19}{46}\times\frac{28}{52}=\frac{11}{3}\times\frac{19}{46}\times\frac{28}{52}=\frac{19\times77}{78\times23}=\frac{1463}{1794}$

Hence, $\mathbf{3\frac{2}{3}\times\frac{19}{46}\times\frac{28}{52}=\frac{1463}{1794}}$ **Ans.**

(f) We have, $2\frac{2}{3}\times1\frac{1}{7}\times2\frac{5}{9}=\frac{8}{3}\times\frac{8}{7}\times\frac{23}{9}$

$=\frac{8\times8\times23}{3\times7\times9}=\frac{1472}{189}=7\frac{149}{189}$

Hence, $\mathbf{2\frac{2}{3}\times1\frac{1}{7}\times2\frac{5}{9}=7\frac{149}{189}}$ **Ans.**

(g) We have, $2\frac{2}{3}\times\frac{6}{7}\times\frac{5}{12}=\frac{8}{3}\times\frac{6}{7}\times\frac{5}{12}=\frac{4\times5}{3\times7}=\frac{20}{21}$

Hence, $\mathbf{2\frac{2}{3}\times\frac{6}{7}\times\frac{5}{12}=\frac{20}{21}}$ **Ans.**

(h) We have, $\frac{1}{3}\times\frac{4}{7}\times\frac{2}{8}=\frac{1}{3\times7}=\frac{1}{21}$

Hence, $\mathbf{\frac{1}{3}\times\frac{4}{7}\times\frac{2}{8}=\frac{1}{21}}$ **Ans.**

3. (a) $\frac{1}{2}$ or $28=\frac{1}{2}\times28=14$ Hence, $\frac{1}{2}$ of $28=\mathbf{14}$ **Ans.**

(b) $\frac{1}{3}$ of $42 = \frac{1}{3} \times 42 = 14$ Hence, $\frac{1}{3}$ of $42 = \mathbf{14}$ **Ans.**

(c) $\frac{2}{5}$ of $300 = \frac{2}{5} \times 300 = 2 \times 60 = 120$ Hence, $\frac{2}{5}$ of $300 = \mathbf{120}$ **Ans.**

(d) $\frac{4}{7}$ of $810 = \frac{4}{7} \times 810 = \frac{4 \times 810}{7} = \frac{3240}{7} = 462\frac{6}{7}$

Hence, $\mathbf{\frac{4}{7}\ of\ 810 = 462\frac{6}{7}}$ **Ans.**

(e) $\frac{7}{10}$ of $8000 = \frac{7}{10} \times 8000 = 7 \times 800 = 5600$

Hence, $\mathbf{\frac{7}{10}\ of\ 8000 = 5600}$ **Ans.**

(f) $\frac{4}{5}$ of ₹$3200 = \frac{4}{5} \times$ ₹$3200 = 4 \times$ ₹$640 =$ ₹2560

Hence, $\frac{4}{5}$ of ₹$3200 =$ ₹2560 **Ans.**

(g) $\frac{9}{10}$ of ₹$6000 = \frac{9}{10} \times$ ₹$6000 = 9 \times$ ₹$600 =$ ₹5400

Hence, $\mathbf{\frac{9}{10}}$ **of** ₹**6000** =₹**5400** **Ans.**

(h) $\frac{3}{7}$ of 420 metres $= \frac{3}{7} \times 420$ metres $= 3 \times 60$ metres $= 180$ metres

Hence, $\mathbf{\frac{3}{7}}$ **of 420 metres = 180 metres** **Ans.**

(i) $\frac{3}{4}$ of an hour $= \frac{3}{4} \times 60$ minutes ($\because$ 1 hr = 60 minutes)

$= 3 \times 15$ minutes $= 45$ minutes

Hence, $\mathbf{\frac{3}{4}}$ **of an hour = 45 minutes** **Ans.**

(j) $\frac{3}{5}$ of 35 litres $= \frac{3}{5} \times 35$ litres $= 3 \times 7$ litres $= 21$ litres.

Hence, $\mathbf{\frac{3}{5}}$ **of 35 litres = 21 litres** **Ans.**

(k) $\frac{1}{3}$ of an year $= \frac{1}{3} \times 12$ months ($\because$ **1 year = 12 months**)

$= 4$ months

Hence, $\frac{1}{3}$ **of an year = 4 months**

(l) $\frac{1}{10}$ of 1 kg $= \frac{1}{10} \times 1000$ g **($\because$ 1 kg = 1000 g)**

$= 100$ g

Hence, $\frac{1}{10}$ **of 1 kg = 100 g** **Ans.**

4. $\because$ Side of square paper $= 25$ cm

$\therefore$ Area of square paper $=$ side $\times$ side $= 25 \text{ cm} \times 25 \text{ cm} = 625 \text{ cm}^2$

Hence, the are a of square paper $= 625 \text{ cm}^2$ **Ans.**

5. $\because$ Height of one chair $= \frac{3}{4}$ m

$\therefore$ Total number of chair kept in a store one over other $= 8$

$\therefore$ The height of the store $= \frac{3}{4} \times 8 \text{ m} = 3 \times 2 \text{ m} = 6 \text{ m}$

Hence, **the total height of the store is 6 m.** **Ans.**

6. $\because$ Preeti saved her pocket money =₹6300

$\therefore$ Preeti purchased a cycle worth $= \frac{1}{7}$ of ₹6300 =₹900

Hence, **the cost of Preeti's cycle =₹900** **Ans.**

7. $\because$ Total number of students $= 900$

$\therefore$ Number of student were absent on a rainy day $= \frac{1}{9}$

$\therefore$ Student were absent $= \frac{1}{9}$ of 900 students

$= \frac{1}{9} \times 900$ students $= 100$ students.

Hence, **the number of students were present**
= 900 − 100 = 800 students. **Ans.**

8. $\because$ Petrol sold at the rate of per litre =₹$55\frac{2}{3}$

$\therefore$ The price of $13\frac{1}{5}$ litres of petrol =₹$55\frac{2}{3} \times 13\frac{1}{5}$

$$= ₹\frac{167}{3} \times \frac{66}{5} = ₹\frac{167 \times 22}{5} = ₹\frac{3674}{5} = ₹734\frac{4}{5}$$

Hence, **the price of $13\frac{1}{5}$ litres of petrol is ₹$734\frac{4}{5}$.** **Ans.**

9. $\because$ Bag contains of sugar $= 6\frac{2}{3}$ kg $= \frac{20}{3}$ kg

$\therefore$ Sugar taken away $= \frac{3}{5}$ of $\frac{20}{3}$kg $= \frac{3}{5} \times \frac{20}{3}$ kg $= 4$ kg

$\therefore$ Sugar remain in the bag $= \frac{20}{3}$ kg $- 4$ kg

$$= \frac{20-12}{3} \text{ kg} = \frac{8}{3} \text{ kg} = 2\frac{2}{3} \text{ kg}$$

Hence, **the sugar remain in the bag is $2\frac{2}{3}$ kg.** **Ans.**

10. $\because$ Refind oil a pack $= 5$ litres

$\therefore$ Refind oil reduced $= \frac{4}{5}$ litres

$\therefore$ Refind oil left in the pack $= \left(5 - \frac{4}{5}\right)$ litres $= \frac{25-4}{5}$ litres

$$= \frac{21}{5} \text{ litres} = 4\frac{1}{5} \text{ litres}$$

Hence, **the refind oil left in the pack $= 4\frac{1}{5}$ litre.** **Ans.**

11. Length of rectangle $= 3\frac{1}{4}$ m $= \frac{13}{4}$ m and breadth $= 2\frac{1}{3}$ m $= \frac{7}{3}$ m.

$\therefore$ Area of rectangle $=$ length $\times$ breadth

$$= \frac{13}{4} \text{ m} \times \frac{7}{3} \text{ m} = \frac{91}{12} \text{ m}^2 = 7\frac{7}{12} \text{ m}^2$$

Hence, **the area of rectangle is $7\frac{7}{12}$ m^2.** **Ans.**

12. $\because$ Cost of 1 packet of biscuits $= ₹20\frac{1}{4} = ₹\frac{81}{4}$

Number of packets of biscuits sold by Arti $= 20$

$\therefore$ Cost of 20 packets of biscuits $= ₹\frac{81}{4} \times 20$

$= ₹81 \times 5 = ₹405$

Hence, **the cost of 20 packets of biscuits is ₹ 405.** **Ans.**

Exercise 2.3

1. (a) Reciprocal of $\frac{2}{3} = \frac{3}{2} = \mathbf{1\frac{1}{2}}$ $\left[\because \frac{2}{3} \times \frac{3}{2} = 1\right]$ **Ans.**

(b) Reciprocal of $\frac{1}{4} = 4$ $\left[\because \frac{1}{4} \times \frac{4}{1} = 1\right]$ **Ans.**

(c) Reciprocal of $\frac{3}{8} = \frac{8}{3} = 2\frac{2}{3}$ $\left[\because \frac{3}{8} \times \frac{8}{3} = 1\right]$ **Ans.**

(d) Reciprocal of $\frac{26}{33} = \frac{33}{26} = 1\frac{7}{26}$ $\left[\because \frac{26}{33} \times \frac{33}{26} = 1\right]$ **Ans.**

(e) Reciprocal of $3 = \frac{1}{3}$ $\left[\because 3 \times \frac{1}{3} = 1\right]$ **Ans.**

(f) Reciprocal of $4\frac{4}{5} =$ Reciprocal of $\frac{24}{5} = \frac{5}{24}$ $\left[\because \frac{24}{5} \times \frac{5}{24} = 1\right]$ **Ans.**

(g) Reciprocal of $5\frac{2}{3} =$ Reciprocal of $\frac{17}{3} = \frac{3}{17}$ $\left[\because \frac{17}{3} \times \frac{3}{17} = 1\right]$ **Ans.**

(h) Reciprocal of $\frac{2}{7} = \frac{7}{2} = \mathbf{3\frac{1}{2}}$ $\left[\because \frac{2}{7} \times \frac{7}{2} = 1\right]$ **Ans.**

2. (a) $42 \div 7 = 42 \times \frac{1}{7} = 6$ Hence, $\mathbf{42 \div 7 = 6}$ **Ans.**

(b) $\frac{1}{40} \div \frac{1}{8} = \frac{1}{40} \times \frac{8}{1} = \frac{1}{5}$ Hence, $\mathbf{\frac{1}{40} \div \frac{1}{8} = \frac{1}{5}}$ **Ans.**

(c) $\frac{125}{150} \div \frac{1}{25} = \frac{125}{150} \times \frac{25}{1} = \frac{125}{6} = 20\frac{5}{6}$ Hence, $\mathbf{\frac{125}{150} \div \frac{1}{25} = 20\frac{5}{6}}$ **Ans.**

(d) $\frac{18}{25} \div \frac{9}{5} = \frac{18}{25} \times \frac{5}{9} = \frac{2}{5}$ Hence, $\mathbf{\frac{18}{25} \div \frac{9}{5} = \frac{2}{5}}$ **Ans.**

(e) $\frac{72}{99} \div \frac{24}{11} = \frac{72}{99} \times \frac{11}{24} = \frac{1}{3}$ Hence, $\mathbf{\frac{72}{99} \div \frac{24}{11} = \frac{1}{3}}$ **Ans.**

(f) $2\frac{1}{2} \div 5\frac{3}{8} = \frac{5}{2} \div \frac{43}{8} = \frac{5}{2} \times \frac{8}{43} = \frac{20}{43}$ Hence, $\mathbf{2\frac{1}{2} \div 5\frac{3}{8} = \frac{20}{43}}$ **Ans.**

(g) $6\frac{5}{9} \div 2\frac{1}{3} = \frac{59}{9} \div \frac{7}{3} = \frac{59}{9} \times \frac{3}{7} = \frac{59}{21} = 2\frac{17}{21}$

Hence, $\mathbf{6\frac{5}{9} \div 2\frac{1}{3} = 2\frac{17}{21}}$ **Ans.**

(h) $9\frac{1}{8} \div 3\frac{1}{16} = \frac{73}{8} \div \frac{49}{16} = \frac{73}{8} \times \frac{16}{49} = \frac{146}{49} = 2\frac{48}{49}$

Hence, $\mathbf{9\frac{1}{8} \div 3\frac{1}{16} = 2\frac{48}{49}}$ **Ans.**

3. (a) $\frac{5}{9} \div \frac{3}{18} = \frac{5}{9} \times \frac{18}{3} = \frac{10}{3} = 3\frac{1}{3}$

Reciprocal of $3\frac{1}{3}$ = Reciprocal of $\frac{10}{3} = \frac{3}{10}$

Hence, $\mathbf{\frac{5}{9} \div \frac{3}{18} = 3\frac{1}{3}}$ **and reciprocal** $\mathbf{= \frac{3}{10}}$ **Ans.**

(b) $\frac{7}{19} \div \frac{35}{57} = \frac{7}{19} \times \frac{57}{35} = \frac{3}{5}$

Reciprocal of $\frac{3}{5} = \frac{5}{3} = 1\frac{2}{3}$

Hence, $\mathbf{\frac{7}{19} \div \frac{35}{57} = \frac{3}{5}}$ **and reciprocal** $\mathbf{= 1\frac{2}{3}}$ **Ans.**

(c) $\frac{8}{27} \div \frac{2}{3} = \frac{8}{27} \times \frac{3}{2} = \frac{4}{9}$

Reciprocal of $\frac{4}{9} = \frac{9}{4} = 2\frac{1}{4}$

Hence, $\mathbf{\frac{8}{27} \div \frac{2}{3} = \frac{4}{9}}$ **and reciprocal** $\mathbf{= 2\frac{1}{4}}$ **Ans.**

(d) $\frac{2}{3} \div \frac{6}{7} = \frac{2}{3} \times \frac{7}{6} = \frac{7}{9}$

Reciprocal of $\frac{7}{9} = \frac{9}{7} = 1\frac{2}{7}$

Hence, $\mathbf{\frac{2}{3} \div \frac{6}{7} = \frac{7}{9}}$ **and reciprocal** $\mathbf{= 1\frac{2}{7}}$ **Ans.**

4. $\because$ Total cost of a ride for all friends $= ₹600\frac{1}{2} = ₹\frac{1201}{2}$

$\therefore$ Cost of one ticket $= ₹75\frac{1}{16} = ₹\frac{1201}{16}$

$\therefore$ Number of friends $= ₹\frac{1201}{2} \div ₹\frac{1201}{16} = \frac{1201}{2} \times \frac{16}{1201} = 8$

Hence, **the number of friends are 8.** **Ans.**

5. $\because$ Area of rectangle $=$ length $\times$ breadth

$\therefore \text{Length} = \frac{\text{Area}}{\text{Breadth}} = 18\frac{1}{3}\text{ cm}^2 \div 2\frac{1}{3}\text{ cm}$

$= \frac{55}{3} \div \frac{7}{3}\text{ cm} = \frac{55}{3} \times \frac{3}{7}\text{ cm} = \frac{55}{7}\text{ cm} = 7\frac{6}{7}\text{ cm}$

Hence, **the length of the rectangle is $7\frac{6}{7}$ cm.** **Ans.**

6. $\because$ Total length of an electric wire $= 20\frac{1}{2}\text{ m} = \frac{41}{2}\text{ m}$

$\therefore$ Number of equal parts cut $= 4$

$\therefore$ Length of each part $= \frac{41}{2}\text{ m} \div 4 = \frac{41}{2} \times \frac{1}{4}\text{ m} = \frac{41}{8}\text{ m} = 5\frac{1}{8}\text{ m}$

Hence, **the length of each part is $5\frac{1}{8}$ m.** **Ans.**

7. Product of two numbers $= 1\frac{36}{63} = \frac{99}{63}$

One of the number $= 1\frac{5}{7} = \frac{12}{7}$

The other number $= \frac{99}{63} \div \frac{12}{7} = \frac{99}{63} \times \frac{7}{12} = \frac{11}{12}$

Hence, **the other number is $\frac{11}{12}$.** **Ans.**

8. $\because$ Total length of the rod $= 26\frac{1}{4}\text{ m} = \frac{105}{4}\text{ m}$

Number of pieces of equal length cut $= 13$

$\therefore$ Length of each piece $= \frac{105}{4}\text{ m} \div 13$

$$= \frac{105}{4} \times \frac{1}{13} \text{ m} = \frac{105}{52} \text{ m} = 2\frac{1}{52} \text{ m}$$

Hence, **the length of each piece is $2\frac{1}{52}$ m.** **Ans.**

9. $\because$ Price of 15 pencils $= ₹16\frac{1}{4} = ₹\frac{65}{4}$

$\therefore$ Price of a pencil $= ₹\frac{65}{4} \div 15 = ₹\frac{65}{4} \times \frac{1}{15} = ₹\frac{13}{12} = ₹1\frac{1}{12}$

Hence, **the price of a pencil is ₹$1\frac{1}{12}$.** **Ans.**

10. $\because$ The cost of 2 dozen (24) soaps $= ₹416\frac{2}{5} = ₹\frac{2082}{5}$

$\therefore$ The cost of one soap cake is $₹\frac{2082}{5} \div 24$

$$= \text{K}\frac{2082}{5} \times \frac{1}{24} = ₹\frac{347}{20} = ₹17\frac{7}{20}$$

Hence, the cost of one soap cake is ₹$17\frac{7}{20}$. **Ans.**

Multiple Choice Questions

1. (i) The H.C.F. of 64 and 128 is 64.

$\therefore$ $$\frac{64}{128} = \frac{64 \div 64}{128 \div 64} = \frac{1}{2}$$

Hence, the answer **(b)** is correct. **Ans.**

(ii) $\frac{2}{3} = \frac{2 \times 2}{3 \times 2} = \frac{4}{6}$

Hence, the answer **(c)** is correct. **Ans.**

(iii) $\frac{2}{3} + \frac{1}{3} = \frac{2+1}{3} = \frac{3}{3} = 1$ [$\because$ Denominator is same]

Hence, the answer **(a)** is correct. **Ans.**

(iv) $\frac{7}{8} - \frac{2}{8} = \frac{7-2}{8} = \frac{5}{8}$ [$\because$ Denominator is same]

Hence, the answer **(b)** is correct. **Ans.**

(v) $\frac{2}{3}$ of $₹450 = \frac{2}{3} \times ₹450 = 2 \times ₹150 = ₹300$

Hence, the answer **(a)** is correct. **Ans.**

(vi) $\frac{3}{4}$ of 4 kg $= \frac{3}{4} \times 4\text{ kg} = 3\text{ kg}$

Hence, the answer **(a)** is correct. **Ans.**

(vii) The reciprocal of $\frac{7}{2} = \frac{2}{7}$

Hence, the answer **(b)** is correct. **Ans.**

(viii) $35 \div \frac{1}{7} = 35 \times \frac{7}{1} = 35 \times 7 = 245$

Hence, the answer **(d)** is correct. **Ans.**

3.Decimals

Exercise 3.1

1. (a) We have, 8.5, 3.96, 4.782 and 6.43 are unlike decimals.
Now, 8.5 = 8.500, 3.96 = 3.960, 4.782 = 4.782 and 6.43 = 6.430
Thus, **8.500, 3.960, 4.782 and 6.430 are like decimals. Ans.**

(b) We have, 38.96, 27.24, 9.079 and 6.3 are unlike decimals.
Now, 38.96 = 38.960, 27.24 = 27.240, 9.079 = 9.079 and 6.3 = 6.300
Thus, **38.960, 27.240, 9.079 and 6.300 are like decimals.**
Ans.

(c) We have, 2.4, 3.805, 4.9637 and 2.06 are unlike decimals.
Now, 2.4 = 2.4000, 3.805 = 3.8050, 4.9637 = 4.9637 and 2.06 = 2.0600
Thus, **2.4000, 3.8050, 4.9637 and 2.0600 are like decimals Ans.**

(d) We have, 9.32, 1.206, 3.6924 and 2.3 are unlike decimals.
Now, 9.32 = 9.3200, 1.206 = 1.2060, 3.6924 = 3.6924 and 2.3 = 2.3000
Thus, **9.3200, 1.2060, 3.6924 and 2.3000 are like decimals Ans.**

2. (a) Since these are unlike decimals, so first we convert them to like decimals as:
8.570, 9.920, 2.953, 3.760
Looking at there whole number parts in these decimals, we clearly find that, $2 < 3 < 8 < 9$
Finally we have, $2.953 < 3.760 < 8.570 < 9.920$
Hence, **ascending order = 2.953, 3.76, 8.57, 9.92** **Ans.**

(b) Since these are unlike decimals, so first we convert them to like decimals as:
6.500, 6.750, 6.896, 60.500, 6.560

Looking at their whole number parts in these decimals. we have four numbers whose whole parts are 6.So, we observe the tenths and hundredth place of decimals part carefully.

Finally we have, $6.500 < 6.560 < 6.750 < 6.896 < 60.500$

Hence, **ascending order = 6.5, 6.56, 6.75, 6.896, 60.5 Ans.**

(c) Since these are unlike decimals, so first we convert them to like decimals as: 1.200, 1.020, 1.203, 1.002

Looking at their whole number parts in these decimals. We have all numbers whose whole number parts are same. So, we observe the tenths, hundredths and thousandth place of decimal part carefully. Findly we have $1.002 < 1.020 < 1.200 < 1.203$

Hence, **ascending order = 1.002, 1.02, 1.2, 1.203 Ans.**

(d) Since these are unlike decimals so first we convert them to like decimals as: 2.950, 2.905, 29.050, 290.600

Looking at their whole number parts in these decimals, we clearly find that $29 < 290$

Now, we have two numbers whose whole number part are 2. So, we observe the tenths place of decimal part, we see that they are same.

Now, we observe the hundredths place of decimal part carefully. Since 5 in 2.950 is greater than 0 in 2.905.

Hence, $2.950 > 2.905$

Finally we have, $2.905 < 2.950 < 29.050 < 290.600$

Hence, **ascending order = 2.905, 2.95, 29.05, 290.6 Ans.**

3. (a) Since there are unlike decimal, so first we convert them to like decimals as :

3.003, 30.030, 300.300, 3003.800

Looking at their whole number parts in these decimals, we clearly find that

$3003 > 300 > 30 > 3$

Finally we have, $3003.800 > 300.300 > 30.030 > 3.003$

Hence, **descending order = 3003.8, 300.3, 30.03, 3.003 Ans.**

(b) Since these are unlike decimals, so first we convert them to like decimals as :

103.300, 9.035, 10.350, 105.300, 10.530

Looking at their whole number parts in these decimals, we clearly find that :

$$105 > 103 > 10 > 9$$

Now, we have two numbers whose whole number parts are 10. So we observe the tenths place of decimals part carefully. Since 5 in 10.530 is greater than 3 in 10.350.

Hence, $10.530 > 10.350$

Finally we have, $105.300 > 103.300 > 10.530 > 10.350 > 9.035$

Hence, **descending order = 105.3, 103.3, 10.53, 10.35, 9.035 Ans.**

(c) Since these are unlike decimals, so first we convert them to like decimals as :

$$6.5750,\ 65.7500,\ 35.7040,\ 35.7006$$

Looking at their whole number parts in these decimals, we clearly find that: $65 > 35 > 6$

Now, we have two numbers whose whole number parts are 35. So, we observe that tenths and hundredths place of decimal part, we see that they are equal. Now we observe the thousands place of decimal part carefully. Since 4 in 35.7040 is greater than 0 in 35.7006.

Hence, $35.7040 > 35.7006$.

Finally we have, $65.7500 > 35.7040 > 35.7006 > 6.5750$

Hence, **descending order = 65.75, 35.704, 35.7006, 6.575 Ans.**

(d) Since these are unlike decimals, so first we convert them to like decimals as :

30.2000, 10.2600, 30.2560, 30.2596

Looking at their whole number parts is these decimals, we clearly find that: $30 > 10$

Now, we have three numbers whose whole number parts are 30. So, we observe that tenths, hundredths and thousandths places of decimals parts carefully.

Now, $30.2596 > 30.2560 > 30.2000$

Finally we have, $30.2596 > 30.2560 > 30.2000 > 10.2600$

Hence, **descending order = 30.2596, 30.256, 30.2, 10.26 Ans.**

4. (a) $0.25 = \frac{25}{100} = \frac{1}{4}$ Hence, $\mathbf{0.25 = \frac{1}{4}}$ **Ans.**

(b) $0.35 = \frac{35}{100} = \frac{7}{20}$ Hence, $\mathbf{0.35 = \frac{7}{20}}$ **Ans.**

(c) $4.5 = \frac{450}{100} = \frac{9}{2} = 4\frac{1}{2}$ Hence, $\mathbf{4.5 = \frac{9}{2} = 4\frac{1}{2}}$ **Ans.**

(d) $30.25 = \frac{3025}{100} = \frac{121}{4} = 30\frac{1}{4}$ Hence, $\mathbf{30.25 = 30\frac{1}{4}}$ **Ans.**

5. (a) $\frac{1}{2}$,

$$\begin{array}{r} 0.5 \\ 2\overline{)\ 1.0} \\ -1\ 0 \\ \hline 0 \\ \hline \end{array}$$

Hence, $\frac{1}{2} = 0.5$ **Ans.**

(b)

$$\begin{array}{r} 0.56 \\ 25\overline{)\ 14.00} \\ -125 \downarrow \\ \hline 150 \\ -150 \\ \hline 0 \\ \hline \end{array}$$

Hence, $\mathbf{\frac{14}{25} = 0.56}$ **Ans.**

(c)

$$\begin{array}{r} 1.44 \\ 25\overline{)\ 36.00} \\ -25 \downarrow \\ \hline 110 \\ -100 \downarrow \\ \hline 100 \\ -100 \\ \hline \times \\ \hline \end{array}$$

Hence, $\frac{36}{25} = 1.44$ **Ans.**

(d) $2\frac{3}{8} = \frac{19}{8}$

$$\begin{array}{r} 2.375 \\ 8\overline{)\ 19.000} \\ -16 \downarrow \\ \hline 30 \\ -24 \downarrow \\ \hline 60 \\ -56 \downarrow \\ \hline 40 \\ -40 \\ \hline \times \\ \hline \end{array}$$

Hence, $\mathbf{\frac{19}{8} = 2.375}$

6. (a) Converting all the decimal into like decimals and putting them one below the other,

We get 3.750, 4.920, 5.866

$$\begin{array}{r} 3.750 \\ 4.920 \\ +\ 5.866 \\ \hline 14.536 \\ \hline \end{array}$$

Hence,

$\mathbf{3.75 + 4.92 + 5.866 = 14.536}$ **Ans.**

(b) Converting the given decimals into like decimals. we get

8.295, 0.720, 2.455, 27.260

$$\begin{array}{r} 8.295 \\ 0.720 \\ 2.455 \\ +27.260 \\ \hline 38.730 \end{array}$$

Hence,

8.295 + 0.72 + 2.455 + 27.26

= 38.730 Ans.

(c) Converting the given decimals into like decimals, we get

22.57, 27.85, 39.25, 31.29

$$\begin{array}{r} 22.57 \\ 27.85 \\ 39.25 \\ +31.29 \\ \hline 120.96 \end{array}$$

Hence,

22.57 + 27.85 + 39.25 + 31.29

= 120.96 Ans.

(d) Converting the given decimals into like decimals, we get

32.45, 27.50, 26.25, 25.56

$$\begin{array}{r} 32.45 \\ 27.50 \\ 26.25 \\ +25.56 \\ \hline 111.76 \end{array}$$

Hence,

32.45 + 27.50 + 26.25 + 25.56

= 111.76 Ans.

7. (a) Here 4.96 and 13.26 are like decimals.

$$\begin{array}{r} 13.26 \\ -4.96 \\ \hline 8.30 \end{array}$$

Hence, **13.26 − 4.96 = 8.3**

Ans.

(b) Hence, 4.456 and 38.456 are like decimals.

$$\begin{array}{r} 38.456 \\ -4.456 \\ \hline 34.000 \end{array}$$

Hence, **38.456 − 4.456 = 34**

Ans.

(c) 2005 = 2005.000 (Converting decimals into like decimals.)

Now,

$$\begin{array}{r} 2005.000 \\ -825.356 \\ \hline 1179.644 \end{array}$$

Hence,

2005 − 825.356 = 1179.644

Ans.

(d) 385 = 385.00 (Converting decimals into like decimals.)

Now,

$$\begin{array}{r} 385.00 \\ -359.76 \\ \hline 25.24 \end{array}$$

Hence, **385 − 359.76 = 25.24**

Ans.

8. (a) 3.93 − 2.45 + 4.98 − 5.32

= (3.93 + 4.98) − (2.45 + 5.32)

= 8.91 − 7.77 = 1.14

$$\begin{array}{r} 8.91 \\ -7.77 \\ \hline 1.14 \end{array}$$

Hence,

3.93 − 2.45 + 4.98 − 5.32 = 1.14

Ans.

(b) 32.001 + 27.05 − 12.782

= (32.001 + 27.05) − 12.782

= 59.051 − 12.782 = 46.269

$$\begin{array}{r} 59.051 \\ -12.782 \\ \hline 46.269 \end{array}$$

Hence,

32.001 + 27.05 − 12.782

= 46.269 Ans.

(c) 1.892 + 3.872 − 1.789 − 1.72

= (1.892 + 3.872)

−(1.789 + 1.72)

= 5.764 − 3.509 = 2.255

$$\begin{array}{r} 5.764 \\ -3.509 \\ \hline 2.255 \end{array}$$

Hence,

1.892 + 3.872 − 1.789 − 1.72

= 2.255 Ans.

(d) 38.52 + 47.98 − 32.34

−12.59 = (38.52 + 47.98)

−(32.34 + 12.59)

= 86.50 − 44.93 = 41.57

$$\begin{array}{r} 86.50 \\ -44.93 \\ \hline 41.57 \end{array}$$

Hence,

38.52 + 47.98 − 32.34 − 12.59

= 41.57 Ans.

9. Tin contained edible oil

= 35.525 litre

Oil present in the tin after leakage = 24.725 litre

Quantity of wasted oil by leakage = 35.525 litre

−24.725 litre

= 10.8 litre

$$\begin{array}{r} 35.525 \\ -24.725 \\ \hline 10.800 \end{array}$$

Hence, **the quantity of wasted oil by leakage**

= 10.8 litre Ans.

10. Om covered the distance by cycled from point A to B

= 3.56 km

Om covered the distance by cycled from point B to C

= 6.76 km

Back distance covered by Om from point C to D

= 4.73 km

∴Distance between from point A to D = 3.56 km + 6.76 km − 4.73 km = (3.56 + 6.76) km − 4.73 km

= 10.32 km − 4.73 km

= 5.59 km

$$\begin{array}{r} 10.32 \text{ km} \\ -4.73 \text{ km} \\ \hline 5.59 \text{ km} \end{array}$$

Hence, **5.59 km far Om from point A. Ans.**

11. Poonam gave to shopkeeper =₹1000

Shopkeeper returned to Poonam =₹348.25

∴Amount payed by Poonam to shopkeeper

=₹1000 −₹348.25

=₹651.75

Hence, ₹ 651.75 payd by Poonam to shopkeeper.Ans.

12. $\because$ 1 kg $= 1000$ kg

(a) $\therefore 408 \text{ g} = \dfrac{408}{1000} \text{ kg} = 0.408 \text{ kg}$

Hence, **408 g = 0.408 kg** **Ans.**

(b) $9486 \text{ g} = \dfrac{9486}{1000} \text{ kg} = 9.486 \text{ kg}$

Hence, **9486 g = 9.486 kg** **Ans.**

(c) $33 \text{ kg } 37 \text{ g} = 33 \text{ kg} + \dfrac{37}{1000} \text{ kg} = 33 \text{ kg} + 0.037 \text{ kg} = 33.037 \text{ kg}$

Hence, **33 kg 37 g = 33.037 kg** **Ans.**

(d) $8 \text{ kg } 887 \text{ g} = 8 \text{ kg} + \dfrac{887}{1000} \text{ kg} = 8 \text{ kg} + 0.887 \text{ kg} = 8.887 \text{ kg}$

Hence, **8 kg 887 g = 8.887 kg** **Ans.**

13. $\because$ ₹1 $= 100$ paise

(a) 35 paise $= ₹\dfrac{35}{100} = ₹\,0.35$ Hence, **35 paise = ₹ 0.35** **Ans.**

(b) 607 paise $= ₹\dfrac{607}{100} = ₹\,6.07$ Hence, **607 paise = ₹ 6.07** **Ans.**

(c) 350 paise $= ₹\dfrac{350}{100} = ₹\,3.50$ Hence, **350 paise = ₹ 3.50** **Ans.**

(d) 336 paise $= ₹\dfrac{336}{100} = ₹\,3.36$ Hence, **336 paise = ₹ 3.36** **Ans.**

14. (a) $\because$ 1 m $= 100$ cm

$\therefore 87 \text{ cm} = \dfrac{87}{100} \text{ m} = 0.87 \text{ m}$ [$\because$ 1 km $= 1000$ m]

$\therefore 0.87 \text{ m} = \dfrac{0.87}{1000} \text{ km} = 0.00087 \text{ km}$

Hence, **87 cm = 0.87 m and 87 cm = 0.00087 km** **Ans.**

(b) $\because$ 1 cm $= 10$ mm

$\therefore 375 \text{ mm} = \dfrac{375}{10} \text{ cm} = 37.5 \text{ cm}$ [$\because$ 1 m $= 100$ cm]

$\therefore 37.5 \text{ cm} = \dfrac{37.5}{100} \text{ m} = 0.375 \text{ m}$

$\because$ 1 km $= 1000$ m

$\therefore 0.375 \text{ m} = \frac{0.375}{1000} \text{ km} = 0.000375 \text{ km}$

Hence, **375 mm = 37.5 cm, 0.375 m and 0.000375 km Ans.**

Exercise 3.2

1. If a decimal is multiplied by 10, shift decimal point to a one place towards right.

(a) $8.3 \times 10 = 83$ Hence, $\mathbf{83 \times 10 = 83}$ **Ans.**

(b) $92.6 \times 10 = 926$ Hence, $\mathbf{92.6 \times 10 = 926}$ **Ans.**

(c) $893.38 \times 10 = 8933.8$ Hence, $\mathbf{893.38 \times 10 = 8933.8}$ **Ans.**

(d) $443.763 \times 10 = 4437.63$ Hence, $\mathbf{443.763 \times 10 = 4437.63}$ **Ans.**

(e) $630.750 \times 10 = 6307.50$ Hence, $\mathbf{630.750 \times 10 = 6307.50}$ **Ans.**

(f) $44.35 \times 10 = 443.5$ Hence, $\mathbf{44.35 \times 10 = 443.5}$ **Ans.**

(g) $36.285 \times 10 = 362.85$ Hence, $\mathbf{36.285 \times 10 = 362.85}$ **Ans.**

(h) $9.387 \times 10 = 93.87$ Hence, $\mathbf{9.387 \times 10 = 93.87}$ **Ans.**

2. If a decimal is multiplied by 100, shift decimal point to two place towards right.

(a) $37.38 \times 100 = 3738$ Hence, $\mathbf{37.38 \times 100 = 3738}$ **Ans.**

(b) $429.896 \times 100 = 42989.6$ Hence, $\mathbf{429.896 \times 100 = 42989.6}$ **Ans.**

(c) $326.953 \times 100 = 32695.3$ Hence, $\mathbf{326.953 \times 100 = 32695.3}$ **Ans.**

(d) $3.78 \times 100 = 378$ Hence, $\mathbf{3.78 \times 100 = 378}$ **Ans.**

(e) $10.837 \times 100 = 1083.7$ Hence, $\mathbf{10.837 \times 100 = 1083.7}$ **Ans.**

(f) $40.006 \times 100 = 4000.6$ Hence, $\mathbf{40.006 \times 100 = 4000.6}$ **Ans.**

(g) $396.285 \times 100 = 39628.5$ Hence, $\mathbf{396.285 \times 100 = 39628.5}$ **Ans.**

(h) $4.236 \times 100 = 423.6$ Hence, $\mathbf{4.236 \times 100 = 423.6}$ **Ans.**

3. If a decimal is multiplied by 1000, shift decimal point to three place towards right.

(a) $83.9694 \times 1000 = 83969.4$ Hence, $83.9694 \times 1000 = 83969.4$ **Ans.**

(b) $355.386 \times 1000 = 355386$ Hence, $\mathbf{355.386 \times 1000 = 355386}$ **Ans.**

(c) $3.856 \times 1000 = 3856$ Hence, $\mathbf{3.856 \times 1000 = 3856}$ **Ans.**

(d) $9.07 \times 1000 = 9070$ Hence, $\mathbf{9.07 \times 1000 = 9070}$ **Ans.**

(e) $3.78 \times 1000 = 3780$ Hence, $\mathbf{3.78 \times 1000 = 3780}$ **Ans.**

(f) $3.895 \times 1000 = 3895$ Hence, $\mathbf{3.895 \times 1000 = 3895}$ **Ans.**

(g) $48.367 \times 1000 = 48367$ Hence, $\mathbf{48.367 \times 1000 = 48367}$ **Ans.**

(h) $429.368 \times 1000 = 429368$ Hence, $\mathbf{429.368 \times 1000 = 429368}$ **Ans.**

4. (a) ∵ Number of decimal place in 0.25 = 2
∴ Decimal place in the product = 2

$$\begin{array}{r} 0.25 \\ \times \quad 8 \\ \hline 2.00 \end{array}$$

Hence, $\mathbf{0.25 \times 8 = 2}$ **Ans.**

(b) Number of decimal place in 3.38 = 2
Decimal place in the product = 2

$$\begin{array}{r} 3.38 \\ \times \quad 9 \\ \hline 30.42 \end{array}$$

Hence, $\mathbf{3.38 \times 9 = 30.42}$ **Ans.**

(c) ∵ Number of decimal place in 2.256 = 3
∴ Decimal place in the product = 3

$$\begin{array}{r} 2.256 \\ \times \quad 46 \\ \hline 13536 \\ 9024\times \\ \hline 103.776 \end{array}$$

Hence, $\mathbf{2.256 \times 46 = 103.776}$ **Ans.**

(d) ∵ Number of decimal place in 32.799 = 3
∴ Decimal place in the product = 3

$$\begin{array}{r} 32.799 \\ \times \ 288 \\ \hline 262392 \\ 262392\times \\ 65598\times\times \\ \hline 9446.112 \end{array}$$

Hence,
$\mathbf{32.799 \times 288 = 9446.112}$ **Ans.**

(e) ∵ Number of decimal place in 4.02 = 2
∴ Decimal place in the product = 2

$$\begin{array}{r} 4.02 \\ \times \quad 63 \\ \hline 1206 \\ 2412\times \\ \hline 253.26 \end{array}$$

Hence, $\mathbf{4.02 \times 63 = 253.26}$ **Ans.**

(f) ∵ Number of decimal place in 0.13125 = 5
∴ Decimal place in the product = 5

$$\begin{array}{r} 0.13125 \\ \times \ 328 \\ \hline 105000 \\ 26250\times \\ 39375\times\times \\ \hline 43.05000 \end{array}$$

Hence, $\mathbf{0.13125 \times 328 = 43.05}$ **Ans.**

(g) ∵ Number of decimal place in 2.3456 = 4
∴ Decimal place in the product = 4

$$\begin{array}{r} 2.3456 \\ \times \quad 32 \\ \hline 46912 \\ 70368\times \\ \hline 75.0592 \end{array}$$

Hence, $\mathbf{2.3456 \times 32 = 75.0592}$ **Ans.**

(h) ∵ Number of decimal place in 44.375 = 3
∴ Decimal place in the product = 3

$$\begin{array}{r} 44.375 \\ \times \quad 23 \\ \hline 133125 \\ 88750\times \\ \hline 1020.625 \end{array}$$

Hence,

44.375 × 23 = 1020.625 Ans.

5. (a) Number of decimal place in 0.3 = 1

Number of decimal place in 0.6 = 1

Total number of decimal place in product = 1 + 1 = 2

$$\begin{array}{r} 0.3 \\ \times \quad 0.6 \\ \hline 0.18 \end{array}$$

Hence, **0.3 × 0.6 = 0.18 Ans.**

(b) Number of decimal place in 0.35 = 2

Number of decimal place in 0.9 = 1

Total number of decimal place in product = 2 + 1 = 3

$$\begin{array}{r} 0.35 \\ \times \ 0.9 \\ \hline 0.315 \end{array}$$

Hence, 0.35 × 0.9 = 0.315 **Ans.**

(c) Number of decimal place in 0.008 = 3

Number of decimal place in 4.7 = 1

Total number of decimal place in product = 3 + 1 = 4

$$\begin{array}{r} 0.008 \\ \times \ 4.7 \\ \hline 056 \\ 032\times \\ \hline 0.0376 \end{array}$$

Hence, **0.008 × 4.7 = 0.0376 Ans.**

(d) Number of decimal place in 3.97 = 2

Number of decimal place in 4.26 = 2

Total number of decimal place in product = 2 + 2 = 4

$$\begin{array}{r} 3.97 \\ \times 4.26 \\ \hline 2382 \\ 794\times \\ 1588\times\times \\ \hline 16.9122 \end{array}$$

Hence,

3.97 × 4.26 = 16.9122

Ans.

(e) Number of decimal place in 8.98 = 2

Number of decimal place in 9.24 = 2

Total number of decimal place in product = 2 + 2 = 4

$$\begin{array}{r} 8.98 \\ \times 9.24 \\ \hline 3592 \\ 1796\times \\ 8082\times\times \\ \hline 82.9752 \end{array}$$

Hence,

8.98 × 9.24 = 82.9752

Ans.

(f) Number of decimal place in $0.008 = 3$

Number of decimal place in $0.08 = 2$

Total number of decimal place in product $= 3 + 2 = 5$

Hence,

$0.008 \times 0.08 = 0.00064$

Ans.

(g) Number of decimal place in $35.27 = 2$

Number of decimal place in $3.5 = 1$

Total number of decimal place in product $= 2 + 1 = 3$

$$\begin{array}{r} 35.27 \\ \times\ 3.5 \\ \hline 17635 \\ 10581\times \\ \hline 123.445 \end{array}$$

Hence, **$35.27 \times 3.5 = 123.445$**

Ans.

(h) Number of decimal place in $3.6 = 1$

Number of decimal place in $0.008 = 3$

Total number of decimal place in product $= 1 + 3 = 4$

$$\begin{array}{r} 3.6 \\ \times 0.008 \\ \hline 0.0288 \end{array}$$

Hence, **$3.6 \times 0.008 = 0.0288$**

Ans.

(i) Number of decimal place in $4.1 = 1$

Number of decimal place in $3.2 = 1$

Total number of decimal place in product $= 1 + 1 = 2$

$$\begin{array}{r} 4.1 \\ \times\ 3.2 \\ \hline 82 \\ 123\times \\ \hline 13.12 \end{array}$$

Hence, **$4.1 \times 3.2 = 13.12$ Ans.**

(j) Number of decimal place in $30.25 = 2$

Number of decimal place in $35.06 = 2$

Total number of decimal place in product $= 2 + 2 = 4$

$$\begin{array}{r} 30.25 \\ \times 35.06 \\ \hline 18150 \\ 0000\times \\ 15125\times\times \\ 9075\times\times\times \\ \hline 1060.5650 \end{array}$$

Hence,

$30.25 \times 35.06 = 1060.565$

Ans.

(k) Number of decimal place in $0.3 = 1$

Number of decimal place in $0.03 = 2$

Number of decimal place in $0.003 = 3$

Total number of decimal place in product $= 1 + 2 + 3 = 6$

Hence,

$0.3 \times 0.03 \times 0.003 = 0.000027$

Ans.

(l) Number of decimal place in $0.6 = 1$
Number of decimal place in $3.6 = 1$
Number of decimal place in $3.06 = 2$
Total number of decimal place in product $= 1 + 1 + 2 = 4$

$$\begin{array}{r} 0.6 \\ \times\ 3.6 \\ \hline 36 \\ 18\times \\ \hline 2.16 \end{array}$$

Now,

$$\begin{array}{r} 2.16 \\ \times\ 3.06 \\ \hline 1296 \\ 000\times \\ 648\times\times \\ \hline 6.6096 \end{array}$$

Hence, $\mathbf{0.6 \times 3.6 \times 3.06 = 6.6096}$ **Ans.**

Exercise 3.3

1. (a) ∵ Number of zeroes after $1 = 1$
∴ Move decimal point 1 place to the left.
Thus, $326.73 \div 10 = \mathbf{32.673}$ **Ans.**

(b) Number of zeroes after $1 = 1$
∴ Move decimal point 1 place to the left.
Thus, $45.85 \div 10 = \mathbf{4.585}$ **Ans.**

(c) Number of zeroes after $1 = 1$
∴ Move decimal point 1 place to the left.
Thus, $37.96 \div 10 = \mathbf{3.796}$ **Ans.**

(d) Decimal of zeroes after $1 = 1$
∴ Move decimal point 1 place to the left.
Thus, $30.76 \div 10 = \mathbf{3.076}$ **Ans.**

(e) Number of zeroes after $1 = 1$
∴ Move decimal point 1 place to the left.
Thus, $9.05 \div 10 = \mathbf{0.905}$ **Ans.**

(f) Number of zeroes after $1 = 1$
∴ Move decimal point 1 place to the left.
Thus, $6.0039 \div 10 = \mathbf{0.60039}$ **Ans.**

(g) Number of zeroes in divisor (100) after $1 = 2$
∴ Move decimal point 2 places to the left.
Thus, $354.6 \div 100 = \mathbf{3.546}$ **Ans.**

(h) Number of zeroes in divisor (100) after $1 = 2$
∴ Move decimal point 2 places to the left.

Thus, $34.8 \div 100 =$ **0.348** **Ans.**

(i) Number of zeroes in divisor (100) after $1 = 2$

$\therefore$ Move decimal point 2 places to the left.

Thus, $92.96 \div 100 =$ **0.9296** **Ans.**

(j) Number of zeroes in divisor (100) after $1 = 2$

$\therefore$ Move decimal point 2 places to the left.

Thus, $1435.76 \div 100 =$ **14.3576** **Ans.**

(k) Number of zeroes in divisor (100) after $1 = 2$

$\therefore$ Move decimal point 2 places to the left.

Thus, $30.83 \div 100 =$ **0.3083** **Ans.**

(l) Number of zeroes in divisor (100) after $1 = 2$

$\therefore$ Move decimal point 2 places to the left.

Thus, $40.03 \div 100 =$ **0.4003** **Ans.**

(m) Number of zeroes in divisor (100) after $1 = 2$

$\therefore$ Move decimal point 2 places to the left.

Thus, $90.0059 \div 100 =$ **0.900059** **Ans.**

(n) Number of zeroes in divisor (1000) after $1 = 3$

$\therefore$ Move decimal point 3 places to the left.

Thus, $3569.3 \div 1000 =$ **3.5693** **Ans.**

(o) Number of zeroes in divisor (1000) after $1 = 3$

$\therefore$ Move decimal point 3 places to the left.

Thus, $2768.94 \div 1000 =$ **2.76894** **Ans.**

(p) Number of zeroes in divisor (1000) after $1 = 3$

$\therefore$ Move decimal point 3 places to the left.

Thus, $72.962 \div 1000 =$ **0.072962** **Ans.**

(q) Number of zeroes in divisor (1000) after $1 = 3$

$\therefore$ Move decimal point 3 places to the left.

Thus, $32.8 \div 1000 =$ **0.0328** **Ans.**

(r) Number of zeroes in divisor (1000) after $1 = 3$

$\therefore$ Move decimal point 3 places to the left.

Thus, $30.7 \div 1000 =$ **0.0307** **Ans.**

(s) Number of zeroes in divisor (1000) after $1 = 3$

$\therefore$ Move decimal point 3 places to the left.

Thus, $40.08 \div 1000 =$ **0.04008** **Ans.**

(t) Number of zeroes in divisor (1000) after $1 = 3$

$\therefore$ Move decimal point 3 places to the left.

Thus, $50.0037 \div 1000 =$ **0.0500037** **Ans.**

2. (a)

```
      5.2
   5 ) 26.0
     –25↓
      10
     –10
      ×
```

Hence, **26 ÷ 5 = 5.2** **Ans.**

(b)

```
      22.25
   4 ) 89.00
     –8↓ | |
      9  | |
     –8  ↓ |
      10 | |
     –8  | ↓
      20 | |
     –20 | |
       0 | |
```

Hence, **89 ÷ 4 = 22.25** **Ans.**

(c)

```
      7.25
  12 ) 87.00
     –84↓ |
      30  |
     –24  ↓
      60
     –60
       0
```

Hence, **87 ÷ 12 = 7.25** **Ans.**

(d)

```
      12.24
  25 ) 306.00
     –25↓ | |
      56  | |
     –50  ↓ |
      60  | |
     –50  | ↓
      100 | |
     –100 | |
        0 | |
```

Hence, **306 ÷ 25 = 12.24** **Ans.**

(e)

```
      26.25
  16 ) 420.00
     –32↓ | | |
      100 | | |
     –96  ↓ | |
       40 | | |
      –32 | ↓ |
        80 | | |
       –80 | | |
         0 | | |
```

Hence, **420 ÷ 16 = 26.25** **Ans.**

(f)

```
      3.16
  25 ) 79.00
     –75↓ | |
      40  | |
     –25  ↓ |
      150 | |
     –150 | |
        0 | |
```

Hence, **79 ÷ 25 = 3.16** **Ans.**

(g)

```
      0.68
  25 ) 17.00
     –150↓ |
      200  |
     –200  ↓
        0
```

Hence, **17 ÷ 25 = 0.68** **Ans.**

(h)

```
      1.4
  25 ) 35.0
     –25↓
      100
     –100
        0
```

Hence, **35 ÷ 25 = 1.4** **Ans.**

3. (a)

$$\begin{array}{r} 3.5 \\ 26\overline{)\ 9\,1.0} \\ -7\,8\downarrow \\ \hline 1\,3\,0 \\ -1\,3\,0 \\ \hline 0 \end{array}$$

Hence, **91 ÷ 26 = 3.5** **Ans.**

(b)

$$\begin{array}{r} 3.184 \\ 13\overline{)\ 4\,1.3\,9\,2} \\ -3\,9\downarrow\ \ \downarrow\ \ \downarrow \\ \hline 2\,3\ \ \ \ \ \ \\ -1\,3\downarrow\ \ \ \ \ \ \\ \hline 1\,0\,9\ \ \ \ \ \ \\ -1\,0\,4\downarrow\ \ \ \ \ \ \\ \hline 5\,2\ \ \ \ \ \ \\ -5\,2\ \ \ \ \ \ \\ \hline 0 \end{array}$$

Hence, **41.392 ÷ 13 = 3.184 Ans.**

(c)

$$\begin{array}{r} 5.44 \\ 18\overline{)\ 9\,7.9\,2} \\ -9\,0\downarrow\ \ \downarrow \\ \hline 7\,9\ \ \ \ \\ -7\,2\downarrow\ \ \ \\ \hline 7\,2\ \ \ \ \\ -7\,2\ \ \ \ \\ \hline 0 \end{array}$$

Hence, **97.92 ÷ 18 = 5.44 Ans.**

(d)

$$\begin{array}{r} 3.786 \\ 23\overline{)\ 8\,7.0\,7\,8} \\ -6\,9\downarrow\ \ \downarrow\ \ \downarrow \\ \hline 1\,8\,0\ \ \ \ \ \ \\ -1\,6\,1\downarrow\ \ \ \ \ \ \\ \hline 1\,9\,7\ \ \ \ \ \ \\ -1\,8\,4\downarrow\ \ \ \ \ \ \\ \hline 1\,3\,8\ \ \ \ \ \ \\ -1\,3\,8\ \ \ \ \ \ \\ \hline 0 \end{array}$$

Hence, **87.078 ÷ 23 = 3.786** **Ans.**

(e)

$$\begin{array}{r} 11.872 \\ 47\overline{)\ 5\,5\,7.9\,8\,4} \\ -4\,7\downarrow\ \ \downarrow\ \ \downarrow\ \ \downarrow \\ \hline 8\,7\ \ \ \ \ \ \ \ \\ -4\,7\downarrow\ \ \ \ \ \ \ \ \\ \hline 4\,0\,9\ \ \ \ \ \ \ \ \\ -3\,7\,6\downarrow\ \ \ \ \ \ \ \ \\ \hline 3\,3\,8\ \ \ \ \ \ \ \ \\ -3\,2\,9\downarrow\ \ \ \ \ \ \ \ \\ \hline 9\,4\ \ \ \ \ \ \ \ \\ -9\,4\ \ \ \ \ \ \ \ \\ \hline 0 \end{array}$$

Hence,
557.984 ÷ 47 = 11.872 **Ans.**

(f)

$$\begin{array}{r} 31.04 \\ 8\overline{)\ 2\,4\,8.3\,2} \\ -2\,4\downarrow\ \ \ \ \downarrow \\ \hline 8\ \ \ \ \ \ \\ -8\ \ \ \ \ \ \\ \hline 3\,2\ \ \ \ \ \ \\ -3\,2\ \ \ \ \ \ \\ \hline 0 \end{array}$$

Hence, **248.32 ÷ 8 = 31.04 Ans.**

(g)

$$\begin{array}{r} 5.464 \\ 11\overline{)\ 6\,0.1\,0\,4} \\ -5\,5\downarrow\ \ \downarrow\ \ \downarrow \\ \hline 5\,1\ \ \ \ \ \ \\ -4\,4\downarrow\ \ \ \ \ \ \\ \hline 7\,0\ \ \ \ \ \ \\ -6\,6\downarrow\ \ \ \ \ \ \\ \hline 4\,4\ \ \ \ \ \ \\ -4\,4\ \ \ \ \ \ \\ \hline 0 \end{array}$$

Hence, **60.104 ÷ 11 = 5.464**
Ans.

(h)
$$\begin{array}{r} 8.518 \\ 18\overline{)\,153.324} \\ -144\downarrow \\ \hline 93 \\ -90\downarrow \\ \hline 32 \\ -18\downarrow \\ \hline 144 \\ -144 \\ \hline 0 \end{array}$$

Hence, **153.324 ÷ 18 = 8.518**

4. (a) 12.72 ÷ 0.6

We have,

$$\frac{12.72}{0.6} = \frac{1272 \times 10}{6 \times 10} = \frac{127.2}{6}$$

Now,
$$\begin{array}{r} 21.2 \\ 6\overline{)\,127.2} \\ -12\downarrow \\ \hline 7 \\ -6\downarrow \\ \hline 12 \\ -12 \\ \hline 0 \end{array}$$

Hence, **12.72 ÷ 0.6 = 21.2 Ans.**

(b) 14.58 ÷ 0.3

We have,

$$\frac{14.58}{0.3} = \frac{1458 \times 10}{3 \times 10} = \frac{145.8}{3}$$

Now,
$$\begin{array}{r} 48.6 \\ 3\overline{)\,145.8} \\ -12\downarrow \\ \hline 25 \\ -24\downarrow \\ \hline 18 \\ -18 \\ \hline 0 \end{array}$$

Hence, **14.58 ÷ 0.3 = 48.6Ans.**

(c) 12.5 ÷ 2.5

We have,

$$\frac{12.5}{2.5} = \frac{125 \times 10}{25 \times 10} = \frac{125}{25}$$

Now,
$$\begin{array}{r} 5 \\ 25\overline{)\,125} \\ -125 \\ \hline 0 \end{array}$$

Hence, **12.5 ÷ 2.5 = 5 Ans.**

(d) 9.9 ÷ 0.03

We have,

$$\frac{9.9}{0.03} = \frac{99 \times 100}{3 \times 100} = \frac{990}{3}$$

Now,
$$\begin{array}{r} 330 \\ 3\overline{)\,990} \\ -9\downarrow \\ \hline 9 \\ -9\downarrow \\ \hline 0 \\ -0 \\ \hline 0 \end{array}$$

Hence, **9.9 ÷ 0.03 = 330Ans.**

(e) 40.29 ÷ 7.9

We have,

$$\frac{40.29}{7.9} = \frac{4029 \times 10}{79 \times 10} = \frac{402.9}{79}$$

Now,
$$\begin{array}{r} 5.1 \\ 79\overline{)\,402.9} \\ -395\downarrow \\ \hline 79 \\ -79 \\ \hline 0 \end{array}$$

Hence, **40.29 ÷ 7.9 = 5.1 Ans.**

(f) 198.628 ÷ 12.7

We have,

$$\frac{198.628}{12.7} = \frac{198628 \times 10}{127 \times 10}$$

$$= \frac{1986.28}{127}$$

Now,

$$\begin{array}{r} 15.64 \\ 127\overline{)\,1\,9\,8\,6.2\,8} \\ -1\,2\,7\downarrow \\ \hline 7\,1\,6 \\ -6\,3\,5\downarrow \\ \hline 8\,1\,2 \\ -7\,6\,2\downarrow \\ \hline 5\,0\,8 \\ -5\,0\,8 \\ \hline 0 \end{array}$$

Hence, $\mathbf{198.628 \div 12.7 = 15.64}$ **Ans.**

(g) $35.31 \div 2.4$

We have,

$$\frac{35.31}{2.4} = \frac{3531 \times 10}{24 \times 10} = \frac{353.1}{24}$$

Now,

$$\begin{array}{r} 14.7125 \\ 24\overline{)\,3\,5\,3.1\,0\,0\,0} \\ -2\,4\downarrow \\ \hline 1\,1\,3 \\ -9\,6\downarrow \\ \hline 1\,7\,1 \\ -1\,6\,8\downarrow \\ \hline 3\,0 \\ -2\,4\downarrow \\ \hline 6\,0 \\ -4\,8\downarrow \\ \hline 1\,2\,0 \\ -1\,2\,0 \\ \hline 0 \end{array}$$

Hence, $\mathbf{35.31 \div 2.4 = 14.7125}$ **Ans.**

(h) $7 \div 0.007$

We have,

$$\frac{7}{0.007} = \frac{7 \times 1000}{7} = \frac{7000}{7}$$

Now,

$$\begin{array}{r} 1000 \\ 7\overline{)\,7\,0\,0\,0} \\ -7\downarrow \\ \hline 0\,0\,0 \end{array}$$

Hence, $\mathbf{7 \div 0.007 = 1000}$ **Ans.**

(i) $0.152 \div 0.19$

We have,

$$\frac{0.152}{0.19} = \frac{152 \times 100}{19 \times 100} = \frac{15.2}{19}$$

Now,

$$\begin{array}{r} 0.8 \\ 19\overline{)\,1\,5.2} \\ -1\,5\,2 \\ \hline 0 \end{array}$$

Hence, $\mathbf{0.152 \div 0.19 = 0.8}$ **Ans.**

(j) $0.456 \div 0.38$

We have,

$$\frac{0.456}{0.38} = \frac{456 \times 100}{38 \times 100} = \frac{45.6}{38}$$

Now,

$$\begin{array}{r} 1.2 \\ 38\overline{)\,4\,5.6} \\ -3\,8\downarrow \\ \hline 7\,6 \\ -7\,6 \\ \hline 0 \end{array}$$

Hence, $0.456 \div 0.38 = 1.2$ **Ans.**

(k) $1.617 \div 0.35$

We have,

$$\frac{1.617}{0.35} = \frac{1617 \times 100}{35 \times 100} = \frac{161.7}{35}$$

Now,

$$\begin{array}{r} 4.62 \\ 35\overline{)\,1\,6\,1.7\,0} \\ -1\,4\,0\downarrow \\ \hline 2\,1\,7 \\ -2\,1\,0\downarrow \\ \hline 7\,0 \\ -7\,0 \\ \hline 0 \end{array}$$

Hence, **1.617 ÷ 0.35 = 4.62**

Ans.

(l)
$$\begin{array}{r} 0.0604 \\ 11\overline{)0.6644} \\ -66\downarrow\downarrow \\ \hline 44 \\ -44 \\ \hline 0 \end{array}$$

Hence, **0.6644 ÷ 11 = 0.0604**

Ans.

Exercise 3.4

1. ∵ Height of the stack = 42.3 cm

∴ Thick (height) of one book = 2.35 cm

∴ Number of books
$$= \frac{42.3\,\text{cm}}{2.35\,\text{cm}} = \frac{423\times100}{235\times100}$$
$$= \frac{4230}{235} = 18 \text{ books}$$
$$\begin{array}{r} 18 \\ 235\overline{)4230} \\ -235\downarrow \\ \hline 1880 \\ -1880 \\ \hline 0 \end{array}$$

Hence, **the number of book in the stack is 18.** **Ans.**

2. ∵ The cost of 1 m suit length = ₹ 1250

∴ Cost of 3.25 m suit length = ₹ 1250 × 3.25 = ₹ 4062.50
$$\begin{array}{r} 1250 \\ \times\ 3.25 \\ \hline 6250 \\ 2500\times \\ 3750\times\times \\ \hline 4062.50 \end{array}$$

Hence, **I will pay ₹ 4062.50 of suit.** **Ans.**

3. ∵ Cost of 1 pen = ₹ 15.75

∴ Number of pen = 2 × 12 = 24 **[∵ 1 dozen = 12]**

∴ Cost of 2 dozen pens = ₹ 15.75 × 24 = ₹ 378
$$\begin{array}{r} 15.75 \\ \times\quad 24 \\ \hline 6300 \\ 3150\times \\ \hline 378.00 \end{array}$$

Hence, **the total cost of pens = ₹ 378** **Ans.**

4. ∵ Total weight of chocolates box = 1.75 kg = 1750 g

∴ Number of chocolate in the box = 35

∴ Weight of each chocolate
$$= \frac{1750}{35}\,\text{g} = 50\,\text{g}$$
$$\begin{array}{r} 50 \\ 35\overline{)1750} \\ -175\downarrow \\ \hline 0 \\ -0 \\ \hline \end{array}$$

Hence, **the weights of each chocolate is 50 g.** **Ans.**

5. ∵ Price of 1 pair shoes = ₹ 759.99

∴ Cost of 5 such pair shoes = ₹ 759.99 × 5 = ₹ 3799.95
$$\begin{array}{r} 759.99 \\ \times\ 5 \\ \hline 3799.95 \end{array}$$

Hence, **the cost of 5 pairs shoes = ₹ 3799.95** **Ans.**

6. ∵ Total needs of sauce = 22.5 kg = 22500 g
∴ Weight of each bottle of sauce = 750 g
∴ Number of bottles
$= \frac{22500\,g}{750\,g} = \frac{2250}{75}$
= 30 bottles

$$\begin{array}{r} 30 \\ 75\overline{)\,2250} \\ -225\downarrow \\ \hline 0 \\ -0 \\ \hline \end{array}$$

Hence, **30 bottles shouce Prateek by.** **Ans.**

7. ∵ Weight of one of tube of toothpaste = 45.50 g
∴ Number of tube = 18
∴ Weight of 18 tube of toothpaste = 45.50 × 18g
= 819 g

$$\begin{array}{r} 45.50 \\ \times\quad 18 \\ \hline 36400 \\ 4550\times \\ \hline 819.00 \end{array}$$

Hence, **the weight of 18 tube of toothpaste box 819 g.** **Ans.**

8. ∵ Capacity of a bucket = 21.25 litre
∴ Capacity of a mug = 1.25 litre
∴ Number of mug can be filled $= \frac{21.25\,\text{litre}}{1.25\,\text{litre}}$
$= \frac{2125}{125} = 17$

$$\begin{array}{r} 17 \\ 125\overline{)\,2125} \\ -125\downarrow \\ \hline 875 \\ -875 \\ \hline 0 \\ \hline \end{array}$$

Hence, **17 mug can be filled.** **Ans.**

9. ∵ Cost of one water bottle = ₹ 252.25
∴ Cost of 12 water bottle = ₹ 252.25 × 12 = ₹ 3027

$$\begin{array}{r} 252.25 \\ \times\quad 12 \\ \hline 50450 \\ 25225\times \\ \hline 3027.00 \end{array}$$

Hence, **the cost of 12 water bottles is ₹ 3027.** **Ans.**

10. ∵ Cost of one spoon = ₹ 25.20
∴ Cost of 12 spoons = ₹ 25.20 × 12 = ₹ 302.40

$$\begin{array}{r} 25.20 \\ \times\quad 12 \\ \hline 5040 \\ 2520\times \\ \hline 302.40 \end{array}$$

Hence, **the cost of 12 spoons is ₹ 302.40.** **Ans.**

11. ∵ Charges of 1 km = ₹ 12.20
∴ Charges of 3.45 km = ₹ 12.20 × 3.45 = ₹ 42.09

$$\begin{array}{r} 12.20 \\ \times\ 3.45 \\ \hline 6100 \\ 4880\times \\ 3660\times\times \\ \hline 42.0900 \end{array}$$

Hence, **I will pay ₹ 42.09 for 3.45 km travel.** **Ans.**

12. ∵ Cost of 1 kg sugar = ₹ 18.50

∴ Cost of 3.5 kg sugar = ₹ 18.50×3.5 = ₹ 64.75

$$\begin{array}{r} 18.50 \\ \times\ 3.5 \\ \hline 9250 \\ 5550\times \\ \hline 64.750 \end{array}$$

Hence, **the cost of 3.5 kg sugar is ₹ 64.75.** **Ans.**

Multiple Choice Questions

1. (i) $3.25 - 2.15 = 1.10$

$$\begin{array}{r} 3.25 \\ -2.15 \\ \hline 1.10 \end{array}$$

Hence, the answer (a) is correct. **Ans.**

(ii) Converting the given decimal into like decimals

We get, $4.850 + 3.175$

$$\begin{array}{r} 4.850 \\ +3.175 \\ \hline 8.025 \end{array}$$

Hence, the answer (b) is correct. **Ans.**

(iii) Converting the given decimals into like decimals.

We get,

$13.1500 - 2.1758 = 10.9742$

$$\begin{array}{r} 13.1500 \\ -2.1758 \\ \hline 10.9742 \end{array}$$

Hence, the answer **(c)** is correct. **Ans.**

(iv) The given decimals into like decimals.

We get,

$137.45 + 243.18 = 380.36$

$$\begin{array}{r} 137.45 \\ +243.18 \\ \hline 380.63 \end{array}$$

Hence, the answer **(d)** is correct. **Ans.**

(v)
$$\begin{array}{r} 2.35 \\ \times 1.76 \\ \hline 1410 \\ 1645\times \\ 235\times\times \\ \hline 4.1360 \end{array}$$

The answer **(a)** is correct. **Ans.**

(vi)
$$\begin{array}{r} 1.75 \\ \times 2.17 \\ \hline 1225 \\ 175\times \\ 350\times\times \\ \hline 3.7975 \end{array}$$

The answer **(b)** is correct. **Ans.**

(vii)
$$\begin{array}{r} 315.68 \\ \times 2.78 \\ \hline 252544 \\ 220976\times \\ 631360\times\times \\ \hline 877.5904 \end{array}$$

The answer **(c)** is correct. **Ans.**

(viii)
$$8.125 \div 3.25 = \frac{8125 \times 100}{325 \times 100}$$
$$= \frac{25}{10} = 2.5$$

Hence, the answer **(b)** is correct. **Ans.**

4. Rational Numbers

Exercise 4.1

1. (a) $\frac{-21}{3} = \frac{(-21)\times 1}{3\times 1} = \frac{\mathbf{-21}}{\mathbf{3}}$ **Ans.**

(b) $\frac{-3}{-15} = \frac{-3\times(-1)}{-15\times(-1)} = \frac{\mathbf{3}}{\mathbf{15}}$ **Ans.**

(c) $\frac{-14}{-1} = \frac{-14\times(-1)}{-1\times(-1)} = \frac{\mathbf{14}}{\mathbf{1}}$ **Ans.**

2. (a) $\frac{11}{7} = \frac{11\times 2}{7\times 2} = \frac{22}{14}; \frac{11\times 3}{7\times 3} = \frac{33}{21}; \frac{11\times 4}{7\times 4} = \frac{44}{28} \therefore \frac{22}{14} = \frac{33}{21} = \frac{44}{28}$

Hence, the three equivalent rational numbers of $\frac{11}{7}$ are

$\mathbf{\frac{22}{14}, \frac{33}{21}}$ **and** $\mathbf{\frac{44}{28}}$**.** **Ans.**

(b) $\frac{-21}{3} = \frac{-21\times 2}{3\times 2} = \frac{-42}{6}; \frac{-21\times 3}{3\times 3}; \frac{-63}{9} = \frac{-21\times 4}{3\times 4} = \frac{-84}{12}$

$\therefore \quad \frac{-42}{6} = \frac{-63}{9} = \frac{-84}{12}$

Hence, the three equivalent rational numbers of $\frac{-21}{3}$ are

$\mathbf{\frac{-42}{6}, \frac{-63}{9}, \frac{-84}{12}}$ **Ans.**

(c) $\frac{-11}{-2} = \frac{-11\times(-1)}{-2\times(-1)} = \frac{11}{2}; \frac{-11\times(-2)}{-2\times(-2)} = \frac{22}{4}; \frac{-11\times(-3)}{-2\times(-3)} = \frac{33}{6}$

$\therefore \quad \frac{11}{2} = \frac{22}{4} = \frac{33}{6}$

Hence, the three equivalent rational numbers of $\frac{-11}{-2}$ are

$\mathbf{\frac{11}{2}, \frac{22}{4}}$ **and** $\mathbf{\frac{33}{6}}$**.** **Ans.**

3. (a) The given number is $\frac{64}{-84}$.

The H.C.F. of 64 and $84 = 4 \quad \therefore \frac{64}{-84} = \frac{64\div(-4)}{-84\div(-4)} = \frac{-16}{21}$

Hence, $\frac{\mathbf{64}}{\mathbf{-84}} = \frac{\mathbf{-16}}{\mathbf{21}}$ (in standard form) **Ans.**

(b) The given number is $\frac{-72}{-324}$.

The H.C.F. of 72 and $324 = 36$ $\quad \therefore \frac{-72}{-324} = \frac{-72 \div 36}{-324 \div 36} = \frac{2}{9}$

Hence, $\frac{\mathbf{-72}}{\mathbf{-324}} = \frac{\mathbf{2}}{\mathbf{9}}$ (in standard form) **Ans.**

(c) The given number is $\frac{200}{-700}$.

The H.C.F. of 200 and 700 is 100.

$\therefore \quad \frac{200}{-700} = \frac{200 \div (-100)}{-700 \div (-100)} = \frac{-2}{7}$

Hence, $\frac{\mathbf{200}}{\mathbf{-700}} = \frac{\mathbf{-2}}{\mathbf{7}}$ (in standard form) **Ans.**

4. (a) $-2 = \frac{\mathbf{-2}}{\mathbf{1}}$ **Ans.** (b) $8 = \frac{\mathbf{8}}{\mathbf{1}}$ **Ans.**

(c) $0.14 = \frac{14}{100} = \frac{\mathbf{7}}{\mathbf{50}}$ **Ans.** (d) $-9 = \frac{\mathbf{-9}}{\mathbf{1}}$ **Ans.**

5. (a) In $\frac{4}{-5}$, Numerator and Denominator are opposite sign

$\therefore \frac{\mathbf{4}}{\mathbf{-5}}$ **is a negative rational number.** **Ans.**

(b) In $\frac{9}{7}$, Numerator and denominator are same sign.

$\therefore \frac{\mathbf{9}}{\mathbf{7}}$ **is a positive rational number.** **Ans.**

(c) In $\frac{-1}{-5,}$ Numerator and denominator are same sign.

$\therefore \frac{-1}{-5}$ is a positive rational number. **Ans.**

(d) In $\frac{-15}{7}$, Numerator and denominator are opposite sign.

$\therefore \frac{\mathbf{-15}}{\mathbf{7}}$ **is a negative rational number.** **Ans.**

6. (a) By what number should we multiply -6 to get -12.

Clearly, $(-12) \div (-6) = 2 \therefore \frac{4}{-6} = \frac{4 \times 2}{-6 \times 2} = \frac{8}{-12}$

Again by what number should we multiply 4 to get -10.

Clearly, $(-10) \div 4 = \frac{-10}{4} = -2.5 \therefore \frac{4}{-6} = \frac{4 \times (-2.5)}{-6 \times (-2.5)} = \frac{-10}{15}$

Hence, $\mathbf{\frac{4}{-6} = \frac{\boxed{8}}{-12} = \frac{-10}{\boxed{15}}}$ **Ans.**

(b) By what number should we divide 28 to get 7.

Clearly, $28 \div 7 = 4$ $\therefore \frac{-32}{28} = \frac{-32 \div 4}{28 \div 4} = \frac{-8}{7}$

Again by what number should be multiply 28 to get 56.

Clearly, $56 \div 28 = 2$

$\therefore$ $\frac{-32}{28} = \frac{-32 \times 2}{28 \times 2} = \frac{-64}{56}$

Hence, $\mathbf{\frac{-32}{28} = \frac{\boxed{-8}}{7} = \frac{\boxed{-64}}{56}}$ **Ans.**

(c) By what number should we multiply (-1) to get 20.

Clearly, $20 \div (-1) = \frac{20}{-1} = -20$ $\therefore \frac{-1}{-5} = \frac{-1 \times (-20)}{-5 \times (-20)} = \frac{20}{100}$

Again what number should we multiply -5 to get -50

Clearly, $(-50) \div (-5) = 10$

$\therefore$ $\frac{-1}{-5} = \frac{-1 \times 10}{-5 \times 10} = \frac{-10}{-50}$

Hence, $\mathbf{\frac{-1}{-5} = \frac{20}{\boxed{100}} = \frac{\boxed{-10}}{-50}}$ **Ans.**

7. (a) H.C.F. of 16 and $24 = 8$

$\therefore \frac{-16}{-24} = \frac{-16 \div 8}{-24 \div 8} = \frac{2}{3}$ Hence, $\mathbf{\frac{-16}{-24} = \frac{2}{3}}$ (in standard form) **Ans.**

(b) By what number should -24 divide to get 15.

Clearly, $-24 \div 15 = \frac{-8}{5}$

$\therefore$ $\frac{-16}{-24} = \frac{-16 \div \left(\frac{-8}{5}\right)}{-24 \div \left(\frac{-8}{5}\right)} = \frac{10}{15} = \frac{10}{15}$ is the required from

Hence, $\mathbf{\frac{-16}{-24} = \frac{10}{15}}$ **Ans.**

(c) By what number should -16 multiply to get -22.

Clearly, $-22 \div (-16) = \frac{11}{8}$

$\therefore \quad \frac{-16}{-24} = \frac{-16 \times \frac{11}{8}}{-24 \times \frac{11}{8}} = \frac{-22}{-33} = \frac{-22}{-33}$ is the required form

Hence, $\mathbf{\frac{-16}{-24} = \frac{-22}{-33}}$ **Ans.**

8. (a) By what number should we multiply -2 to get 40.

Clearly, $40 \div (-2) = -20$

$\therefore \quad \frac{-2}{-5} = \frac{-2 \times (-20)}{-5 \times (-20)} = \frac{40}{100}$ is required form

Hence, $\mathbf{\frac{-2}{-5} = \frac{40}{100}}$ **Ans.**

(b) By what number should we multiply -2 to get -36.

Clearly, $-36 \div (-2) = 18$

$\therefore \quad \frac{-2}{-5} = \frac{-2 \times 18}{-5 \times 18} = \frac{-36}{-90}$ is required form

Hence, $\mathbf{\frac{-2}{-5} = \frac{-36}{-90}}$ **Ans.**

(c) By what number should we multiply -2 to get 4.

Clearly, $4 \div (-2) = -2$

$\therefore \quad \frac{-2}{-5} = \frac{-2 \times (-2)}{-5 \times (-2)} = \frac{4}{10}$ is the required form

Hence, $\mathbf{\frac{-2}{-5} = \frac{4}{10}}$ **Ans.**

(d) By what number should we multiply -2 to get 100.

Clearly, $100 \div (-2) = -50$

$\therefore \quad \frac{-2}{-5} = \frac{-2 \times (-50)}{-5 \times (-50)} = \frac{100}{250}$ is the required form

Hence, $\mathbf{\frac{-2}{-5} = \frac{100}{250}}$ **Ans.**

9. (a) By what number should we multiply 4 to get -32.

Clearly, $-32 \div 4 = -8$

$\therefore \quad \frac{-3}{4} = \frac{-3\times(-8)}{4\times(-8)} = \frac{24}{-32}$ is the required form

Hence, $\mathbf{\frac{-3}{4} = \frac{24}{-32}}$ **Ans.**

(b) By what number should we multiply 4 to get -16.
Clearly, $-16 \div 4 = -4$
$\therefore \frac{-3}{4} = \frac{-3\times(-4)}{4\times(-4)} = \frac{12}{-16}$ is the required form

Hence, $\mathbf{\frac{-3}{4} = \frac{12}{-16}}$ **Ans.**

(c) By what number should we multiply 4 to get -60.
Clearly, $(-60) \div 4 = -15$
$\therefore \quad \frac{-3}{4} = \frac{-3\times(-15)}{4\times(-15)} = \frac{45}{-60}$ is the required form

Hence, $\mathbf{\frac{-3}{4} = \frac{45}{-60}}$ **Ans.**

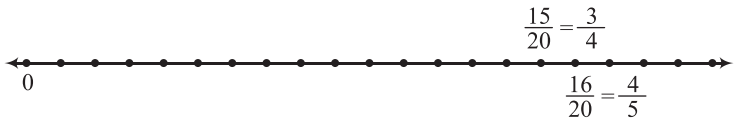
(d) By what number should we multiply 4 to get 80.
Clearly, $80 \div 4 = 20$
$\therefore \quad \frac{-3}{4} = \frac{-3\times 20}{4\times 20} = \frac{-60}{80}$ is the required form

Hence, $\frac{-3}{4} = \frac{-60}{80}$ **Ans.**

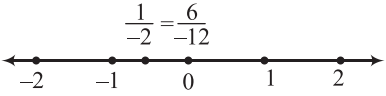
10. (a) Each rational number is not a natural number. **True**
(b) Rational number is lowest form is the standard form. **True**
(c) Every whole number is a rational number. **True**
(d) Negative rational number do not exist. **False**
(e) Every integer is a rational number. **True**
(f) Every rational number is an integer. **False**
(g) Zero is a rational number. **True**
(h) Every decimal number is not a rational number. **False**

Exercise 4.2

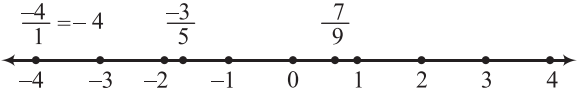
1. Here, $\frac{4}{5} = \frac{4\times 4}{5\times 4} = \frac{16}{20}$ and $\frac{3}{4} = \frac{3\times 5}{4\times 5} = \frac{15}{20}$



2. $\frac{6}{-12}=\frac{6\div 6}{-12\div 6}=\frac{1}{-2}$



3. Here, $\frac{-4}{1}=-4$; $\frac{7}{9}=\frac{7}{9}$ is a positive rational number and less than 1. And $\frac{3}{-5}=-\frac{3}{5}$ is a negative rational number and greater than -1.



4. (a) Taking L.C.M. of denominators, i.e., 5 and 3 is 15, therfore,

$$\frac{-3}{5}=\frac{-3\times 3}{5\times 3}=\frac{-9}{15} \text{ and } \frac{-4}{3}=\frac{-4\times 5}{3\times 5}=\frac{-20}{15}$$

But $-9>-20$

So, $\frac{-9}{15}>\frac{-20}{15}$ i.e. $\frac{-3}{5}>\frac{-4}{3}$ Hence, $\mathbf{\frac{-3}{5}}$ **is greater.** **Ans.**

(b) First rewrite rational number with positive denominators.

$$\frac{8}{-3}=\frac{8\times(-1)}{-3\times(-1)}=\frac{-8}{3} \qquad \text{[Multiply by } -1\text{]}$$

Now, we have to compare, $\frac{-8}{3}$ and $\frac{-2}{1}$

Taking L.C.M. of denominators, i.e., 3 and 1 is 3, therfore,

$$\frac{-8}{3}=\frac{-8\times 1}{3\times 1}=\frac{-8}{3} \text{ and } \frac{-2\times 3}{1\times 3}=\frac{-6}{3}$$

But $-6>-8$ So $\frac{-6}{3}>\frac{-8}{3}$ i.e., $-2>\frac{8}{-3}$

Hence, **–2 is greater**. **Ans.**

5. (a) We have, -2 and $\frac{-1}{2}$ or $\frac{-2}{1}$ and $\frac{-1}{2}$.

Taking L.C.M. of denominators, i.e., 1 and 2 is 2, therefore,

$$\frac{-2}{1}=\frac{-2\times 2}{1\times 2}=\frac{-4}{2} \text{ and } \frac{-1}{2}=\frac{-1\times 1}{2\times 1}=\frac{-1}{2} \text{ But } -4<-1$$

So, $\frac{-4}{2}<\frac{-1}{2}$ i.e., $-2<\frac{-1}{2}$

Hence, **–2 is smaller.** **Ans.**

(b) We have, $\frac{-5}{6}$ and $\frac{5}{6}$

Here, two rational numbers with common denominator are $\frac{-5}{6}$ and $\frac{5}{6}$.

But $-5 < 5$ So, $\frac{-5}{6} < \frac{5}{6}$

Hence, $\mathbf{\frac{-5}{6}}$ **is smaller.**

Ans.

6. (a) First write these denominator in positive denominators.

$\frac{2}{3} = \frac{2}{3}, -2 = \frac{-2}{1}$ and $\frac{9}{-4} = \frac{9 \times (-1)}{-4 \times (-1)} = \frac{-9}{4}$

Now, we have $\frac{2}{3}, \frac{-2}{1}, \frac{-9}{4}$

Taking L.C.M. of denominators 4 and 3 is 12.

$\therefore \frac{2}{3} = \frac{2 \times 4}{3 \times 4} = \frac{8}{12}, \frac{-2}{1} = \frac{-2 \times 12}{1 \times 12} = \frac{-24}{12}$ and $\frac{-9}{4} = \frac{-9 \times 3}{4 \times 3} = \frac{-27}{12}$

Now, arranging numerators in ascending order, $-27 < -24 < 8$

or $\frac{-27}{12} < \frac{-24}{12} < \frac{8}{12}$ or $\frac{-9}{4} < -2 < \frac{2}{3}$

Hence, **the ascending order are** $\mathbf{\frac{-9}{4}, -2, \frac{2}{3}}$**.**

Ans.

(b) We have, 0, $\frac{-4}{5}$ and 1 We know that, $\frac{-4}{5} < 0 < 1$ So, $\frac{-4}{5} < 0 < 1$

Hence, **the ascending order are** $\mathbf{\frac{-4}{5}}$**, 0, 1.**

Ans.

(c) We have, $\frac{-7}{8}, \frac{-1}{3}, \frac{-8}{1}$

Taking L.C.M. of denominators 8, 3 and $1 = 24$

$\therefore \frac{-7}{8} = \frac{-7 \times 3}{8 \times 3} = \frac{-21}{24}, \frac{-1}{3} = \frac{-1 \times 8}{3 \times 8} = \frac{-8}{24}$

and $\frac{-8}{1} = \frac{-8 \times 24}{1 \times 24} = \frac{-192}{24}$

Now, arranging numerators in ascending order,

$-192 < -21 < -8$ or $\frac{-192}{24} < \frac{-21}{24} < \frac{-8}{24}$ or $\frac{-8}{1} < \frac{-7}{8} < \frac{-1}{3}$

Hence, **the ascending order are $\frac{-8}{1}, \frac{-7}{8}, \frac{-1}{3}$.** **Ans.**

7. (a) First write these denominators in positive denominators.

$$\frac{1}{-3} = \frac{1\times(-1)}{-3\times(-1)} = \frac{-1}{3}, -1 = \frac{-1}{1} \text{ and } 4 = \frac{4}{1}$$

Now, rewriting the given rational numbers with same denominators.

$$\therefore \quad \frac{-1}{3} = \frac{-1}{3}, \frac{-1}{1} = \frac{-1\times3}{1\times3} = \frac{-3}{3} \text{ and } \frac{4}{1} = \frac{4\times3}{1\times3} = \frac{12}{3}$$

Now, arranging numerators in descending order, $12 > -1 > -3$

or $\frac{12}{3} > \frac{-3}{3} > \frac{-1}{3}$ or $4 > -1 > \frac{-1}{3}$

Hence, **the descending order are $4, -1, \frac{-1}{3}$** **Ans.**

(b) First write these denominator in positive denominators.

$$\frac{7}{-6} = \frac{7\times(-1)}{-6\times(-1)} = \frac{-7}{6}$$

Now, we have to compare $\frac{-3}{4}, \frac{-7}{6}$ and $\frac{1}{4}$.

Taking L.C.M. of denominators 4, 6 and 4 is 12.

$$\therefore \frac{-3}{4} = \frac{-3\times3}{4\times3} = \frac{-9}{12}, \frac{-7}{6} = \frac{-7\times2}{6\times2} = \frac{-14}{12} \text{ and } \frac{1}{4} = \frac{1\times3}{4\times3} = \frac{3}{12}$$

Now, arranging numerator in descending order, $3 > -9 > -14$.

or $\frac{3}{12} > \frac{-9}{12} > \frac{-14}{12}$ or $\frac{1}{4} > \frac{-3}{4} > \frac{7}{-6}$

Hence, **the descending order are $\frac{1}{4}, \frac{-3}{4}, \frac{7}{-6}$.** **Ans.**

(c) First write these denominator in positive denominators.

$$\frac{7}{-13} = \frac{7\times(-1)}{-13\times(-1)} = \frac{-7}{13}$$

Now, we have to compare $\frac{-7}{13}, \frac{7}{12}, \frac{7}{18}$

Taking L.C.M. of denominators 13, 12 and 18 is 312.

$\therefore \frac{-7}{13} = \frac{-7\times24}{13\times24} = \frac{-168}{312}, \frac{7}{12} = \frac{7\times26}{12\times26} = \frac{182}{312}$

and $\frac{7}{8} = \frac{7\times39}{8\times39} = \frac{273}{312}$

Now, arranging numerators in descending order,

$273 > 182 > -168$

or $\frac{273}{312} > \frac{182}{312} > \frac{-168}{312}$ or $\frac{7}{8} > \frac{7}{12} > \frac{7}{-13}$

Hence, **the descending order are $\frac{7}{8}, \frac{7}{12}, \frac{7}{-13}$.** **Ans.**

8. $\because$ Let us write $\frac{3}{7}$ and $\frac{5}{7}$ as rational numbers with denominators 70.

$\therefore \frac{3}{7} = \frac{3\times10}{7\times10} = \frac{30}{70}$ and $\frac{5}{7} = \frac{5\times10}{7\times10} = \frac{50}{70}$

Now, integers between 30 and 50 are 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, ..., 49.

So, the required rational number are $\frac{31}{70}$,

$\frac{32}{70}, \frac{33}{70}, \frac{34}{70}, \frac{35}{70}, \frac{36}{70}, \frac{37}{70}, \frac{38}{70}, \frac{39}{70}, \frac{40}{70}, ..., \frac{48}{70}, \frac{49}{70}$.

Hence, ten rational numbers between $\frac{3}{7}$ and $\frac{5}{7}$ are

$\frac{31}{70}, \frac{32}{70}, \frac{33}{70}, \frac{34}{70}, \frac{35}{70}, \frac{36}{70}, \frac{37}{70}, \frac{38}{70}, \frac{39}{70}, \frac{40}{70}$, ... **Ans.**

9. Let us write -7 and -9 as rational number with denominator 10.

$\therefore -7 = \frac{-7}{1} = \frac{-7\times10}{1\times10} = \frac{-70}{10}$ and $-9 = \frac{-9}{1} = \frac{-9\times10}{1\times10} = \frac{-90}{10}$

Now, integers between -70 and -90 are

$-71, -72, -73, -74, -75, -76, -77, -78, ..., -89.$

So, the required rational number are

$\frac{-71}{10}, \frac{-72}{10}, \frac{-73}{10}, \frac{-74}{10}, \frac{-75}{10}, ..., \frac{-89}{10}$

Hence, five rational numbers between -7 and -9 are

$\frac{-71}{10}, \frac{-72}{10}, \frac{-73}{10}, \frac{-74}{10}, \frac{-75}{10}$, ... **Ans.**

10. (a) Zero is less than every positive rational number. **True**

(b) Negative rational number is less than zero. **True**

(c) Rational number $\frac{-3}{2}$ lies right to $\frac{3}{2}$ on number line. **False**

(d) All rational numbers can not be represented on number line. **False**

(e) We have infinite rational numbers between two rational numbers. **True**

11. (a) $\frac{1}{-7} > \frac{-2}{4}$ (b) $\frac{3}{2} > \frac{1}{3}$ (c) $\frac{-1}{4} < \frac{-1}{5}$ (d) $\frac{4}{7} < \frac{3}{5}$ (e) $\frac{24}{7} > \frac{7}{9}$ (f) $\frac{3}{7} = \frac{3}{7}$

Exercise 4.3

1. (a) First rewrite rational numbers with positive denominators

$$\frac{6}{-5} = \frac{6\times(-1)}{-5\times(-1)} = \frac{-6}{5}$$

Now, we have to add $\frac{2}{3}$ and $\frac{-6}{5}$.

The denominator are 3 and 5.

So, the L.C.M. of 3 and 5 is 15.

$\therefore \frac{2}{3} = \frac{2\times5}{3\times5} = \frac{10}{15}$ and $\frac{-6\times3}{5\times3} = \frac{-18}{15}$ or $\frac{10}{15} + \frac{-18}{15} = \frac{10-18}{15} = \frac{-8}{15}$

Hence, $\mathbf{\frac{2}{3} + \frac{6}{-5} = \frac{-8}{15}}$ **Ans.**

(b) The denominator are 5 and 3. So, the L.C.M. of 3 and $5 = 15$

$\therefore \frac{-7}{5} = \frac{-7\times3}{5\times3} = \frac{-21}{15}$ and $\frac{9}{3} = \frac{9\times5}{3\times5} = \frac{45}{15}$

or $\frac{-21}{15} + \frac{45}{15} = \frac{-21+45}{15} = \frac{24}{15} = \frac{24\div3}{15\div3} = \frac{8}{5} = 1\frac{3}{5}$

Hence, $\mathbf{\frac{-7}{5} + \frac{9}{3} = 1\frac{3}{5}}$ **Ans.**

(c) The rewrite rational numbers with positive denominators.

$$\frac{9}{-5} = \frac{9\times(-1)}{-5\times(-1)} = \frac{-9}{5}$$

Now, we have to add $\frac{-12}{20} + \frac{-9}{5}$

The denominator are 20 and 5. So, the L.C.M. of 20 and 5 is 20.

$\therefore \frac{-12}{20} = \frac{-12\times1}{20\times1} = \frac{-12}{20}$ and $\frac{-9}{5} = \frac{-9\times4}{5\times4} = \frac{-36}{20}$

or $\frac{-12}{20} + \frac{-36}{20} = \frac{(-12)+(-36)}{20} = \frac{-48}{20} = \frac{-48\div4}{20\div4} = \frac{-12}{5} = -2\frac{2}{5}$

Hence, $\frac{\mathbf{-12}}{\mathbf{20}} + \frac{\mathbf{9}}{\mathbf{-5}} = \mathbf{-2\frac{2}{5}}$ **Ans.**

(d) First rewrite rational numbers with positive denominators.

$\frac{-2}{-7} = \frac{-2\times(-1)}{-7\times(-1)} = \frac{2}{7}$

Now, we have to add $\frac{2}{7} + 1$ or $\frac{2}{7} + \frac{1}{1}$

L.C.M. of 7 and 1 is 7.

Now, $\frac{2}{7} = \frac{2\times1}{7\times1} = \frac{2}{7}$ and $\frac{1}{1} = \frac{1\times7}{1\times7} = \frac{7}{7}$

or $\frac{2}{7} + \frac{7}{7} = \frac{2+7}{7} = \frac{9}{7} = 1\frac{2}{7}$

Hence, $\frac{\mathbf{-2}}{\mathbf{-7}} + \mathbf{1} = \mathbf{1\frac{2}{7}}$ **Ans.**

2. (a) The denominators are 13 and 2. So, the L.C.M. of 2 and 13 is 26.

Now, $\frac{4}{13} = \frac{4\times2}{13\times2} = \frac{8}{26}$ and $\frac{-7}{2} = \frac{-7\times13}{2\times13} = \frac{-91}{26}$

$\therefore \left(\frac{-7}{2}\right) - \frac{4}{13} = \frac{-91}{26} - \frac{8}{26} = \frac{-91-8}{26} = \frac{-99}{26} = -3\frac{21}{26}$

Hence, $\frac{\mathbf{-7}}{\mathbf{2}} - \frac{\mathbf{4}}{\mathbf{13}} = \mathbf{-3\frac{21}{26}}$ **Ans.**

(b) Here, the denominators are same.

$\therefore \frac{-6}{5} - \frac{6}{5} = \frac{-6-6}{5} = \frac{-12}{5} = -2\frac{2}{5}$

Hence, $\frac{\mathbf{-6}}{\mathbf{5}} - \frac{\mathbf{6}}{\mathbf{5}} = \mathbf{-2\frac{2}{5}}$ **Ans.**

(c) The denominators are 9 and 2. So, the L.C.M. of 9 and 2 is 18.

Now, $\frac{2}{9} = \frac{2\times2}{9\times2} = \frac{4}{18}$ and $\frac{-9}{2} = \frac{-9\times9}{2\times9} = \frac{-81}{18}$

$\therefore \quad \frac{-9}{2}-\frac{2}{9}=\frac{-81}{18}-\frac{4}{18}=\frac{-81-4}{18}=\frac{-85}{18}=-4\frac{13}{18}$

Hence, $\mathbf{\frac{-9}{2}-\frac{2}{9}=-4\frac{13}{18}}$ **Ans.**

(d) We have, $\frac{-22}{15}$ and $\frac{2}{1}$

The denominator are 15 and 1.
So, the L.C.M. of 15 and 1 is 15.

Now, $\frac{-22}{15}=\frac{-22\times1}{15\times1}=\frac{-22}{15}$ and $\frac{2}{1}=\frac{2\times15}{1\times15}=\frac{30}{15}$

$\therefore \quad 2-\left(-\frac{22}{15}\right)=\frac{30}{15}-\left(-\frac{22}{15}\right)=\frac{30+22}{15}=\frac{52}{15}=3\frac{7}{15}$

Hence, $2-\left(-\frac{22}{15}\right)=3\frac{7}{15}$ **Ans.**

3. (a) The denominator are 3, 3 and 5. So, L.C.M. of 3, 3 and 5 is 15.

$\because \frac{-1}{3}=\frac{-1\times5}{3\times5}=\frac{-5}{15}, \frac{4}{3}=\frac{4\times5}{3\times5}=\frac{20}{15}$ and $\frac{3}{5}=\frac{3\times3}{5\times3}=\frac{9}{15}$

Now, $\frac{-1}{3}+\frac{4}{3}+\frac{3}{5}=\frac{-5}{15}+\frac{20}{15}+\frac{9}{15}=\frac{-5+20+9}{15}=\frac{-5+29}{15}=\frac{24}{15}$

$=\frac{24\div3}{15\div3}=\frac{8}{5}=1\frac{3}{5}$

Hence, $\mathbf{\frac{-1}{3}+\frac{4}{5}+\frac{3}{5}=1\frac{3}{5}}$ **Ans.**

(b) The denominator are 3, 4 and 2. So, the L.C.M. of 3, 4 and 2 is 12.

$\therefore \frac{7}{3}=\frac{7\times4}{3\times4}=\frac{28}{12}, \frac{-3}{4}=\frac{-3\times3}{4\times3}=\frac{-9}{12}$ and $\frac{-8}{2}=\frac{-8\times6}{2\times6}=\frac{-48}{12}$

Now, $\frac{7}{3}-\frac{3}{4}-\frac{8}{2}=\frac{28}{12}-\frac{9}{12}-\frac{48}{12}=\frac{28-9-48}{12}$

$=\frac{28-57}{12}=\frac{-29}{12}=-2\frac{5}{12}$

Hence, $\mathbf{\frac{7}{3}-\frac{3}{4}-\frac{8}{2}=-2\frac{5}{12}}$ **Ans.**

(c) The denominators are 15, 6 and 10. So, the L.C.M. of 15, 6 and 10 is 30.

$\therefore \frac{4}{15}=\frac{4\times2}{15\times2}=\frac{8}{30}, \frac{1}{6}=\frac{1\times5}{6\times5}=\frac{5}{30}$ and $\frac{-6}{10}=\frac{-6\times3}{10\times3}=\frac{-18}{30}$

Now, $\frac{4}{15}+\frac{1}{6}-\frac{6}{10}=\frac{8}{30}+\frac{5}{30}-\frac{18}{30}=\frac{8+5-18}{30}$

$=\frac{13-18}{30}=\frac{-5}{30}=\frac{-5\div5}{30\div5}=-\frac{1}{6}$

Hence, $\mathbf{\frac{4}{15}+\frac{1}{6}-\frac{6}{10}=-\frac{1}{6}}$ **Ans.**

(d) The denominators are 8, 8 and 12. So the L.C.M. of 8, 8 and 12 is 24.

$\therefore \frac{1}{8}=\frac{1\times3}{8\times3}=\frac{3}{24}, \frac{-4}{8}=\frac{-4\times3}{8\times3}=\frac{-12}{24}$ and $\frac{-15}{12}=\frac{-15\times2}{12\times2}=\frac{-30}{24}$

Now, $\frac{1}{8}-\frac{4}{8}-\frac{15}{12}=\frac{3}{24}-\frac{12}{24}-\frac{30}{24}=\frac{3-12-30}{24}$

$=\frac{3-42}{24}=\frac{-39}{24}=\frac{-39\div3}{24\div3}=\frac{-13}{8}=-1\frac{5}{8}$

Hence, $\mathbf{\frac{1}{8}-\frac{4}{8}-\frac{15}{12}=-1\frac{5}{8}}$ **Ans.**

4. (a) L.H.S. $=\frac{3}{4}-\frac{2}{3}+\frac{1}{2}=\frac{3\times3}{4\times3}-\frac{2\times4}{3\times4}+\frac{1\times6}{2\times6}$

[L.C.M. of 4, 3 and 2 is 12]

$=\frac{9}{12}-\frac{8}{12}+\frac{6}{12}=\frac{9-8+6}{12}=\frac{15-8}{12}=\frac{7}{12}$

R.H.S. $=\frac{1}{2}+\frac{2}{-3}+\frac{3}{4}=\frac{1}{2}+\frac{-2}{3}+\frac{3}{4}$

[Rewrite positive denominator]

$=\frac{1\times6}{2\times6}-\frac{2\times4}{3\times4}+\frac{3\times3}{4\times3}=\frac{6}{12}-\frac{8}{12}+\frac{9}{12}$

[L.C.M. of 2, 3 and 4 is 12]

$=\frac{6-8+9}{12}=\frac{15-8}{12}=\frac{7}{12}$

Hence, $\mathbf{L.H.S.=R.H.S.=\frac{7}{12}}$ **Verify**

(b) L.H.S. $=\frac{6}{5}+\frac{2}{-3}-\frac{4}{-2}=\frac{6}{5}+\frac{-2}{3}+\frac{4}{2}$

[Rewrite positive denominators]

$=\frac{6\times6}{5\times6}+\frac{-2\times10}{3\times10}+\frac{4\times15}{2\times15}$ [L.C.M. of 5, 3 and 2 is 30]

$$= \frac{36}{30} + \left(-\frac{20}{30}\right) + \frac{60}{30} = \frac{36-20+60}{30} = \frac{96-20}{30} = \frac{76}{30}$$

$$= \frac{76 \div 2}{30 \div 2} = \frac{38}{15}$$

$$\text{R.H.S.} = \frac{4}{2} - \frac{6}{-5} + \frac{-2}{3} = \frac{4}{2} + \frac{6}{5} + \frac{-2}{3}$$

[Rewrite positive denominators]

$$= \frac{4 \times 15}{2 \times 15} + \frac{6 \times 6}{5 \times 6} + \left(\frac{-2 \times 10}{3 \times 10}\right) = \frac{60}{30} + \frac{36}{30} - \frac{20}{30}$$

$$= \frac{96-20}{30} = \frac{76}{30} = \frac{76 \div 2}{30 \div 2} = \frac{38}{15}$$

Hence, **L.H.S. = R.H.S. = $\frac{38}{15}$** **Verify**

(c) $$\text{L.H.S.} = \frac{7}{-9} - \frac{4}{3} - \frac{1}{-6} = \frac{-7}{9} - \frac{4}{3} - \frac{(-1)}{6}$$

[Rewrite positive denominators]

$$= \frac{-7 \times 2}{9 \times 2} - \frac{4 \times 6}{3 \times 6} - \left(\frac{-1 \times 3}{6 \times 3}\right) = \frac{-14}{18} - \frac{24}{18} + \frac{3}{18}$$

$$= \frac{-14-24+3}{18} = \frac{-38+3}{18} = \frac{-35}{18}$$

$$\text{R.H.S.} = \frac{1}{6} + \frac{(-7)}{9} + \frac{4}{-3} = \frac{1}{6} + \frac{(-7)}{9} + \frac{(-4)}{3}$$

$$= \frac{1 \times 3}{6 \times 3} + \frac{(-7 \times 2)}{9 \times 2} + \frac{(-4 \times 6)}{3 \times 6} = \frac{3}{18} - \frac{14}{18} - \frac{24}{18}$$

$$= \frac{3-14-24}{18} = \frac{3-38}{18} = \frac{-35}{18}$$

Hence, **L.H.S. = R.H.S. = $\frac{-35}{18}$** **Verify**

(d) $$\text{L.H.S.} = \frac{2}{3} + \frac{3}{5} + \frac{6}{7} = \frac{2 \times 35}{3 \times 35} + \frac{3 \times 21}{5 \times 21} + \frac{6 \times 15}{7 \times 15}$$

[L.C.M. of 3, 5 and 7 is 105]

$$= \frac{70}{105} + \frac{63}{105} + \frac{90}{105} = \frac{70+63+90}{105} = \frac{223}{105}$$

R.H.S. $= \frac{6}{7} + \frac{3}{5} + \frac{2}{3} = \frac{6\times15}{7\times15} + \frac{3\times21}{5\times21} + \frac{2\times35}{3\times35}$

[L.C.M. of 7, 5 and 3 is 105]

$= \frac{90}{105} + \frac{63}{105} + \frac{70}{105} = \frac{90+63+70}{105} = \frac{223}{105}$

Hence, **L.H.S. = R.H.S.** $= \mathbf{\frac{223}{105}}$ **Verify.**

5. (a) Additive inverse of $\frac{6}{-3} = -\left(\frac{6}{-3}\right) = \frac{-6}{-3}$

Rewriting it as positive denominator.

$$\frac{-6}{-3} = \frac{-6\times(-1)}{-3\times(-1)} = \frac{6}{3} = 2$$

Hence, **additive inverse of** $\mathbf{\frac{6}{-3} = 2}$ **Ans.**

(b) Additive inverse of $\frac{-4}{-2} = -\left(\frac{-4}{-2}\right) = \frac{4}{-2}$

Rewriting it as positive denominator.

$$\frac{4}{-2} = \frac{4\times(-1)}{-2\times(-1)} = \frac{-4}{2} = -2$$

Hence, **additive inverse of** $\mathbf{\frac{-4}{-2} = -2}$ **Ans.**

(c) Additive inverse of $\left(\frac{1}{4} - \frac{1}{5}\right) = -\left(\frac{1\times5}{4\times5} - \frac{1\times4}{5\times4}\right) = -\left(\frac{5}{20} - \frac{4}{20}\right)$

$$= -\left(\frac{5-4}{20}\right) = -\left(\frac{1}{20}\right) = -\frac{1}{20}$$

Hence, **additive inverse of** $\mathbf{\left(\frac{1}{4} - \frac{1}{5}\right) = -\frac{1}{20}}$ **Ans.**

(d) Additive inverse of $\left(\frac{1}{6} + \frac{1}{7}\right) = -\left(\frac{1}{6} + \frac{1}{7}\right) = -\left(\frac{1\times7}{6\times7} + \frac{1\times6}{7\times6}\right)$

$$= -\left(\frac{7}{42} + \frac{6}{42}\right) = -\left(\frac{7+6}{42}\right) = -\frac{13}{42}$$

Hence, **additive inverse of** $\mathbf{\left(\frac{1}{6} + \frac{1}{7}\right) = -\frac{13}{42}}$ **Ans.**

6. Let the required number be x.

Thus, $-\frac{2}{7}+x=\frac{4}{5}$ or $x=\frac{4}{5}+\frac{2}{7}$ [Transposing $-\frac{2}{7}$ to R.H.S.]

$\Rightarrow \quad x=\frac{4\times 7}{5\times 7}+\frac{2\times 5}{7\times 5}$ [L.C.M. of 5 and 7 is 35]

$\Rightarrow \quad x=\frac{28}{35}+\frac{10}{35}\Rightarrow x=\frac{28+10}{35}\Rightarrow x=\frac{38}{35}=1\frac{3}{35}$

Hence, **the required number** $=\mathbf{1\frac{3}{35}}$ **Ans.**

7. Let we subtract x from $\frac{9}{7}$ to get $\frac{4}{3}$. Then,

$$\frac{9}{7}-x=\frac{4}{3}$$

$\Rightarrow \quad -x=\frac{4}{3}-\frac{9}{7}$ [Transposing $\frac{9}{7}$ to R.H.S.]

$\Rightarrow \quad -x=\frac{4\times 7}{3\times 7}-\frac{9\times 3}{7\times 3}$ [L.C.M. of 3 and 7 is 21.]

$\Rightarrow \quad -x=\frac{28}{21}-\frac{27}{21}$

$\Rightarrow \quad -x=\frac{28-27}{21}$

$\Rightarrow \quad -x=\frac{1}{21}\Rightarrow x=-\frac{1}{21}$

Hence, $-\mathbf{\frac{1}{21}}$ **should be subtracted.** **Ans.**

8. First write denominators in positive denominator.

$$\frac{6}{-7}=\frac{6\times(-1)}{-7\times(-1)}=\frac{-6}{7}$$

Now, let the required number be x.

$\therefore \quad \frac{-6}{7}+x=0\Rightarrow x=0+\frac{6}{7}$ [Transposing $\frac{-6}{7}$ to R.H.S.]

$$x=\frac{6}{7}$$

Hence, **the required number be** $\mathbf{\frac{6}{7}}$**.** **Ans.**

9. $\therefore \frac{8}{21} - (\text{Required number}) = 0$

or $\frac{8}{21} + (-\text{Required number}) = 0$ [By the property of subtraction of rational number]

We know that number added to its additive inverse to zero.

$\therefore (-\text{Required number}) = \text{Additive inverse of } \frac{8}{21}$

or $-\text{required number} = \frac{-8}{21}$

or Required number $= \frac{8}{21}$ (As negative sign is in both side)

Hence, **required number** $= \mathbf{\frac{8}{21}}$ **Ans.**

10. The sum of two rational numbers $= 0$

One number $= \frac{13}{-19} = \frac{13 \times (-1)}{-19 \times (-1)} = \frac{-13}{19}$

$\therefore$ Other number $= 0 - \left(\frac{-13}{19}\right) = \frac{13}{19}$

Hence, **the other number is** $\mathbf{\frac{13}{19}}$**.** **Ans.**

11. Sum of $\frac{5}{-3}$ and $\frac{-4}{3}$

$\frac{5}{-3} = \frac{5 \times (-1)}{-3 \times (-1)} = \frac{-5}{3}$ (Rewrite positive denominator)

$\therefore \quad \frac{-5}{3} + \frac{-4}{3} = \frac{-5 + (-4)}{3}$ (same denominators)

$= \frac{-9}{3} = \frac{-9 \div 3}{3 \div 3} = \frac{-3}{1} = -3$

Now, sum of $\frac{-1}{5}$ and $\frac{-1}{8}$

$\therefore \quad \frac{-1}{5} + \frac{-1}{8} = \frac{-1 \times 8}{5 \times 8} + \frac{-1 \times 5}{8 \times 5}$ [$\because$ L.C.M. of 5 and 8 is 40]

$$= \frac{-8}{40} + \frac{-5}{40} = \frac{-8+(-5)}{40} = \frac{-13}{40}$$

Now, $-3 - \left(\frac{-13}{40}\right) = -3 + \frac{13}{40} = \frac{-3}{1} + \frac{13}{40}$

$$= \frac{-3\times 40}{1\times 40} + \frac{13\times 1}{40\times 1} = \frac{-120}{40} + \frac{13}{40}$$

$$= \frac{-120+13}{40} = \frac{-107}{40} = \mathbf{-2\,\frac{27}{40}}$$

Ans.

12. (a) The addition of two rational numbers is not closed in the set of rational numbers. **False**

(b) Zero is the additive inverse and identity element of itself. **True**

(c) There exists additive inverse of each rational number. **True**

(d) The difference of two rational numbers is a rational number. **True**

(e) Zero is not the identity element for negative rational numbers. **True**

Exercise 4.4

1. (a) $\frac{3}{5}\times\frac{-4}{7}\times\frac{7}{-2} = \frac{3\times(-4)\times 7}{5\times 7\times(-2)} = \frac{6}{5} = 1\frac{1}{5}$

Hence, $\mathbf{\frac{3}{5}\times\frac{-4}{7}\times\frac{7}{-2} = 1\frac{1}{5}}$ **Ans.**

(b) $\frac{9}{3}\times\frac{(-3)}{5}\times\frac{11}{3} = \frac{9\times(-3)\times 11}{3\times 5\times 3} = \frac{-33}{5} = -6\frac{3}{5}$

Hence, $\mathbf{\frac{9}{3}\times\frac{(-3)}{5}\times\frac{11}{3} = -6\frac{3}{5}}$ **Ans.**

(c) $\frac{4}{5}\times\frac{1}{4}\times\frac{6}{7} = \frac{4\times 1\times 6}{5\times 4\times 7} = \frac{6}{35}$

Hence, $\mathbf{\frac{4}{5}\times\frac{1}{4}\times\frac{6}{7} = \frac{6}{35}}$ **Ans.**

(d) $\frac{5}{6}\times\frac{-1}{13}\times\frac{9}{7} = \frac{5\times(-1)\times 9}{6\times 13\times 7} = -\frac{15}{182}$

Hence, $\mathbf{\frac{5}{6}\times\frac{-1}{13}\times\frac{9}{7} = -\frac{15}{182}}$ **Ans.**

2. (a) $\frac{4}{5}\times\left(\frac{1}{4}+\frac{1}{2}\right)=\frac{4}{5}\times\frac{1}{4}+\frac{4}{5}\times\frac{1}{2}$ [Using distributive law]

$$=\frac{1}{5}+\frac{2}{5}=\frac{1+2}{5}=\frac{3}{5}$$

Hence, $\boldsymbol{\frac{4}{5}\times\left(\frac{1}{4}+\frac{1}{2}\right)=\frac{3}{5}}$ **Ans.**

(b) $\frac{11}{3}\times\left(\frac{11}{12}-\frac{9}{6}\right)=\frac{11}{3}\times\frac{11}{12}-\frac{11}{3}\times\frac{9}{6}$

[By the distributive property of multiplication]

$=\frac{121}{36}-\frac{99}{18}=\frac{121\times1}{36\times1}-\frac{99\times2}{18\times2}$ [L.C.M. of 36 and 18 is 36]

$=\frac{121}{36}-\frac{198}{36}=\frac{121-198}{36}=-\frac{77}{36}=-2\frac{5}{36}$

Hence, $\boldsymbol{\frac{11}{3}\times\left(\frac{11}{12}-\frac{9}{6}\right)=-2\frac{5}{36}}$ **Ans.**

(c) $\frac{3}{5}\times\left(\frac{21}{2}-\frac{2}{3}+\frac{10}{5}\right)=\frac{3}{5}\times\frac{21}{2}-\frac{3}{5}\times\frac{2}{3}+\frac{3}{5}\times\frac{10}{5}$

$$=\frac{63}{10}-\frac{6}{15}+\frac{30}{25}=\frac{63\times15}{10\times15}-\frac{6\times10}{15\times10}+\frac{30\times6}{25\times6}$$

[L.C.M. of 10, 15 and 25 is 150]

$$=\frac{945}{150}-\frac{60}{150}+\frac{180}{150}=\frac{945+180-60}{150}$$

$$=\frac{1125-60}{150}=\frac{1065}{150}=\frac{71}{10}=7\frac{1}{10}$$

Hence, $\boldsymbol{\frac{3}{5}\times\left(\frac{21}{2}-\frac{2}{3}+\frac{10}{5}\right)=7\frac{1}{10}}$ **Ans.**

3. (a) Reciprocal of $\frac{-3}{9}=\frac{9}{-3}=\boldsymbol{-3}$ **Ans.**

(b) Reciprocal of $\frac{7}{-4}=\frac{-4}{7}=\boldsymbol{-\frac{4}{7}}$ **Ans.**

(c) Reciprocal of $\frac{-8}{-3}=\frac{-3}{-8}=\frac{-3\times(-1)}{-8\times(-1)}=\boldsymbol{\frac{3}{8}}$ **Ans.**

(d) Reciprocal of $\frac{-12}{5}=\frac{5}{-12}=\frac{5\times(-1)}{-12\times(-1)}=\boldsymbol{-\frac{5}{12}}$ **Ans.**

(e) Reciprocal of $\frac{98}{6} = \frac{6}{98} = \frac{6 \div 2}{98 \div 2} = \frac{\mathbf{3}}{\mathbf{49}}$ **Ans.**

(f) Reciprocal of $\frac{14}{-15} = \frac{-15}{14} = \mathbf{-1\frac{1}{14}}$ **Ans.**

(g) Reciprocal of $-2 = \frac{1}{-2} = \frac{1 \times (-1)}{-2 \times (-1)} = \mathbf{-\frac{1}{2}}$ **Ans.**

(h) Reciprocal of $1 = \frac{1}{1} = \mathbf{1}$ **Ans.**

(i) Reciprocal of $3 = \mathbf{\frac{1}{3}}$ **Ans.**

(j) Reciprocal of $\frac{18}{17} = \mathbf{\frac{17}{18}}$ **Ans.**

(k) Reciprocal of $14 = \mathbf{\frac{1}{14}}$ **Ans.**

(l) Reciprocal of $9 = \mathbf{\frac{1}{9}}$ **Ans.**

4. (a) $\frac{a}{b} - c + a = \frac{2}{-3} - 1 + 2 = \frac{2 \times (-1)}{-3 \times (-1)} + 1 = \frac{-2}{3} + 1 = -\frac{2}{3} + \frac{1}{1}$

$= \frac{-2 \times 1}{3 \times 1} + \frac{1 \times 3}{1 \times 3} = \frac{-2}{3} + \frac{3}{3} = \frac{-2+3}{3} = \mathbf{\frac{1}{3}}$ **Ans.**

(b) $\frac{a}{c} - \frac{b}{c} - \frac{a}{d} = \frac{2}{1} - \frac{(-3)}{1} - \frac{2}{5} = \frac{2}{1} + \frac{3}{1} - \frac{2}{5}$

$= \frac{5}{1} - \frac{2}{5} = \frac{5 \times 5}{1 \times 5} - \frac{2 \times 1}{5 \times 1}$ [L.C.M. of 1 and 5 is 5]

$= \frac{25}{5} - \frac{2}{5} = \frac{25-2}{5} = \frac{23}{5} = \mathbf{4\frac{3}{5}}$ **Ans.**

(c) $\frac{a}{b} \times \frac{c}{d} \times \frac{d}{a} = \frac{2}{-3} \times \frac{1}{5} \times \frac{5}{2} = \frac{2 \times 1 \times 5}{-3 \times 5 \times 2} = \frac{1}{-3} = \frac{1 \times (-1)}{-3 \times (-1)} = \mathbf{-\frac{1}{3}}$

Ans.

(d) $a \times \left(\frac{b}{c} - \frac{c}{d}\right) + d = 2\left(\frac{-3}{1} - \frac{1}{5}\right) + 5$

$= 2 \times \frac{(-3)}{1} - \frac{2 \times 1}{5} + 5 = \frac{-6}{1} - \frac{2}{5} + 5$

$= \frac{-6 \times 5}{1 \times 5} - \frac{2 \times 1}{5 \times 1} + \frac{5 \times 5}{1 \times 5} = \frac{-30}{5} - \frac{2}{5} + \frac{25}{5}$

$$= \frac{-30-2+25}{5} = \frac{-32+25}{5} = \frac{-7}{5} = \mathbf{-1\,\frac{2}{5}}$$ **Ans.**

(e) $\frac{a}{b} \times \frac{b}{c} \times \frac{c}{d} \times \frac{d}{a} = \frac{2}{-3} \times \frac{-3}{1} \times \frac{1}{5} \times \frac{5}{2} = \frac{2 \times (-3) \times 1 \times 5}{(-3) \times 1 \times 5 \times 2} = \mathbf{1}$ **Ans.**

(f) $\frac{a}{b} \times \frac{b}{a} + \frac{c}{d} \times \frac{d}{c} - \frac{c}{a} = \frac{2}{(-3)} \times \frac{(-3)}{2} + \frac{1}{5} \times \frac{5}{1} - \frac{1}{2}$

$$= \frac{2 \times (-3)}{(-3) \times 2} + \frac{1 \times 5}{5 \times 1} - \frac{1}{2} = 1 + 1 - \frac{1}{2}$$

$$= 2 - \frac{1}{2} = \frac{2 \times 2}{1 \times 2} - \frac{1 \times 1}{2 \times 1} = \frac{4}{2} - \frac{1}{2} = \frac{4-1}{2} = \frac{3}{2} = \mathbf{1\,\frac{1}{2}}$$ **Ans.**

(g) $\frac{a}{c} \times \frac{c}{a} - \frac{b}{a} \times \frac{d}{b} = \frac{2}{1} \times \frac{1}{2} - \frac{(-3)}{2} \times \frac{5}{-3}$

$$= \frac{2 \times 1}{1 \times 2} - \frac{(-3) \times 5}{2 \times (-3)} = 1 - \frac{5}{2} = \frac{1}{1} - \frac{5}{2} = \frac{1 \times 2}{1 \times 2} - \frac{5 \times 1}{2 \times 1} = \frac{2}{2} - \frac{5}{2}$$

$$= \frac{2-5}{2} = \frac{-3}{2} = \mathbf{-1\,\frac{1}{2}}$$ **Ans.**

5. (a) $\frac{9}{8} \times \left(\frac{4}{5} - \frac{4}{3}\right) + \frac{6}{3} \times \frac{9}{8} = \frac{9}{8} \times \frac{4}{5} - \frac{9}{8} \times \frac{4}{3} + \frac{6}{3} \times \frac{9}{8}$

$$= \frac{9}{10} - \frac{3}{2} + \frac{9}{4} = \frac{9 \times 2}{10 \times 2} - \frac{3 \times 10}{2 \times 10} + \frac{9 \times 5}{4 \times 5}$$

[L.C.M. of 10, 2 and 4 is 20]

$$= \frac{18}{20} - \frac{30}{20} + \frac{45}{20} = \frac{18-30+45}{20} = \frac{63-30}{20} = \frac{33}{20} = 1\frac{13}{20}$$

Hence, $\mathbf{\frac{9}{8} \times \left(\frac{4}{5} - \frac{4}{3}\right) + \frac{6}{3} \times \frac{9}{8} = 1\,\frac{13}{20}}$ **Ans.**

(b) $\frac{1}{4} \times \frac{5}{6} - \frac{4}{2} \times \frac{6}{3} = \frac{1 \times 5}{4 \times 6} - \frac{4 \times 6}{2 \times 3} = \frac{5}{24} - 4 = \frac{5}{24} - \frac{4}{1}$

$$= \frac{5 \times 1}{24 \times 1} - \frac{4 \times 24}{1 \times 24}$$ [L.C.M. of 24 and 1 is 24]

$$= \frac{5}{24} - \frac{96}{24} = \frac{5-96}{24} = \frac{-91}{24} = -3\frac{19}{24}$$

Hence, $\mathbf{\frac{1}{4} \times \frac{5}{6} - \frac{4}{2} \times \frac{6}{3} = -3\,\frac{19}{24}}$ **Ans.**

(c) $\left(\frac{2}{2}+\frac{4}{3}\right)\times\frac{7}{6}=\frac{2}{2}\times\frac{7}{6}+\frac{4}{3}\times\frac{7}{6}=\frac{2\times7}{2\times6}+\frac{4\times7}{3\times6}$

$=\frac{7}{6}+\frac{14}{9}=\frac{7\times3}{6\times3}+\frac{14\times2}{9\times2}$ [L.C.M. of 6 and 9 is 18]

$=\frac{21}{18}+\frac{28}{18}=\frac{21+28}{18}=\frac{49}{18}=2\frac{13}{18}$

Hence, $\left(\frac{\mathbf{2}}{\mathbf{2}}+\frac{\mathbf{4}}{\mathbf{3}}\right)\times\frac{\mathbf{7}}{\mathbf{6}}=\mathbf{2}\frac{\mathbf{13}}{\mathbf{18}}$ **Ans.**

6. (a) **L.H.S.** $=\frac{7}{5}\times\left(\frac{1}{8}-\frac{1}{3}-\frac{1}{4}\right)$

$=\frac{7}{5}\times\left(\frac{1\times3-1\times8-1\times6}{24}\right)$ [L.C.M. of 8,3 and 4 is 24.]

$=\frac{7}{5}\times\left(\frac{3-8-6}{24}\right)=\frac{7}{5}\times\left(\frac{3-14}{24}\right)=\frac{7}{5}\times\frac{(-11)}{24}=\frac{-77}{120}$

R.H.S. $=\frac{7}{5}\times\frac{1}{8}-\frac{7}{5}\times\frac{1}{3}-\frac{7}{5}\times\frac{1}{4}=\frac{7}{40}-\frac{7}{15}-\frac{7}{20}$

$=\frac{7\times3}{40\times3}-\frac{7\times8}{15\times8}-\frac{7\times6}{20\times6}$ [L.C.M. of 40, 15 and 20 is 120]

$=\frac{21}{120}-\frac{56}{120}-\frac{42}{120}=\frac{21-56-42}{120}$

$=\frac{21-98}{120}=-\frac{77}{120}=\frac{-77}{120}$

Hence, L.H.S. = R.H.S. $=\frac{\mathbf{-77}}{\mathbf{120}}$ **Verified**

(b) **L.H.S.** $=\frac{3}{5}\times\left(\frac{9}{8}+\frac{7}{4}\right)=\frac{3}{5}\times\frac{9}{8}+\frac{3}{5}\times\frac{7}{4}$

$=\frac{27}{40}+\frac{21}{20}$

$=\frac{27\times1}{40\times1}+\frac{21\times2}{20\times2}$ [L.C.M. of 40 and 20 is 40]

$=\frac{27}{40}+\frac{42}{40}=\frac{27+42}{40}=\frac{69}{40}$

R.H.S. $=\frac{3}{5}\times\frac{9}{8}+\frac{3}{5}\times\frac{7}{4}=\frac{3\times9}{5\times8}+\frac{3\times7}{5\times4}=\frac{27}{40}+\frac{21}{20}$

$$= \frac{27 \times 1}{40 \times 1} + \frac{21 \times 2}{20 \times 2} \text{ [L.C.M. of 40 and 20 is 40]}$$

$$= \frac{27}{40} + \frac{42}{40} = \frac{27 + 42}{40} = \frac{69}{40}$$

Hence, **L.H.S.** = **R.H.S.** = $\mathbf{\frac{69}{40}}$ **Verified.**

7. (a) **L.H.S.** $= \frac{3}{8} \times \left(\frac{-2}{3} \times \frac{7}{4} \right) = \frac{3}{8} \times \left(\frac{-2 \times 7}{3 \times 4} \right)$

$$= \frac{3}{8} \times \frac{-7}{6} = \frac{3 \times (-7)}{8 \times 6} = -\frac{7}{16}$$

R.H.S. $= \left(\frac{3}{8} \times \frac{7}{4} \right) \times \frac{-2}{3} = \left(\frac{3 \times 7}{8 \times 4} \right) \times \frac{-2}{3} = \frac{21}{32} \times \frac{-2}{3}$

$$= \frac{21 \times (-2)}{32 \times 3} = -\frac{7}{16}$$

Hence, **L.H.S.** = **R.H.S.** = $\mathbf{-\frac{7}{16}}$ **Verified**

(b) **L.H.S.** $= \left(\frac{9}{3} \times \frac{-4}{2} \right) \times \frac{5}{6} = \left(\frac{9 \times (-4)}{3 \times 2} \right) \times \frac{5}{6} = (-6) \times \frac{5}{6} = -5$

R.H.S. $= \left(\frac{5}{6} \times \frac{9}{3} \right) \times \frac{-4}{2} = \left(\frac{5 \times 9}{6 \times 3} \right) \times \frac{-4}{2} = \frac{5}{2} \times \frac{(-4)}{2}$

$$= \frac{5 \times (-4)}{2 \times 2} = -5$$

Hence, **L.H.S.** = **R.H.S** = **−5** **Verified**

(c) **L.H.S.** $= \left(\frac{1}{5} \times \frac{1}{-3} \right) \times \left(\frac{2}{4} \times \frac{7}{6} \right) = \left(\frac{1 \times 1}{5 \times (-3)} \right) \times \left(\frac{2 \times 7}{4 \times 6} \right)$

$$= \frac{1}{-15} \times \frac{7}{12} = \frac{7}{-180} = \frac{7 \times (-1)}{-180 \times (-1)}$$

[Writing the positive denominator]

$$= \frac{-7}{180}$$

R.H.S. $= \left(\frac{1}{-3} \times \frac{7}{6} \right) \times \left(\frac{1}{5} \times \frac{2}{4} \right) = \left(\frac{1 \times 7}{-3 \times 6} \right) \times \left(\frac{1 \times 2}{5 \times 4} \right)$

$$= \frac{7}{-18} \times \frac{1}{10} = \frac{7}{-180}$$

$= \dfrac{7 \times (-1)}{-180 \times (-1)}$ [Writing the positive denominator]

$= -\dfrac{7}{180}$

Hence, **L.H.S.** = **R.H.S.** $= -\dfrac{\mathbf{7}}{\mathbf{180}}$ **Varified**

(d) **L.H.S.** $= \left(\dfrac{11}{13} \times \dfrac{4}{-5}\right) \times \dfrac{1}{2} = \left(\dfrac{11 \times 4}{13 \times -5}\right) \times \dfrac{1}{2} = \dfrac{44}{-65} \times \dfrac{1}{2} = \dfrac{22}{-65}$

$= \dfrac{22 \times (-1)}{-65 \times (-1)}$ [Writing the positive denominator]

$= -\dfrac{22}{65}$

R.H.S. $= \dfrac{11}{13} \times \left(\dfrac{4}{-5} \times \dfrac{1}{2}\right) = \dfrac{11}{13} \times \left(\dfrac{4 \times 1}{-5 \times 2}\right) = \dfrac{11}{13} \times \dfrac{4}{-10} = \dfrac{22}{-65}$

$= \dfrac{22 \times (-1)}{-65 \times (-1)}$ [Writing the positive denominator]

$= \dfrac{-22}{65}$

Hence, **L.H.S.** = **R.H.S.** $= \dfrac{\mathbf{-22}}{\mathbf{65}}$ **Verified**

8. (a) $\dfrac{-2}{6} \times \dfrac{1}{5} = \dfrac{1}{5} \times \boxed{\dfrac{2}{-6}}$ (b) $\dfrac{1}{3} \times \left(\dfrac{5}{6} - \dfrac{7}{3}\right) = \dfrac{1}{3} \times \dfrac{5}{6} + \dfrac{1}{3} \times \boxed{\dfrac{-7}{3}}$

(c) $\dfrac{-9}{7} \times \boxed{\dfrac{7}{-9}} = 1$ (d) $\dfrac{3}{4}\left(\dfrac{9}{2} - \dfrac{1}{3}\right) = \boxed{\dfrac{3}{4}} \times \dfrac{9}{2} + \dfrac{3}{4} \times \boxed{\dfrac{-1}{3}}$

(e) $\boxed{\dfrac{7}{6}} \times \dfrac{6}{7} = 1$ (f) $\dfrac{8}{-9} \times \boxed{0} = 0$

(g) $\dfrac{-3}{-8} \times \dfrac{-8}{-3} = \boxed{1}$ (h) $-8 \times \boxed{-1} = 8$

(i) $\dfrac{-1}{4} \times \left(\dfrac{-1}{2} + 1\right) = \dfrac{-1}{4} \times \boxed{\dfrac{-1}{2}} + 1 \times \boxed{\dfrac{-1}{4}}$

9. Let the number x be multiply.

$\therefore \quad \dfrac{-25}{28} \times x = \dfrac{-6}{7}$

$\Rightarrow \quad -25x = \dfrac{-6 \times 28}{7}$

$\Rightarrow \quad x = \dfrac{-6 \times 28}{7 \times (-25)} = \dfrac{-6 \times 4}{-25} = \dfrac{-24}{-25} = \mathbf{\dfrac{24}{25}}$ **Ans.**

10. Product of two rational numbers $= \dfrac{-18}{9}$

One number $= \dfrac{-14}{15}$

$\therefore$ Other number $= \dfrac{-18}{9} \div \dfrac{-14}{15} = \dfrac{-18}{9} \times \dfrac{15}{(-14)} = \dfrac{-18 \times 15}{9 \times (-14)} = \dfrac{15}{7} = 2\dfrac{1}{7}$

Hence, **the other number is $2\dfrac{1}{7}$.** **Ans.**

11. (a) Multiplication of rational numbers does not obey distributive law over addition. **False**

(b) If the product of two rational numbers is zero, then one of the rational number compulsary zero. **True**

(c) 1 and -1 are the reciprocals of each other. **False**

(d) Zero has no reciprocal. **True**

(e) The reciprocal of a negative rational number is always negative and that of positive rational number is always positive. **True**

Exercise 4.5

1. (a) $\dfrac{-5}{14} \div \dfrac{13}{14} = \dfrac{-5}{14} \times \dfrac{14}{13} = \dfrac{-5}{13}$

Hence, $\mathbf{\dfrac{-5}{14} \div \dfrac{13}{14} = \dfrac{-5}{13}}$ **Ans.**

(b) $\dfrac{11}{2} \div \dfrac{-13}{4} = \dfrac{11}{2} \times \dfrac{4}{-13} = \dfrac{11 \times 4}{-26} = \dfrac{44}{-26}$

$= \dfrac{44 \times (-1)}{-26 \times (-1)} = \dfrac{-44}{26}$

(Rewriting is standard form with denominator positive)

$= \dfrac{-22}{13} = -1\dfrac{9}{13}$

Hence, $\frac{11}{2} \div \frac{-13}{4} = -1\frac{9}{13}$ **Ans.**

(c) $\frac{25}{-30} \div \frac{-5}{6} = \frac{25}{-30} \times \frac{6}{-5} = \frac{25 \times 6}{(-30) \times (-5)} = 1$

Hence, $\frac{25}{-30} \div \frac{-5}{6} = 1$ **Ans.**

(d) $20 \div \frac{-1}{4} = 20 \times \frac{4}{-1} = \frac{80}{-1} = -80$

Hence, $20 \div \frac{-1}{4} = -80$ **Ans.**

(e) $-25 \div \frac{2}{-5} = -25 \times \frac{-5}{2} = \frac{125}{2} = 62\frac{1}{2}$

Hence, $-25 \div \frac{2}{-5} = 62\frac{1}{2}$ **Ans.**

(f) $\frac{-2}{3} \div \frac{-4}{5} = \frac{-2}{3} \times \frac{5}{-4} = \frac{-2 \times 5}{3 \times (-4)} = \frac{5}{6}$

Hence, $\frac{-2}{3} \div \frac{-4}{5} = \frac{5}{6}$ **Ans.**

2. (a) Absolute value of $-6 = |-6| = 6$ **Ans.**

(b) Absolute value of $\frac{7}{-5} = \left|\frac{7}{-5}\right| = \frac{7}{5} = 1\frac{2}{5}$ **Ans.**

(c) Absolute value of $\frac{8}{9} = \left|\frac{8}{9}\right| = \frac{8}{9}$ **Ans.**

(d) Absolute value of $\frac{-3}{2} = \left|\frac{-3}{2}\right| = \frac{3}{2} = 1\frac{1}{2}$ **Ans.**

(e) Absolute value of $1 = |1| = 1$ **Ans.**

(f) Absolute value of $-4 = |-4| = 4$ **Ans.**

(g) Absolute value of $\frac{-21}{-12} = \left|\frac{-21}{-12}\right| = \left|\frac{7}{4}\right| = \frac{7}{4} = 1\frac{3}{4}$ **Ans.**

(h) Absolute value of $\frac{-15}{2} = \left|\frac{-15}{2}\right| = \frac{15}{2} = 7\frac{1}{2}$ **Ans.**

3. (a) $\left|\frac{1}{2} - \frac{4}{3}\right| = \left|\frac{1 \times 3}{2 \times 3} - \frac{4 \times 2}{3 \times 2}\right|$ [$\because$ L.C.M. of 2 and 3 is 6]

$$= \left|\frac{3}{6} - \frac{8}{6}\right| = \left|\frac{3-8}{6}\right| = \left|\frac{-5}{6}\right| = \frac{5}{6}$$

Hence, $\left|\mathbf{\frac{1}{2} - \frac{4}{3}}\right| = \mathbf{\frac{5}{6}}$ **Ans.**

(b) $\frac{6}{5} \times \left|\frac{-4}{5} + \frac{9}{4}\right| = \frac{6}{5} \times \left|\frac{-4\times4}{5\times4} + \frac{9\times5}{4\times5}\right|$ [∵ L.C.M. of 5 and 4 is 20]

$$= \frac{6}{5} \times \left|\frac{-16}{20} + \frac{45}{20}\right| = \frac{6}{5} \times \left|\frac{-16+45}{20}\right|$$

$$= \frac{6}{5} \times \frac{29}{20} = \frac{6\times29}{5\times20} = \frac{87}{50} = 1\frac{37}{50}$$

Hence, $\mathbf{\frac{6}{5} \times \left|\frac{-4}{5} + \frac{9}{4}\right| = 1\frac{37}{50}}$ **Ans.**

(c) $\left(\frac{-2}{4}\right) \times \left|\frac{-2}{4}\right| = \frac{-2}{4} \times \frac{2}{4} = \frac{-2\times2}{4\times4} = -\frac{1}{4}$

Hence, $\mathbf{\left(\frac{-2}{4}\right) \times \left|\frac{-2}{4}\right| = -\frac{1}{4}}$ **Ans.**

(d) $\left|\frac{6}{5} + \frac{7}{2}\right| - 2 = \left|\frac{6\times2}{5\times2} + \frac{7\times5}{2\times5}\right| - 2 = \left|\frac{12}{10} + \frac{35}{10}\right| - 2$

$$= \left|\frac{47}{10}\right| - 2 = \frac{47}{10} - 2 = \frac{47}{10} - \frac{2}{1} = \frac{47-20}{10} = \frac{27}{10} = 2\frac{7}{10}$$

Hence, $\left|\mathbf{\frac{6}{5} + \frac{7}{2}}\right| \mathbf{- 2 = 2\frac{7}{10}}$ **Ans.**

(e) $\left|\left(\frac{-8}{9}\right) \div \frac{8}{9}\right| = \left|\frac{-8}{9} \times \frac{9}{8}\right| = \left|\frac{-8\times9}{9\times8}\right| = |-1| = 1$

Hence, $\left|\mathbf{\left(\frac{-8}{9}\right) \div \frac{8}{9}}\right| = \mathbf{1}$ **Ans.**

(f) $-\left|\frac{1}{2} - \frac{4}{6}\right| = -\left|\frac{1\times3}{2\times3} - \frac{4\times1}{6\times1}\right|$ [∵ L.C.M. of 2 and 6 is 6]

$$= -\left|\frac{3}{6} - \frac{4}{6}\right| = -\left|\frac{3-4}{6}\right| = -\left|\frac{-1}{6}\right|$$

$$= -\left(\frac{1}{6}\right) = -\frac{1}{6}$$

Hence, $$-\left|\frac{\mathbf{1}}{\mathbf{2}} - \frac{\mathbf{4}}{\mathbf{6}}\right| = -\frac{\mathbf{1}}{\mathbf{6}}$$ **Ans.**

4. (a) $-\frac{16}{19} \div 1 = \boxed{-\frac{16}{19}}$ (b) $-1 \div \boxed{-4} = \frac{1}{4}$ (c) $\frac{15}{6} \div \boxed{\frac{15}{6}} = 1$

(d) $\boxed{0} \div \frac{17}{9} = 0$ (e) $\frac{4}{5} \times \boxed{\frac{-5}{4}} = 1$ (f) $\frac{14}{5} \times \boxed{0} = 0$

(g) $|-1| = \boxed{1}$ (h) $\frac{1}{12} \times \boxed{-1} = \frac{-1}{12}$ (i) $|1| + |-1| = \boxed{2}$

(j) $-|1| + |1| = \boxed{0}$ (k) $\left|\frac{9}{7} + \left(\frac{-9}{7}\right)\right| = \boxed{0}$ (l) $\left|\frac{-8}{4} + \frac{-8}{4}\right| = \boxed{4}$

5. $m + n = \frac{7}{6} + \frac{1}{4} = \frac{7\times2}{6\times2} + \frac{1\times3}{4\times3}$ [L.C.M. of 6 and 4 is 12]

$$= \frac{14}{12} + \frac{3}{12} = \frac{14+3}{12} = \frac{17}{12}$$

$\therefore \quad |m+n| = \left|\frac{17}{12}\right| \Rightarrow |m+n| = \frac{17}{12}$

$\because \quad m = \frac{7}{6} \Rightarrow |m| = \frac{7}{6}$ and $n = \frac{1}{4} \Rightarrow |n| = \frac{1}{4}$

$\therefore \quad |m| + |n| = \frac{7}{6} + \frac{1}{4} = \frac{7\times2}{6\times2} + \frac{1\times3}{4\times3} = \frac{14}{12} + \frac{3}{12} = \frac{14+3}{12} = \frac{17}{12}$

Hence, $|\boldsymbol{m} + \boldsymbol{n}| = |\boldsymbol{m}| + |\boldsymbol{n}|$ **Proved.**

6. $x - y = \frac{-2}{3} - \frac{(-4)}{5} = \frac{-2\times5}{3\times5} - \frac{-4\times3}{5\times3}$ [$\because$ L.C.M. of 3 and 5 is 15]

$$= \frac{-10}{15} + \frac{12}{15} = \frac{-10+12}{15} = \frac{2}{15}$$

$\therefore \quad |x-y| = \left|\frac{2}{15}\right| \Rightarrow |x-y| = \frac{2}{15}$

$\because \quad x = \frac{-2}{3} \Rightarrow |x| = \left|\frac{-2}{3}\right| \Rightarrow |x| = \frac{2}{3}$

$$y = \frac{-4}{5} \Rightarrow |y| = \left|\frac{-4}{5}\right| \Rightarrow |y| = \frac{4}{5}$$

$\therefore \quad |x| \times |y| = \frac{2}{3} \times \frac{4}{5} = \frac{8}{15}$

$\because \quad |x - y| = \frac{2}{15}$ and $|x \times y| = \frac{8}{15}$

$\therefore \quad |x - y| < |x \times y|$

Hence, $|x - y| < |x| \times |y|$ **Proved**

7. $x \times y = \frac{1}{5} \times \frac{-7}{6} = \frac{-7}{30}$ and $|x \times y| = \left|\frac{-7}{30}\right| = \frac{7}{30}$

$\because \quad x = \frac{1}{5} \Rightarrow |x| = \frac{1}{5}$ and $y = \frac{-7}{6} \Rightarrow |y| = \left|\frac{-7}{6}\right| = \frac{7}{6}$

$\therefore \quad |x| \times |y| = \frac{1}{5} \times \frac{7}{6} = \frac{7}{30}$

Hence, $|x \times y| = |x| \times |y|$ **Proved**

8. $m + n = \frac{-1}{9} + \frac{-3}{8} = \frac{-1 \times 8}{9 \times 8} + \frac{-3 \times 9}{8 \times 9}$ [$\because$ L.C.M. of 9 and 8 = 72]

$= \frac{-8}{72} + \frac{-27}{72} = \frac{-8 - 27}{72} = \frac{-35}{72}$

$\therefore \quad |m + n| = \left|\frac{-35}{72}\right| \Rightarrow |m + n| = \frac{35}{72}$

$\because m = -\frac{1}{9} \Rightarrow |m| = \left|\frac{-1}{9}\right| = \frac{1}{9}$ and $n = \frac{-3}{8} \Rightarrow |n| = \left|\frac{-3}{8}\right| = \frac{3}{8}$

$\therefore \quad |m| + |n| = \frac{1}{9} + \frac{3}{8} = \frac{1 \times 8}{9 \times 8} + \frac{3 \times 9}{8 \times 9}$ [$\because$ L.C.M. of 9 and 8 = 72]

$= \frac{8}{72} + \frac{27}{72} = \frac{8 + 27}{72} = \frac{35}{72}$

Hence, $|m + n| = |m| + |n|$ **Proved**

9. Product of two rational numbers $= -10$

$\because$ One number $= \frac{-9}{-16}$

$\therefore$ Other number $= -10 \div \frac{-9}{-16} = -10 \times \frac{-16}{-9}$

$= \frac{-10 \times (-16)}{-9} = \frac{-160}{9} = -17\frac{7}{9}$

Hence, **the other number is $-17\frac{7}{9}$.** **Ans.**

10. Let the number be x.

$\therefore \quad \frac{7}{-9} \div x = -3$

$\frac{7}{-9} \times \frac{1}{x} = -3$ or $\frac{7}{-9x} = -3$ or $7 = -3 \times (-9x)$ or $7 = 27x$ or $x = \frac{7}{27}$

Hence, **the number** $= \mathbf{\frac{7}{27}}$ **Ans.**

11. $\because$ The product of $\frac{4}{5}$ and $m = \frac{9}{8}$

$\therefore \quad \frac{4}{5} \times m = \frac{9}{8}$

$\Rightarrow \quad \frac{4m}{5} = \frac{9}{8}$

$\Rightarrow \quad 4m \times 8 = 9 \times 5$ [By cross-multiplication]

$\Rightarrow \quad 32m = 9 \times 5$

$\Rightarrow \quad \frac{32m}{32} = \frac{9 \times 5}{32}$ [Divide both sides by 32]

$\Rightarrow \quad m = \frac{45}{32} = 1\frac{13}{32}$

Hence, **the value of** $\boldsymbol{m} = \mathbf{1\frac{13}{32}}$ **Ans.**

12. Let the required number be x.

$\therefore \quad \frac{13}{5} \times x = \frac{15}{6} \Rightarrow \frac{13x}{5} = \frac{15}{6}$

$\Rightarrow \quad 13x \times 6 = 15 \times 5$ [By cross-multiplication]

$\Rightarrow \quad 78x = 75$

$\Rightarrow \quad \frac{78x}{78} = \frac{75}{78}$ [Divide both sides by 78]

$\Rightarrow \quad x = \frac{75}{78} = \frac{25}{26}$

Hence, **the required number is** $\mathbf{\frac{25}{26}}$. **Ans.**

13. Product of two rational number $= -1$

One number $= \frac{22}{26}$

$\therefore$ Other number $= -1 \div \frac{22}{26} = -1 \times \frac{26}{22}$

$= \frac{-1 \times 26}{22} = \frac{-26}{22} = \frac{-13}{11} = -1\frac{2}{11}$

Hence, **the other number is $-1\frac{2}{11}$.** **Ans.**

14. Let the required number be x.

$\therefore \quad \frac{99}{100} \times x = 1$ or $\frac{99x}{100} = 1$

or $\quad 99x = 100$ or $\frac{99x}{99} = \frac{100}{99}$ [Divide both sides by 99]

$x = \frac{100}{99} = 1\frac{1}{99}$

Hence, **the required number is $1\frac{1}{99}$.** **Ans.**

15. $\frac{15}{20} \div x = \frac{3}{2}$ or $\frac{15}{20} \times \frac{1}{x} = \frac{3}{2}$ or $\frac{15}{20x} = \frac{3}{2}$ or $20x \times 3 = 15 \times 2$

[By cross-multiplication]

or $\quad 60x = 30$ or $\frac{60x}{60} = \frac{30}{60}$ (Divide both sides by 60)

or $\quad x = \frac{30 \div 30}{60 \div 60} = \frac{1}{2}$

Hence, **the value of $x = \frac{1}{2}$** **Ans.**

Multiple Choice Questions

1. (i) The answer **(a)** is correct. **Ans.**

(ii) The reciprocal of $\frac{3}{2} = \frac{2}{3}$

Hence, the answer **(c)** is correct. **Ans.**

(iii) $\frac{-2}{3} \div \frac{2}{3} = \frac{-2}{3} \times \frac{3}{2} = -1$

Hence, the answer **(a)** is correct. **Ans.**

(iv) The positive rational number is $\frac{15}{9}$.

Hence, the answer **(c)** is correct. **Ans.**

(v) $\frac{a}{b}=\frac{c}{d}=a\times d=b\times c$ [By cross-multiplication]

Hence, the answer **(d)** is correct. **Ans.**

(vi) $\frac{-1}{6}=\frac{-1\times 5}{6\times 5}=\frac{-5}{30}$

Hence, the answer **(a)** is correct. **Ans.**

(vii) $\frac{-8}{7}=\frac{-8\times 2}{7\times 2}=\frac{-16}{14}=\frac{-16\times(-1)}{14\times(-1)}=\frac{16}{-14}$

Hence, the answer **(d)** is correct. **Ans.**

(viii) Additive inverse of $\frac{-9}{5}=-\left(\frac{-9}{5}\right)=\frac{9}{5}$

Hence, the answer **(c)** is correct. **Ans.**

(ix) $\frac{2}{3}=\frac{2\times 2}{3\times 2}=\frac{4}{6}$

Hence, the answer **(c)** is correct. **Ans.**

5. Exponents and Powers

Exercise 5.1

1. (a) $\left(\frac{2}{3}\right)^4=\frac{2}{3}\times\frac{2}{3}\times\frac{2}{3}\times\frac{2}{3}=\mathbf{\frac{16}{81}}$ **Ans.**

(b) $\left(\frac{-3}{2}\right)^4=\left(\frac{-3}{2}\right)\times\left(\frac{-3}{2}\right)\times\left(\frac{-3}{2}\right)\times\left(\frac{-3}{2}\right)=\mathbf{\frac{81}{16}}$ **Ans.**

(c) $\left(\frac{4}{-3}\right)^3=\frac{4}{(-3)}\times\frac{4}{(-3)}\times\frac{4}{(-3)}=\mathbf{\frac{64}{-27}}$ **Ans.**

(d) $\left(\frac{2}{5}\right)^{-2}=\frac{1}{\left(\frac{2}{5}\right)^2}=\left(\frac{5}{2}\right)^2=\frac{5\times 5}{2\times 2}=\frac{25}{4}=\mathbf{6\frac{1}{4}}$ **Ans.**

(e) $\left(\frac{1}{4}\right)^{-3}=4^3=4\times 4\times 4=\mathbf{64}$ **Ans.**

(f) $\left(\frac{2}{7}\right)^3=\frac{2}{7}\times\frac{2}{7}\times\frac{2}{7}=\mathbf{\frac{8}{343}}$ **Ans.**

(g) $\left(\frac{-3}{2}\right)^6 = \frac{(-3)}{2}\times\frac{(-3)}{2}\times\frac{(-3)}{2}\times\frac{(-3)}{2}\times\frac{(-3)}{2}\times\frac{(-3)}{2} = \frac{729}{64}$

$= \mathbf{11\,\frac{25}{64}}$ **Ans.**

(h) $\left(\frac{1}{9}\right)^{-2} = \left(\frac{1}{\frac{1}{9}}\right)^2 = (9)^2 = 9\times 9 = \mathbf{81}$

Ans.

2. (a) $\left(\frac{-1}{2}\right)\times\left(\frac{-1}{2}\right)\times\left(\frac{-1}{2}\right)\times\left(\frac{-1}{2}\right)\times\left(\frac{-1}{2}\right)\times\left(\frac{-1}{2}\right) = \left(\frac{\mathbf{-1}}{\mathbf{2}}\right)^6$ **Ans.**

(b) $\left(\frac{2}{3}\right)\times\left(\frac{2}{3}\right)\times\left(\frac{2}{3}\right)\times\left(\frac{2}{3}\right)\times\left(\frac{2}{3}\right)\times\left(\frac{2}{3}\right)\times\left(\frac{2}{3}\right) = \left(\frac{\mathbf{2}}{\mathbf{3}}\right)^7$ **Ans.**

(c) $\frac{16}{81} = \frac{2\times2\times2\times2}{3\times3\times3\times3} = \frac{2^4}{3^4} = \left(\frac{\mathbf{2}}{\mathbf{3}}\right)^4$ **Ans.**

(d) $\frac{1}{256} = \frac{1}{2\times2\times2\times2\times2\times2\times2\times2} = \frac{1}{2^8} = \left(\frac{\mathbf{1}}{\mathbf{2}}\right)^8$ **Ans.**

(e) $\frac{64}{729} = \frac{2\times2\times2\times2\times2\times2}{3\times3\times3\times3\times3\times3} = \frac{2^6}{3^6} = \left(\frac{\mathbf{2}}{\mathbf{3}}\right)^6$ **Ans.**

(f) $\frac{-1}{343} = \frac{-1}{7\times7\times7} = \frac{-1}{7^3} = \left(\frac{\mathbf{-1}}{\mathbf{7}}\right)^3$ **Ans.**

(g) $\frac{81}{625} = \frac{3\times3\times3\times3}{5\times5\times5\times5} = \frac{3^4}{5^4} = \left(\frac{\mathbf{3}}{\mathbf{5}}\right)^4$ **Ans.**

3. (a) $\left(\frac{2}{3}\right)^2\times\left(\frac{3}{5}\right)^2 = \frac{2^2}{3^2}\times\frac{3^2}{5^2} = \frac{2\times2\times3\times3}{3\times3\times5\times5} = \mathbf{\frac{4}{25}}$ **Ans.**

(b) $\left(\frac{-1}{4}\right)^3\times\left(\frac{4}{-9}\right)^4 = \frac{(-1)^3}{4^3}\times\frac{4^4}{(-9)^4}$

$= \frac{-1\times4\times4\times4\times4}{4\times4\times4\times(-9)\times(-9)\times(-9)\times(-9)} = \mathbf{\frac{-4}{6561}}$ **Ans.**

(c) $\left(\frac{7}{-16}\right)\times\left(\frac{24}{3}\right)^2 = \frac{7}{-16}\times\frac{24^2}{3^2} = \frac{7\times24\times24}{-16\times3\times3} = \mathbf{-28}$ **Ans.**

(d) $\left(\frac{-1}{2}\right)^3\times\left(\frac{-1}{8}\right)^3 = \frac{(-1)^3}{2^3}\times\frac{(-1)^3}{8^3} = \frac{(-1)^6}{8\times512} = \mathbf{\frac{1}{4096}}$ **Ans.**

4. (a) Reciprocal of $\left(\frac{4}{3}\right)^3 = \left(\frac{4}{3}\right)^{-3} = \left(\frac{\mathbf{3}}{\mathbf{4}}\right)^{\mathbf{3}}$ **Ans.**

(b) Reciprocal of $\left(\frac{-7}{3}\right)^5 = \left(\frac{-7}{3}\right)^{-5} = \left(\frac{\mathbf{3}}{\mathbf{-7}}\right)^{\mathbf{5}}$ **Ans.**

(c) Reciprocal of $(-6)^3 = (-6)^{-3} = \left(-\frac{\mathbf{1}}{\mathbf{6}}\right)^{\mathbf{3}}$ **Ans.**

(d) Reciprocal of $\left(\frac{-5}{3}\right)^{25} = \left(-\frac{5}{3}\right)^{-25} = \left(\frac{\mathbf{3}}{\mathbf{-5}}\right)^{\mathbf{25}}$ **Ans.**

(e) Reciprocal of $\left(\frac{4}{5}\right)^{-30} = \left(\frac{4}{5}\right)^{-(-30)} = \left(\frac{\mathbf{4}}{\mathbf{5}}\right)^{\mathbf{30}}$ **Ans.**

(f) Reciprocal of $\left(\frac{13}{8}\right)^{-11} = \left(\frac{13}{8}\right)^{-(-11)} = \left(\frac{\mathbf{13}}{\mathbf{8}}\right)^{\mathbf{11}}$ **Ans.**

(g) Reciprocal of $(-26)^3 = (-26)^{-3} = \left(-\frac{\mathbf{1}}{\mathbf{26}}\right)^{\mathbf{3}}$ **Ans.**

(h) Reciprocal of $9^3 = 9^{-3} = \left(\frac{\mathbf{1}}{\mathbf{9}}\right)^{\mathbf{3}}$ **Ans.**

(i) Reciprocal of $\left(\frac{9}{2}\right)^{10} = \left(\frac{9}{2}\right)^{-10} = \left(\frac{\mathbf{2}}{\mathbf{9}}\right)^{\mathbf{10}}$ **Ans.**

(j) Reciprocal of $(-13)^{-3} = (-13)^{-(-3)} = \mathbf{(-13)^3}$ **Ans.**

Exercise 5.2

1. (a) $\left(\frac{7}{3}\right)^2 \div \left(\frac{7}{3}\right)^3 = \frac{1}{\left(\frac{7}{3}\right)^{3-2}} = \frac{1}{\left(\frac{7}{3}\right)} = \frac{\mathbf{3}}{\mathbf{7}}$ **Ans.**

(b) $\left(\frac{-6}{4}\right)^5 \div \left(\frac{-6}{4}\right)^{10} = \frac{1}{\left(\frac{-6}{4}\right)^{10-5}} = \frac{1}{\left(\frac{-6}{4}\right)^5} = \left(\frac{4}{-6}\right)^5 = \left(-\frac{\mathbf{2}}{\mathbf{3}}\right)^{\mathbf{5}}$ **Ans.**

(c) $\left(\frac{9}{5}\right)^{-3} \div \left(\frac{5}{9}\right)^2 = \left(\frac{5}{9}\right)^3 \div \left(\frac{5}{9}\right)^2 = \left(\frac{5}{9}\right)^{3-2} = \left(\frac{5}{9}\right)^1 = \frac{\mathbf{5}}{\mathbf{9}}$ **Ans.**

(d) $\left(\frac{11}{7}\right)^{-4} \div \left(\frac{11}{7}\right)^{-5} = \left(\frac{11}{7}\right)^{-4-(-5)} = \left(\frac{11}{7}\right)^{-4+5} = \left(\frac{11}{7}\right)^{1} = \frac{11}{7} = \mathbf{1\frac{4}{7}}$

Ans.

2. (a) $\left[\left(\frac{12}{7}\right)^{4}\right]^{1} = \left(\frac{12}{7}\right)^{4} = \frac{12^4}{7^4} = \frac{20736}{2401} = \mathbf{8\frac{1528}{2401}}$

Ans.

(b) $\left[\left(\frac{-2}{3}\right)^{4}\right]^{2} = \left(\frac{-2}{3}\right)^{4\times 2} = \left(\frac{-2}{3}\right)^{8} = \frac{-2^8}{3^8} = \mathbf{\frac{256}{6561}}$

Ans.

(c) $\left[\left(\frac{1}{5}\right)^{-3}\right]^{2} = \left(\frac{1}{5}\right)^{-3\times 2} = \left(\frac{1}{5}\right)^{-6} = (5)^6 = \mathbf{15625}$

Ans.

(d) $\left[\left(\frac{-2}{6}\right)^{2}\right]^{-3} = \left(\frac{-2}{6}\right)^{2\times(-3)} = \left(\frac{-2}{6}\right)^{-6} = \left(\frac{-1}{3}\right)^{-6} = (-3)^6 = \mathbf{729}$

Ans.

3. (a) $\left(\frac{13}{5}\right)^{10} \div \left(\frac{13}{5}\right)^{15} = \frac{1}{\left(\frac{13}{5}\right)^{15-10}} = \frac{1}{\left(\frac{13}{5}\right)^{5}} = \left(\frac{5}{13}\right)^{5} = \frac{5^5}{13^5}$

$= \mathbf{\frac{3125}{371293}}$

Ans.

(b) $\left(\frac{21}{8}\right)^{4} \div \left(\frac{21}{8}\right)^{3} = \left(\frac{21}{8}\right)^{4-3} = \left(\frac{21}{8}\right)^{1} = \frac{21}{8} = \mathbf{2\frac{5}{8}}$

Ans.

(c) $\left(\frac{12}{5}\right)^{10} \div \left(\frac{12}{5}\right)^{10} = \left(\frac{12}{5}\right)^{10-10} = \left(\frac{12}{5}\right)^{0} = \mathbf{1}$

Ans.

(d) $\left(\frac{-41}{4}\right)^{3} \div \left(\frac{-41}{4}\right)^{8} = \frac{1}{\left(\frac{-41}{4}\right)^{8-3}} = \frac{1}{\left(\frac{-41}{4}\right)^{5}} = \left(\frac{4}{\mathbf{-41}}\right)^{5}$

Ans.

4. (a) $\left(\frac{6}{7}\right)^{4} \times \left(\frac{6}{7}\right)^{x} = \left(\frac{6}{7}\right)^{9}$

or $\left(\frac{6}{7}\right)^{4+x} = \left(\frac{6}{7}\right)^{9}$

$\because$ Base is same, so equal the power on both sides.

$\Rightarrow \quad 4+x=9$

$\Rightarrow \quad x=9-4$

$\Rightarrow \quad x=5$ **Ans.**

(b) $\left(\frac{-1}{9}\right)^{4x}\times\left(\frac{-1}{9}\right)^{3x}=\left(\frac{-1}{9}\right)^{21}$

$\Rightarrow \quad \left(\frac{-1}{9}\right)^{4x+3x}=\left(\frac{-1}{9}\right)^{21}$

$\Rightarrow \quad \left(\frac{-1}{9}\right)^{7x}=\left(\frac{-1}{9}\right)^{21};\ 7x=21;\ x=\frac{21}{7}=3$

Hence, $\boldsymbol{x=3}$ **Ans.**

(c) $\left(\frac{7}{5}\right)^{10}\div\left(\frac{7}{5}\right)^{3x}=\left(\frac{7}{5}\right);\left(\frac{7}{5}\right)^{10-3x}=\left(\frac{7}{5}\right)^{1}$

$\Rightarrow \quad 10-3x=1;\ -3x=1-10=-9;\ x=\frac{-9}{-3}=3$

Hence $\boldsymbol{x=3}$ **Ans.**

(d) $\left[\left(\frac{-1}{6}\right)^{x}\right]^{4}=\left(\frac{-1}{6}\right)^{16};\left(\frac{-1}{6}\right)^{x\times4}=\left(\frac{-1}{6}\right)^{16};\left(\frac{-1}{6}\right)^{4x}=\left(\frac{-1}{6}\right)^{16}$

$\Rightarrow \quad 4x=16;\ x=\frac{16}{4};\ x=4$ **Ans.**

Hence, $\boldsymbol{x=4}$

5. Let the number be x.

$\therefore \quad x\times6^{-5}=6^{5};\ x\times\frac{1}{6^{5}}=6^{5};\ x=6^{5}\times6^{5};\ x=6^{5+5}$

$x=6^{10}$ **Ans.**

6. Product of two numbers $=(-19)^{-4}$

One of the number $=(-19)^{-2}$

$\therefore$ Other number $=(-19)^{-4}\div(-19)^{-2}=(-19)^{-4-(-2)}$

$=(-19)^{-4+2}=(-19)^{-2}=\frac{1}{(-19)^{2}}=\frac{1}{(-19)\times(-19)}=\frac{1}{361}$

Hence, **the other number is $\frac{1}{361}$.** **Ans.**

7. $\left[\left(\frac{3}{4}\right)^3\right]^2 \times \left(\frac{1}{4}\right)^{-2} \times 4^2 \times \frac{1}{12} = \left(\frac{3}{4}\right)^{3\times 2} \times (4)^2 \times 4^2 \times \frac{1}{12}$

$= \left(\frac{3}{4}\right)^6 \times 4^2 \times 4^2 \times \frac{1}{12} = \frac{3^6}{4^6} \times 4^{2+2} \times \frac{1}{12}$

$= \frac{729}{4096} \times 256 \times \frac{1}{12} = \frac{729 \times 256}{4096 \times 12} = \frac{243}{64} = \mathbf{3\,\frac{51}{64}}$ **Ans.**

8. $(8^{-1} - 7^{-1})^{-2} + (7^{-1} - 2^3) = \left(\frac{1}{8} - \frac{1}{7}\right)^{-2} + \left(\frac{1}{7} - 8\right)$

$= \left(\frac{7-8}{56}\right)^{-2} + \left(\frac{1-56}{7}\right) = \left(\frac{-1}{56}\right)^{-2} + \left(\frac{-55}{7}\right) = (-56)^2 + \frac{-55}{7}$

$= 3136 - \frac{55}{7} = \frac{21952 - 55}{7} = \frac{21897}{7} = \mathbf{3128\,\frac{1}{7}}$ **Ans.**

Exercise 5.3

1. (a) $47500000000 = 475 \times 10^8 = \mathbf{4.75 \times 10^{10}}$ **Ans.**

(b) $2100000000 = 21 \times 10^8 = \mathbf{2.1 \times 10^9}$ **Ans.**

(c) $0.00000052 = \frac{52}{100000000} = 52 \times 10^{-8} = \mathbf{5.2 \times 10^{-7}}$ **Ans.**

(d) $0.00012 = \frac{12}{100000} = 12 \times 10^{-5} = \mathbf{1.2 \times 10^{-4}}$ **Ans.**

(e) $61000000000 = 61 \times 10^9 = \mathbf{6.1 \times 10^{10}}$ **Ans.**

(f) $0.00000000024 = \frac{24}{100000000000} = \frac{24}{10^{11}}$

$= 24 \times 10^{-11} = \mathbf{2.4 \times 10^{-10}}$ **Ans.**

(g) $0.0083 = \frac{83}{10000} = \frac{83}{10^4} = 83 \times 10^{-4} = \mathbf{8.3 \times 10^{-3}}$ **Ans.**

(h) $0.0000034 = \frac{34}{10000000} = \frac{34}{10^7} = 34 \times 10^{-7} = \mathbf{3.4 \times 10^{-6}}$ **Ans.**

2. (a) $13.63 \times 10^7 = \frac{1363}{100} \times 10^7 = 1363 \times 10^5 = \mathbf{136300000}$ **Ans.**

(b) $2.814 \times 10^6 = \frac{2814}{1000} \times 10^6 = 2814 \times 10^3 = \mathbf{2814000}$ **Ans.**

(c) $3.6\times10^{-6}=\dfrac{3.6}{10^6}=\dfrac{36}{10\times10^6}=\mathbf{0.0000036}$ **Ans.**

(d) $6.8\times10^{-9}=\dfrac{6.8}{10^9}=\dfrac{68}{10\times10^9}=\dfrac{68}{10^{10}}=\mathbf{0.0000000068}$ **Ans.**

(e) $21.2\times10^6=\dfrac{212}{10}\times10^6=212\times10^5=\mathbf{21200000}$ **Ans.**

(f) $3.05\times10^7=\dfrac{305}{100}\times10^7=305\times10^5=\mathbf{30500000}$ **Ans.**

(g) $0.0164\times10^9=\dfrac{164}{10000}\times10^9=164\times10^5=\mathbf{16400000}$ **Ans.**

(h) $2.7\times10^{-4}=\dfrac{27}{10\times10^4}=\dfrac{27}{10^5}=\mathbf{0.00027}$ **Ans.**

3. The distance of Moon from Earth $=984680000$ km

$=98468\times10^4$ km $=\mathbf{9.8468\times10^8}$ **km** **Ans.**

4. Speed of light $=19800000000$ m/s $=198\times10^8$ m/s

$=\mathbf{1.98\times10^{10}}$ **m/s** **Ans.**

5. Mass of Earth $=6.191\times10^{26}$ kg $=\dfrac{6191}{1000}\times10^{26}$ kg

$=6191\times10^{23}$ kg $=$ **6191000000000000000000000000 kg** **Ans.**

6. Distance of Sun $=26140000000$ meter $=2614\times10^7$ metre

$=\mathbf{2.614\times10^{10}}$ **metre** **Ans.**

Multiple Choice Questions

1. (i) $\{(6)^3\}^5=6^{3\times5}=6^{15}$

Hence, the answer **(b)** is correct. **Ans.**

(ii) $a^x\times a^y=a^{x+y}$

Hence, the answer **(b)** is correct. **Ans.**

(iii) $\left(\dfrac{1}{5}\right)^{-2}+\left(\dfrac{1}{6}\right)^{-2}+\left(\dfrac{1}{7}\right)^{-2}=\left(\dfrac{5}{1}\right)^2+\left(\dfrac{6}{1}\right)^2+\left(\dfrac{7}{1}\right)^2$

$=(5)^2+(6)^2+(7)^2=25+36+49=110$

Hence, the answer **(a)** is correct. **Ans.**

(iv) $a^x\div a^y=\dfrac{a^x}{a^y}=a^{x-y}$

Hence, the answer **(b)** is correct. **Ans.**

(v) The value of $\left(\frac{1}{6}\right)^0 = 1$ $[\because a^0 = 1]$

Hence, the answer **(c)** is correct. **Ans.**

(vi) $a^x \times a^y \times a^z = a^{x+y+z}$

Hence, the answer **(b)** is correct. **Ans.**

(vii) $(a^x)^y = a^{x \times y} = a^{xy}$ $[\because (a^m)^n = a^{mn}]$

Hence, the answer **(c)** is correct. **Ans.**

(viii) $(4^{-1} - 5^{-1})^{-1} = \left(\frac{1}{4} - \frac{1}{5}\right)^{-1} = \left(\frac{5-4}{20}\right)^{-1}$

[L.C.M. of 4 and 5 is 20]

$= \left(\frac{1}{20}\right)^{-1} = \frac{20}{1} = 20$

Hence, the answer **(a)** is correct. **Ans.**

6. Algebraic Expressions

Exercise 6.1

1. (a) $(-6x^4) \times 2y^3 \times (-x^2y^2) = (-6 \times 2) \times (x^4 \times y^3) \times (-x^2y^2)$

$= 12 \times x^{4+2} y^{3+2} = \mathbf{12x^6y^5}$ **Ans.**

(b) $m^3n^2 \times (-4m^3) \times (-6n^3) = (-4 \times -6) \times m^3n^2 \times m^3 \times n^3$

$= 24 \times m^{3+3} \times n^{2+3} = \mathbf{24m^6n^5}$ **Ans.**

(c) $\left(\frac{4}{2}a^2b^2\right) \times \left(\frac{-1}{4}a^3\right) \times (-b^4) = \left(\frac{4}{2} \times \frac{-1}{4}\right) \times a^2b^2 \times a^3 \times (-b^4)$

$= \frac{1}{2} \times a^{2+3} \times b^{2+4} = \mathbf{\frac{1}{2}a^5b^6}$ **Ans.**

(d) $\left(\frac{3}{6}x^2y^2\right) \times \left(\frac{-2}{5}x^2y^3\right) = \left(\frac{3}{6} \times \frac{-2}{5}\right) \times x^2y^2 \times x^2y^3$

$= \frac{-1}{5} \times x^{2+2} \times y^{2+3} = \mathbf{\frac{-1}{5}x^4y^5}$ **Ans.**

(e) $\left(\frac{-2}{5}m^2n\right) \times \left(\frac{-1}{4}m^3n^4\right) \times (-4) = \left(\frac{-2}{5} \times \frac{-1}{4} \times -4\right)$

$\times m^2n \times m^3n^4$

$$= \frac{-2}{5} \times m^{2+3} \times n^{1+4} = \frac{-2}{5} \boldsymbol{m^5 n^5}$$ **Ans.**

(f) $a^3 b^4 \times \left(\frac{-1}{2}\right) \times \left(\frac{1}{2} a^2 b^2\right) = \left(-\frac{1}{2} \times \frac{1}{2}\right) \times a^3 b^4 \times a^2 b^2$

$$= -\frac{1}{4} \times a^{3+2} \times b^{4+2} = -\frac{1}{4} \boldsymbol{a^5 b^6}$$ **Ans.**

2. (a) $(-2x^4 y^2) \times (-x^2 y^4) \times (-y^6 x^3)$

$= (-2) \times x^4 y^2 \times (-x^2 y^4) \times (-y^6 x^3)$

$= -2 \times x^{4+2+3} \times y^{2+4+6}$

$= \boldsymbol{-2x^9 y^{12}}$ **Ans.**

(b) $(-m^2 n^2) \times (m^2 n^2) \times (-m^3 n) \times (m^2 n^3)$

$= m^2 n^2 \times m^2 n^2 \times m^3 n \times m^2 n^3$ $[\because (-) \times (-) = +]$

$= m^{2+2+3+2} \times n^{2+2+1+3} = \boldsymbol{m^9 n^8}$ **Ans.**

(c) $\left(\frac{1}{2} a^2 b^4\right) \times \left(\frac{-3}{2} a^2 c^2\right) \times (-b^3 c)$

$= \left(\frac{1}{2} \times \frac{-3}{2} \times (-1)\right) \times (a^2 b^4 \times a^2 c^2 \times b^3 c)$

$= \frac{3}{4} \times a^{2+2} \times b^{4+3} \times c^{2+1} = \boldsymbol{\frac{3}{4} a^4 b^7 c^3}$ **Ans.**

(d) $\left(\frac{1}{3} a^2 b^2 c\right) \times \left(\frac{-2}{5} a^2 c^2 b\right) \times \left(-\frac{1}{5} a^4 b^3 c^3\right)$

$= \left(\frac{1}{3} \times \frac{-2}{5} \times \frac{-1}{5}\right) \times a^2 b^2 c \times a^2 c^2 b \times a^4 b^3 c^3$

$= \frac{2}{75} \times a^{2+2+4} \times b^{2+1+3} \times c^{1+2+3} = \boldsymbol{\frac{2}{75} a^8 b^6 c^6}$ **Ans.**

3. $\left(\frac{1}{3} x^3 y^2\right) \times \left(\frac{-3}{2} x^2 y^3\right) = \left(\frac{1}{3} \times \frac{-3}{2}\right) \times x^3 y^2 \times x^2 y^3$

$= -\frac{1}{2} \times x^{3+2} \times y^{2+3} = \boldsymbol{-\frac{1}{2} x^5 y^5}$ **Ans.**

Now, L.H.S. $= \left(\frac{1}{3} x^3 y^2\right) \times \left(\frac{-3}{2} x^2 y^3\right)$

Putting the value of $x = 3$ and $y = -5$

L.H.S. $= \frac{1}{3} \times (3)^3 \times (-5)^2 \times \left(\frac{-3}{2}\right) \times (3)^2 \times (-5)^3$

$= \frac{1}{3} \times 27 \times 25 \times \left(-\frac{3}{2}\right) \times 9 \times (-125) = 225 \times \frac{3375}{2} = \frac{759375}{2}$

R.H.S. $= -\frac{1}{2} x^5 y^5 = -\frac{1}{2} \times (3)^5 \times (-5)^5$

$= \frac{1}{2} \times 243 \times 3125 = \frac{759375}{2}$

Thus, L.H.S. = R.H.S., and the product is verified. Proved

4. $\left(-\frac{1}{5} ab^2c^2\right) \times (-a^2b^2c^2) \times \left(\frac{3}{4} a^2\right)$

$= \left(-\frac{1}{5} \times (-1) \times \frac{3}{4}\right) \times ab^2c^2 \times a^2b^2c^2 \times a^2$

$= \frac{3}{20} \times a^{1+2+2} \times b^{2+2} \times c^{2+2} = \frac{3}{20} a^5 b^4 c^4$ **Ans.**

Now, L.H.S. $= \left(-\frac{1}{5} ab^2c^2\right) \times (-a^2b^2c^2) \times \left(\frac{3}{4} a^2\right)$

Putting the value of $a = 2$, $b = -1$ and $c = 2$

L.H.S. $= \left(-\frac{1}{5} \times 2 \times (-1)^2 \times 2^2\right) \times [-(2)^2] \times (-1)^2 \times 2^2 \times \left(\frac{3}{4} \times 2^2\right)$

$= \left(-\frac{8}{5}\right) \times (-16) \times 3 = \frac{384}{5}$

R.H.S. $= \frac{3}{20} \times (2)^5 \times (-1)^4 \times (2)^4 = \frac{3}{20} \times 32 \times 16 = \frac{48 \times 8}{5} = \frac{384}{5}$

Thus, **L.H.S. = R.H.S. and the product is verified. Proved**

5. (a) $(-3a^2b^2) \times (a^2 - b^3) = -3a^2b^2 \times a^2 + 3a^2b^2 \times b^3$

(Using distributive law)

$= \mathbf{-3a^4b^2 + 3a^2b^5}$ **Ans.**

(b) $x^4y^3 \times (-3x^3 - y^3) = x^4y^3 \times (-3x^3) - x^4y^3 \times y^3$

$= -3x^{4+3}y^3 - x^4y^{3+3} = \mathbf{-3x^7y^3 - x^4y^6}$ **Ans.**

(c) $(-4x) \times (x^2 - y - z^2) = -4x \times x^2 + 4x \times y + 4x \times z^2$

$= \mathbf{-4x^3 + 4xy + 4xz^2}$ **Ans.**

(d) $\left(-\frac{2}{3}a^2b^2\right)\times\left(\frac{1}{4}a^2b^2-\frac{1}{2}b^3a\right)=\left(-\frac{2}{3}\times\frac{1}{4}\right)a^2b^2\times a^2b^2$

$+\left(\frac{2}{3}\times\frac{1}{2}\right)\times a^2b^2\times b^3a$

$=-\frac{1}{6}a^{2+2}\times b^{2+2}+\frac{1}{3}a^{2+1}\times b^{2+3}=\mathbf{-\frac{1}{6}a^4b^4+\frac{1}{3}a^3b^5}$ **Ans.**

(e) $\left[\frac{3}{5}m^2-\frac{1}{2}mn^2-\frac{2}{10}n^2\right]\times 20m^2n^2=\left(\frac{3}{5}\times 20\right)$

$\times m^2\times m^2n^2-\left(\frac{1}{2}\times 20\right)mn^2\times m^2n^2-\left(\frac{2}{10}\times 20\right)n^2\times m^2n^2$

$=\mathbf{12m^4n^2-10m^3n^4-4m^2n^4}$ **Ans.**

6. (a) $x^2(y-z)+y^2(z-x)+z^2(x-y)$

$=\mathbf{x^2y-x^2z+y^2z-y^2x+z^2x-z^2y}$ **Ans.**

(b) $x^2(y^2-z^2)+y^2(x^2-z^2)+z^2(x^2-y^2)$

$=y^2x^2-z^2x^2+y^2x^2-z^2y^2+z^2x^2-z^2y^2$

$=2y^2x^2-2z^2y^2=\mathbf{2y^2(x^2-z^2)}$ **Ans.**

(c) $a^2b^2c^2\left(\frac{a^2}{b^2}+\frac{b^2}{c^2}+\frac{c^2}{a^2}\right)=a^2b^2c^2\times\frac{a^2}{b^2}+a^2b^2c^2\times\frac{b^2}{c^2}$

$+a^2b^2c^2\times\frac{c^2}{a^2}$

$=\mathbf{a^4c^2+a^2b^4+b^2c^4}$ **Ans.**

(d) $a^3(b+c)+b^3(a-c)-ab(a+b+c)$

$=\mathbf{a^3b+a^3c+b^3a-b^3c-a^2b-ab^2-abc}$ **Ans.**

(e) $m^2n(m-n)+mn^2(m+n)=m^3n-m^2n^2+m^2n^2+mn^3$

$=m^3n+mn^3=\mathbf{mn(m^2+n^2)}$ **Ans.**

(f) $xyz(xy^2+yz^2+zx^2)=xyz\times xy^2+xyz\times yz^2+xyz\times zx^2$

$=\mathbf{x^2y^3z+xy^2z^3+x^3yz^2}$ **Ans.**

7. $\left(\frac{1}{4}ab^2\right)\left(\frac{2}{3}a^3b^2-\frac{1}{2}a^2b^3\right)$

$=\frac{1}{4}ab^2\times\frac{2}{3}a^3b^2-\frac{1}{4}ab^2\times\frac{1}{2}a^2b^3$

$$= \frac{1}{4} \times \frac{2}{3} \times ab^2 \times a^3 b^2 - \frac{1}{4} \times \frac{1}{2} \times ab^2 \times a^2 b^3$$

$$= \frac{1}{6} a^{1+3} \times b^{2+2} - \frac{1}{8} a^{1+2} \times b^{2+3} = \mathbf{\frac{1}{6} a^4 b^4 - \frac{1}{8} a^3 b^5}$$ **Ans.**

Now, **L.H.S.** $= \left(\frac{1}{4} ab^2\right)\left(\frac{2}{3} a^3 b^2 - \frac{1}{2} a^2 b^3\right)$

Putting the value of $a = 2$ and $b = -2$

L.H.S. $= \left[\frac{1}{4} \times 2 \times (-2)^2\right]\left[\frac{2}{3} \times (2)^3 \times (-2)^2 - \frac{1}{2} \times (2)^2 \times (-2)^3\right]$

$$= \left[\frac{1}{4} \times 2 \times 4\right]\left[\frac{2}{3} \times 8 \times 4 - \frac{1}{2} \times 4 \times (-8)\right]$$

$$= (2)\left[\frac{64}{3} + 16\right] = 2\left[\frac{64 + 48}{3}\right] = 2\left(\frac{112}{3}\right)$$

$$= 2 \times \frac{112}{3} = \frac{224}{3} = 74\frac{2}{3}$$

R.H.S. $= \frac{1}{6} a^4 b^4 - \frac{1}{8} a^3 b^5 = \frac{1}{6} \times (2)^4 \times (-2)^4 - \frac{1}{8} \times (2)^3 \times (-2)^5$

$$= \frac{1}{6} \times 16 \times 16 - \frac{1}{8} \times 8 \times (-32) = \frac{128}{3} + 32 = \frac{128 + 96}{3} = \frac{224}{3} = 74\frac{2}{3}$$

Thus, **L.H.S. = R.H.S. and the product is verified.** **Proved**

8. $\left(\frac{-1}{3} x^3 y^2\right)\left(-\frac{1}{2} x^2 - \frac{1}{2} y^2\right)$

$$= -\frac{1}{3} x^3 y^2 \times \frac{-1}{2} x^2 - \frac{1}{3} x^3 y^2 \times \left(-\frac{1}{2} y^2\right)$$

$$= -\frac{1}{3} \times \frac{-1}{2} \times x^3 y^2 \times x^2 - \frac{1}{3} \times \frac{-1}{2} x^3 y^2 \times y^2$$

$$= \frac{1}{6} x^{3+2} \times y^2 + \frac{1}{6} x^3 \times y^{2+2} = \mathbf{\frac{1}{6} x^5 y^2 + \frac{1}{6} x^3 y^4}$$ **Ans.**

Now, L.H.S. $= \left(-\frac{1}{3} x^3 y^2\right)\left(-\frac{1}{2} x^2 - \frac{1}{2} y^2\right)$

Putting the value of $x = 1$ and $y = 2$

L.H.S. $= \left[-\frac{1}{3}(1)^3 \times (2)^2\right]\left[-\frac{1}{2}(1)^2 - \frac{1}{2}(2)^2\right]$

$$= \left[-\frac{1}{3}\times 1\times 4\right]\left[-\frac{1}{2}\times 1-\frac{1}{2}\times 4\right] = \left(-\frac{4}{3}\right)\left[-\frac{1}{2}-\frac{1}{2}\times 4\right]$$

$$= \left(-\frac{4}{3}\right)\left(-\frac{1}{2}-2\right) = -\frac{4}{3}\times\left(\frac{-1-4}{2}\right) = \frac{-4}{3}\times\frac{-5}{2} = \frac{10}{3} = 3\frac{1}{3}$$

R.H.S. $= \frac{1}{6}\times(1)^5\times(2)^2 + \frac{1}{6}(1)^3\times(2)^4 = \frac{1}{6}\times 1\times 4 + \frac{1}{6}\times 1\times 16$

$$= \frac{2}{3}+\frac{8}{3} = \frac{2+8}{3} = \frac{10}{3} = 3\frac{1}{3}$$

Thus, **L.H.S. = R.H.S., and the product is verified.** **Proved**

9. $x^4(-4x^3 - x^2 + 3) = x^4\times -4x^3 - x^4\times x^2 + x^4\times 3$

$$= -4x^{4+3} - x^{4+2} + 3x^4 = \mathbf{-4x^7 - x^6 + 3x^4}$$ **Ans.**

Now, putting the value of $x = -2$

$$= -4(2)^7 - (2)^6 + 3(2)^4$$

$$= -4\times 128 - 64 + 3\times 16 = -512 - 64 + 48$$

$$= -576 + 48 = -528$$

Hence, **the value of product is –528.** **Ans.**

10. $(a^2b)(-a^4 + b^4) = -a^2b\times a^4 + a^2b\times b^4$

$$= -a^6b + a^2b^5$$ **Ans.**

Now, putting the value of $a = 1$, $b = -1$

$$= -(1)^6\times(-1) + (1)^2\times(-1)^5 = 1\times 1 - 1\times 1 = 1 - 1 = 0$$

Hence, **the value of product is 0.** **Ans.**

Exrcise 6.2

1. (a) $(x^2 + 3y^2)(x^2 + xy) = x^2(x^2 + xy) + 3y^2(x^2 + xy)$

$$= x^2\times x^2 + x^2\times xy + 3y^2\times x^2 + 3y^2\times xy$$

$$= \mathbf{x^4 + x^3y + 3x^2y^2 + 3xy^3}$$ **Ans.**

(b) $(a^2 - b)(a^3b + 2b^2) = a^2(a^3b + 2b^2) - b(a^3b + 2b^2)$

$$= a^2\times a^3b + a^2\times 2b^2 - b\times a^3b - b\times 2b^2$$

$$= \mathbf{a^5b + 2a^2b^2 - a^3b^2 - 2b^3}$$ **Ans.**

(c) $(a - b)(a^2 - 3b) = a(a^2 - 3b) - b(a^2 - 3b)$

$$= a\times a^2 - a\times 3b - b\times a^2 + b\times 3b$$

$$= \mathbf{a^3 - 3ab - a^2b + 3b^2}$$ **Ans.**

(d) $(x - 2y^2)(x^3 + y^3 + z^3) = x(x^3 + y^3 + z^3)$

$$-2y^2(x^3 + y^3 + z^3)$$

$= x \times x^3 + x \times y^3 + x \times z^3 - 2y^2 \times x^3 - 2y^2 \times y^3 - 2y^2 \times z^3$

$= \boldsymbol{x^4 + xy^3 + xz^3 - 2x^3y^2 - 2y^5 - 2y^2z^3}$ **Ans.**

(e) $(m^2 - 2n^2)(m^2 - 2n) = m^2(m^2 - 2n) - 2n^2(m^2 - 2n)$

$= m^2 \times m^2 - m^2 \times 2n - 2n^2 \times m^2 + 2n^2 \times 2n$

$= \boldsymbol{m^4 - 2m^2n - 2m^2n^2 + 4n^3}$ **Ans.**

(f) $(a + b)(a^2 + b^2 - ab) = a(a^2 + b^2 - ab) + b(a^2 + b^2 - ab)$

$= a \times a^2 + a \times b^2 - a \times ab + b \times a^2 + b \times b^2 - b \times ab$

$= a^3 + ab^2 - a^2b + a^2b + b^3 - ab^2 = \boldsymbol{a^3 + b^3}$ **Ans.**

(g) $(x^3 - y^4)(x + y^2 - x^2y^2) = x^3(x + y^2 - x^2y^2)$

$-y^4(x + y^2 - x^2y^2)$

$= x^3 \times x + x^3 \times y^2 - x^3 \times x^2y^2 - y^4$

$\times x - y^4 \times y^2 + y^4 \times x^2y^2$

$= \boldsymbol{x^4 + x^3y^2 - x^5y^2 - xy^4 - y^6 + x^2y^6}$ **Ans.**

(h) $(x + y^2 + xy)(x^5 - y^4) = x(x^5 - y^4)$

$+ y^2(x^5 - y^4) + xy(x^5 - y^4)$

$= x \times x^5 - x \times y^4 + y^2 \times x^5 - y^2 \times y^4 + xy \times x^5 - xy \times y^4$

$= \boldsymbol{x^6 - xy^4 + x^5y^2 - y^6 + x^6y - xy^5}$ **Ans.**

(i) $(a + b)(a - b) = a(a - b) + b(a - b)$

$= a \times a - a \times b + b \times a - b \times b$

$= a^2 - ab + ab - b^2 = \boldsymbol{a^2 - b^2}$ **Ans.**

2. (a) $(4x + 6y)(4x + 6y) = (4x + 6y)^2$

$= (4x)^2 + 2 \times 4x \times 6y + (6y)^2$ **[Using $(a + b)^2 = a^2 + 2ab + b^2$]**

$= \boldsymbol{16x^2 + 48xy + 36y^2}$ **Ans.**

(b) $(2m + 4n)(2m + 4n) = (2m + 4n)^2$

$= (2m)^2 + 2 \times 2m \times 4n + (4n)^2$ **[Using $(a + b)^2 = a^2 + 2ab + b^2$]**

$= \boldsymbol{4m^2 + 16mn + 16n^2}$ **Ans.**

(c) $\left(\frac{1}{4}a^2 + \frac{3}{2}b\right)\left(\frac{1}{4}a^2 + \frac{3}{2}b\right) = \left(\frac{1}{4}a^2 + \frac{3}{2}b\right)^2$

$= \left(\frac{1}{4}a^2\right)^2 + 2 \times \frac{1}{4}a^2 \times \frac{3}{2}b + \left(\frac{3}{2}b\right)^2$

$= \boldsymbol{\frac{1}{16}a^4 + \frac{3}{4}a^2b + \frac{9}{4}b^2}$ **Ans.**

(d) $\left(2p-\frac{1}{2}q^2\right)\left(2p-\frac{1}{2}q^2\right)=\left(2p-\frac{1}{2}q^2\right)^2$

$=(2p)^2-2\times 2p\times\frac{1}{2}q^2+\left(\frac{1}{2}q^2\right)^2$

[Using $(a-b)^2=a^2-2ab+b^2$]

$=\mathbf{4p^2-2pq^2+\frac{1}{4}q^4}$ **Ans.**

(e) $\left(\frac{1}{5}m+3n^2\right)\left(\frac{1}{5}m-3n^2\right)=\left(\frac{1}{5}m\right)^2-(3n^2)^2$

[Using $(a+b)(a-b)=a^2-b^2$]

$=\mathbf{\frac{1}{25}m^2-9n^4}$ **Ans.**

(f) $\left(\frac{4}{3}a-3b^2\right)\left(\frac{4}{3}a+3b^2\right)=\left(\frac{4}{3}a\right)^2-(3b^2)^2$

[Using $(a-b)(a+b)=a^2-b^2$]

$=\mathbf{\frac{16}{9}a^2-9b^4}$ **Ans.**

(g) $\left(a^3b^3-\frac{1}{a^3b^3}\right)\left(a^3b^3+\frac{1}{a^3b^3}\right)\left(a^6b^6+\frac{1}{a^6b^6}\right)$

$=\left[(a^3b^3)^2-\left(\frac{1}{a^3b^3}\right)^2\right]\left(a^6b^6+\frac{1}{a^6b^6}\right)$

[Using $(a-b)(a+b)=a^2-b^2$]

$=\left(a^6b^6-\frac{1}{a^6b^6}\right)\left(a^6b^6+\frac{1}{a^6b^6}\right)$

$=(a^6b^6)^2-\left(\frac{1}{a^6b^6}\right)^2$

$=\mathbf{a^{12}b^{12}-\frac{1}{a^{12}b^{12}}}$ **Ans.**

(h) $\left(x^2-\frac{1}{y^2}\right)\left(x^2+\frac{1}{y^2}\right)\left(x^4+\frac{1}{y^4}\right)$

$=\left[(x^2)^2-\left(\frac{1}{y^2}\right)^2\right]\left(x^4+\frac{1}{y^4}\right)$ **[Using $(a-b)(a+b)=a^2-b^2$]**

$=\left(x^4-\frac{1}{y^4}\right)\left(x^4+\frac{1}{y^4}\right)=(x^4)^2-\left(\frac{1}{y^4}\right)^2=\boldsymbol{x^8-\frac{1}{y^8}}$ **Ans.**

3. (a) $(6m-3n)^2=(6m)^2-2(6m)(3n)+(3n)^2$

[Using $(a-b)^2=a^2-2ab+b^2$]

$=\boldsymbol{36m^2-36mn+9n^2}$ **Ans.**

(b) $\left(4a+\frac{2b}{3}\right)^2=(4a)^2+2(4a)\left(\frac{2b}{3}\right)+\left(\frac{2b}{3}\right)^2$

[Using $(a+b)^2=a^2+2ab+b^2$]

$=\boldsymbol{16a^2+\frac{16}{3}ab+\frac{4b^2}{9}}$ **Ans.**

(c) $\left(\frac{1}{4}m-\frac{5}{2}n\right)^2=\left(\frac{1}{4}m\right)^2-2\left(\frac{1}{4}m\right)\left(\frac{5}{2}n\right)+\left(\frac{5}{2}n\right)^2$

[Using $(a-b)^2=a^2-2ab+b^2$]

$=\boldsymbol{\frac{1}{16}m^2-\frac{5}{4}mn+\frac{25}{4}n^2}$ **Ans.**

(d) $\left(6a^2+\frac{2}{5}b^2\right)^2=(6a^2)^2+2\cdot(6a^2)\cdot\left(\frac{2}{5}b^2\right)+\left(\frac{2}{5}b^2\right)^2$

[Using $(a+b)^2=a^2+2ab+b^2$]

$=\boldsymbol{36a^4+\frac{24}{5}a^2b^2+\frac{4}{25}b^4}$ **Ans.**

(e) $(9xyz-2abc)^2=(9xyz)^2-2\cdot(9xyz)\cdot(2abc)+(2abc)^2$

[Using $(a-b)^2=a^2-2ab+b^2$]

$=\boldsymbol{81x^2y^2z^2-36xyz\,abc+4a^2b^2c^2}$ **Ans.**

(f) $\left(2x^2+\frac{1}{x^2}\right)^2=(2x^2)^2+2\cdot(2x^2)\cdot\left(\frac{1}{x^2}\right)+\left(\frac{1}{x^2}\right)^2$

[Using $(a+b)^2=a^2+2ab+b^2$]

$= \mathbf{4x^4 + 4 + \frac{1}{x^4}}$ **Ans.**

(g) $\left(6a^3 - \frac{1}{6b^3}\right)^2 = (6a^3)^2 - 2(6a^3)\left(\frac{1}{6b^3}\right) + \left(\frac{1}{6b^3}\right)^2$

[Using $(a-b)^2 = a^2 - 2ab + b^2$]

$= \mathbf{36a^6 - \frac{2a^3}{b^3} + \frac{1}{36b^6}}$ **Ans.**

(h) $\left(\frac{2}{a} - \frac{2}{b}\right)^2 = \left(\frac{2}{a}\right)^2 - 2\left(\frac{2}{a}\right)\cdot\left(\frac{2}{b}\right) + \left(\frac{2}{b}\right)^2$

[Using $(a-b)^2 = a^2 - 2ab + b^2$]

$= \mathbf{\frac{4}{a^2} - \frac{8}{ab} + \frac{4}{b^2}}$ **Ans.**

4. (a) $(105)^2 = (100+5)^2 = (100)^2 + 2\times100\times5 + (5)^2$

[Using $(a+b)^2 = a^2 + 2ab + b^2$]

$= 10000 + 1000 + 25 = \mathbf{11025}$ **Ans.**

(b) $(185)^2 = (200-15)^2 = (200)^2 - 2\times200\times15 + (15)^2$

[Using $(a-b)^2 = a^2 - 2ab + b^2$]

$= 40000 - 6000 + 225 = 40225 - 6000 = \mathbf{34225}$ **Ans.**

(c) $(867)^2 = (900-33)^2 = (900)^2 - 2\times900\times33 + (33)^2$

[Using $(a-b)^2 = a^2 - 2ab + b^2$]

$= 810000 - 59400 + 1089 = 811089 - 59400 = \mathbf{751689}$ **Ans.**

(d) $(1001)^2 = (1000+1)^2 = (1000)^2 + 2\times1000\times1 + (1)^2$

[Using $(a+b)^2 = a^2 + 2ab + b^2$]

$= 1000000 + 2000 + 1 = \mathbf{1002001}$ **Ans.**

(e) $(402)^2 = (400+2)^2 = (400)^2 + 2\times400\times2 + (2)^2$

[Using $(a+b)^2 = a^2 + 2ab + b^2$]

$= 160000 + 1600 + 4 = \mathbf{161604}$ **Ans.**

(f) $(560)^2 = (500+60)^2 = (500)^2 + 2\times500\times60 + (60)^2$

[Using $(a+b)^2 = a^2 + 2ab + b^2$]

$= 250000 + 60000 + 3600 = \mathbf{313600}$ **Ans.**

(g) $(310)^2 = (300+10)^2 = (300)^2 + 2\times300\times10 + (10)^2$

$$[\text{Using } (a+b)^2 = a^2 + 2ab + b^2]$$

$= 90000 + 6000 + 100 = \mathbf{96100}$ **Ans.**

(h) $(799)^2 = (800-1)^2 = (800)^2 - 2\times 800\times 1 + (1)^2$

$$[\text{Using } (a-b)^2 = a^2 - 2ab + b^2]$$

$= 640000 - 1600 + 1 = 640001 - 1600 = \mathbf{638401}$ **Ans.**

5. (a) $120\times 80 = (100+20)(100-20) = (100)^2 - (20)^2$

$$[\text{Using } (a+b)(a-b) = a^2 - b^2]$$

$= 10000 - 400 = \mathbf{9600}$ **Ans.**

(b) $610\times 590 = (600+10)(600-10) = (600)^2 - (10)^2$

$$[\text{Using } (a+b)(a-b) = a^2 - b^2]$$

$= 360000 - 100 = \mathbf{359900}$ **Ans.**

(c) $6.4\times 6.4 = (6+0.4)(6+0.4) = (6+0.4)^2$

$= (6)^2 + 2\times 6\times 0.4 + (0.4)^2$ $[\text{Using } (a+b)^2 = a^2 + 2ab + b^2]$

$= 36 + 4.8 + 0.16 = \mathbf{40.96}$ **Ans.**

(d) $99\times 101 = (100-1)(100+1)$

$= (100)^2 - (1)^2$ $[\text{Using } (a+b)(a-b) = a^2 - b^2]$

$= 10000 - 1 = \mathbf{9999}$ **Ans.**

(e) $1100\times 900 = (1000+100)(1000-100)$

$= (1000)^2 - (100)^2$ $[\text{Using } (a+b)(a-b) = a^2 - b^2]$

$= 1000000 - 10000 = \mathbf{990000}$ **Ans.**

(f) $46\times 46 = (50-4)(50-4) = (50-4)^2$

$= (50)^2 - 2\times 50\times 4 + (4)^2$ $[\text{Using } (a-b)^2 = a^2 - 2ab + b^2]$

$= 2500 - 400 + 16 = 2516 - 400 = \mathbf{2116}$ **Ans.**

(g) $215\times 215 = (200+15)(200+15) = (200+15)^2$

$= (200)^2 + 2\times 200\times 15 + (15)^2$ $[\text{Using } (a+b)^2 = a^2 + 2ab + b^2]$

$= 40000 + 6000 + 225 = \mathbf{46225}$ **Ans.**

(h) $524\times 476 = (500+24)(500-24) = (500)^2 - (24)^2$

$$[\text{Using } (a+b)(a-b) = a^2 - b^2]$$

$= 250000 - 476 = \mathbf{249524}$ **Ans.**

6. (a) $\dfrac{131\times 131 - 41\times 41}{90} = \dfrac{(131)^2 - (41)^2}{90} = \dfrac{(131+41)(131-41)}{90}$

$$[\text{Using } a^2 - b^2 = (a+b)(a-b)]$$

$$= \frac{172 \times 90}{90} = \mathbf{172}$$ **Ans.**

(b) $\dfrac{225 \times 225 - 25 \times 25}{250} = \dfrac{(225)^2 - (25)^2}{250} = \dfrac{(225+25)(225-25)}{250}$

[Using $a^2 - b^2 = (a+b)(a-b)$]

$$= \frac{250 \times 200}{250} = \mathbf{200}$$ **Ans.**

(c) $\dfrac{4.1 \times 4.1 - 2.7 \times 2.7}{6.8} = \dfrac{(4.1)^2 - (2.7)^2}{6.8} = \dfrac{(4.1+2.7)(4.1-2.7)}{6.8}$

[Using $a^2 - b^2 = (a+b)(a-b)$]

$$= \frac{6.8 \times 1.4}{6.8} = \mathbf{1.4}$$ **Ans.**

(d) $\dfrac{6.5 \times 6.5 - 2.5 \times 2.5}{4.0} = \dfrac{(6.5)^2 - (2.5)^2}{4.0} = \dfrac{(6.5+2.5)(6.5-2.5)}{4.0}$

[Using $a^2 - b^2 = (a+b)(a-b)$]

$$= \frac{9 \times 4}{4} = \mathbf{9}$$ **Ans.**

(e) $\dfrac{0.006 \times 0.006 - 0.001 \times 0.001}{0.07} = \dfrac{(0.006)^2 - (0.001)^2}{0.07}$

$= \dfrac{(0.006+0.001)(0.006-0.001)}{0.07} = \dfrac{0.007 \times 0.005}{0.07} = \mathbf{0.0005}$ **Ans.**

7. $\because x + \dfrac{1}{x} = 9 \qquad \therefore \left(x + \dfrac{1}{x}\right)^2 = (9)^2$ [Squaring both sides]

$\Rightarrow \qquad x^2 + 2 \times x \times \dfrac{1}{x} + \dfrac{1}{x^2} = 81$

or $x^2 + 2 + \dfrac{1}{x^2} = 81$ or $x^2 + \dfrac{1}{x^2} = 81 - 2$ or $x^2 + \dfrac{1}{x^2} = \mathbf{79}$ **Ans.**

8. $\because x - \dfrac{1}{x} = 5 \qquad \therefore \left(x - \dfrac{1}{x}\right)^2 = (5)^2$ [Squaring both sides]

or $x^2 - 2 \times x \times \dfrac{1}{x} + \dfrac{1}{x^2} = 25$ or $x^2 - 2 + \dfrac{1}{x^2} = 25$

or $x^2 + \dfrac{1}{x^2} = 25 + 2$ or $x^2 + \dfrac{1}{x^2} = \mathbf{27}$

Ans.

9. $\because x+\frac{1}{x}=4 \qquad \therefore\left(x+\frac{1}{x}\right)^2=(4)^2$ [Squaring both sides]

or $x^2+2\times x\times\frac{1}{x}+\frac{1}{x^2}=16 \qquad [\because (a+b)^2=a^2+2ab+b^2]$

or $x^2+2+\frac{1}{x^2}=16 \quad$ or $x^2+\frac{1}{x^2}=16-2$

$$x^2+\frac{1}{x^2}=14$$

Again, squaring both sides

$$\left(x^2+\frac{1}{x^2}\right)^2=(14)^2\Rightarrow x^4+2\times x^2\times\frac{1}{x^2}+\frac{1}{x^4}=196$$

$\Rightarrow x^4+2+\frac{1}{x^4}=196\Rightarrow x^4+\frac{1}{x^4}=196-2 \quad$ or $x^4+\frac{1}{x^4}=\mathbf{194}$ **Ans.**

10. $a^2-\frac{1}{a^2}=(a)^2-\left(\frac{1}{a}\right)^2=\left(a+\frac{1}{a}\right)\left(a-\frac{1}{a}\right)$

$=3\times 2 \qquad [\because a+\frac{1}{a}=3 \text{ and } a-\frac{1}{a}=2]$

$=\mathbf{6}$ **Ans.**

11. (a) $(15)^2-(5)^2=5x$

or $(15+5)(15-5)=5x \quad [\because \text{Using } a^2-b^2=(a+b)(a-b)]$

or $20\times 10=5x \qquad$ or $x=\frac{20\times 10}{5}$

$\therefore \quad \boldsymbol{x=40}$ **Ans.**

(b) $(18+17)(18-17)=5x$

or $18^2-17^2=5x \qquad [\text{Using } (a+b)(a-b)=a^2-b^2]$

or $324-289=5x \qquad$ or $35=5x$

$\therefore \quad x=\frac{35}{5}\Rightarrow \boldsymbol{x=7}$

Ans.

(c) $(65)^2-(25)^2=2x$ or $(65+25)(65-25)=2x$

or $90\times 40=2x \qquad$ or $x=\frac{90\times 40}{2}$

$\therefore \quad \boldsymbol{x=1800}$ **Ans.**

12. (a) $\left(a^2-\frac{1}{b^2}\right)\left(a^2+\frac{1}{b^2}\right)\left(a^4+\frac{1}{b^4}\right)$

$=\left(a^4-\frac{1}{b^4}\right)\left(a^4+\frac{1}{b^4}\right)$ **[Using $(a-b)(a+b)=a^2-b^2$]**

$=(a^4)^2-\left(\frac{1}{b^4}\right)^2=\boldsymbol{a^8-\frac{1}{b^8}}$ **Ans.**

(b) $(m-n)(m+n)(m^2+n^2)=(m^2-n^2)(m^2+n^2)$

[Using $(a-b)(a+b)=a^2-b^2$]

$=(m^2)^2-(n^2)^2=\boldsymbol{m^4-n^4}$ **Ans.**

(c) $(9x-y)(9x+y)(81x^2+y^2)=[(9x)^2-(y)^2][81x^2+y^2]$

[Using $(a-b)(a+b)=a^2-b^2$]

$=(81x^2-y^2)(81x^2+y^2)=(81x^2)^2-(y^2)^2=\boldsymbol{6561x^4-y^4}$ **Ans.**

(d) $(m-1)(m+1)(m^2+1)(m^4+1)=(m^2-1)(m^2+1)(m^4+1)$

$=[(m^2)^2-1^2](m^4+1)=(m^4-1)(m^4+1)$

$=(m^4)^2-(1)^2=\boldsymbol{m^8-1}$ **Ans.**

13. (a) $(3x+\boldsymbol{3y})^2=9x^2+18xy+9y^2$ **Ans.**

(b) $(2m-\boldsymbol{3n})^2=4m^2-12mn+9n^2$ **Ans.**

(c) $\left(\frac{1}{2}a+\frac{1}{2}b\right)\left(\frac{1}{2}a-\frac{1}{2}b\right)=\frac{1}{4}a^2-\boldsymbol{\frac{1}{4}b^2}$ **Ans.**

(d) $(206)^2=(200+6)^2=40000+2400+36=\boldsymbol{42436}$ **Ans.**

Exercise 6.3

1. (a) The factors are 1, 3, 5, 15, x, $3x$, $5x$, $15x$, xy, $3xy$, $5xy$, $15xy$, xy^2, $3xy^2$, $5xy^2$, y, y^2, $15xy^2$ **Ans.**

(b) The factors are 1, 2, 3, 6, x, $2x$, $3x$, $6x$, x^2, $2x^2$, $3x^2$, $6x^2$ **Ans.**

(c) The factors are 1, 2, 5, 10, x, $2x$, $5x$, $10x$, xy, $2xy$, $5xy$, $10xy$, xyz, $2xyz$, $5xyz$, $10xyz$, xyz^2, $2xyz^2$, $5xyz^2$, $10xyz^2$ **Ans.**

2. (a) $12x^2y^2=2^2\times3\times x^2\times y^2$, $9x^3y^3=3^2\times x^3\times y^3$

and $18x^2y^4=2\times3^2\times x^2\times y^4$

$\therefore$ Greatest common factor $=3\times x^2\times y^2=\boldsymbol{3x^2y^2}$ **Ans.**

(b) $25ab^2c=5^2\times a\times b^2\times c$

$40ab^3c^2 = 2^3 \times 5 \times a \times b^3 \times c^2$

and $10a^2bc^2 = 2 \times 5 \times a^2 \times b \times c^2$

$\therefore$ Greatest common factor $= 5 \times a \times b \times c = \mathbf{5abc}$ **Ans.**

(c) $24x^4y^4 = 3 \times 2^3 \times x^4 \times y^4$; $20x^5y^3 = 5 \times 2^2 \times x^5 \times y^3$

and $8x^2y^2 = 2^3 \times x^2 \times y^2$

$\therefore$ Greatest common factor $= 2^2 \times x^2 \times y^2 = \mathbf{4x^2y^2}$ **Ans.**

(d) $14p^2q^2 = 2 \times 7 \times p^2 \times q^2$; $35p^3q^2 = 5 \times 7 \times p^3 \times q^2$

and $21p^3q^2 = 3 \times 7 \times p^3 \times q^2$

$\therefore$ Greatest common factor $= 7 \times p^2 \times q^2 = \mathbf{7p^2q^2}$ **Ans.**

(e) $15m^3x^4 = 3 \times 5 \times m^3 \times n^4$; $18m^2n^2 = 3^2 \times 2 \times m^2 \times n^2$

and $21mn^2 = 3 \times 7 \times m \times n^2$

$\therefore$ Greatest common factor $= 3 \times m \times n^2 = \mathbf{3mn^2}$ **Ans.**

(f) $2a^3b^2 = 2 \times a^3 \times b^2$; $9a^2b = 3^2 \times a^2 \times b$

and $ab^2 = a \times b^2$

$\therefore$ Greatest common factor $= a \times b = \mathbf{ab}$ **Ans.**

(g) $11ab^2c^3 = 11 \times a \times b^2 \times c^3$; $13a^2b^2c = 13 \times a^2 \times b^2 \times c$

$17a^2bc = 17 \times a^2 \times b \times c$

$\therefore$ Greatest common factor $= a \times b \times c = \mathbf{abc}$ **Ans.**

(h) $2x^4 = 2 \times x^4$; $4t^4 = 2^2 \times t^4$

and $6z^4 = 3 \times 2 \times z^4$

$\therefore$ Greatest common factor $= \mathbf{2}$ **Ans.**

3. (a) Here, greatest common factor is $4x$.

$\therefore$ $16x - 4x^2 = 4x(4 - x)$

Thus, **factorized form is $\mathbf{4x(4-x)}$.** **Ans.**

(b) Here, greatest common factor is $3y^3$.

$\therefore$ $9y^4 + 6y^3 = 3y^3(3y + 2)$

Thus, **factorized form is $\mathbf{3y^3(3y+2)}$.** **Ans.**

(c) Here, greatest common factor is $4y^2x$.

$\therefore$ $12y^2x + 4x^2y^2 = 4y^2x(3 + x)$

Thus, **factorized form is $\mathbf{4y^2x(3+x)}$.** **Ans.**

(d) Here, greatest common factor is $14xy$.

$\therefore \quad 42x^2y^3 - 14xy + 28x^2y^2 = \mathbf{14xy(3xy^2 - 1 + 2xy)}$

Thus, factorized form is $\mathbf{14xy(3xy^2 - 1 + 2xy)}$. **Ans.**

(e) Here, greatest common factor is a^2.

$\therefore \quad a^6 + a^3b + a^2b^2 = a^2(a^4 + ab + b^2)$

Thus, factorized form is $\mathbf{a^2(a^4 + ab + b^2)}$. **Ans.**

(f) Here, greatest common factor is y^3.

$\therefore \quad y^7 - y^5 - y^3 = y^3(y^4 - y^2 - 1)$

Thus, **factorized form is** $\mathbf{y^3(y^4 - y^2 - 1)}$. **Ans.**

(g) Here, greatest common factor is abc^2.

$\therefore \quad ab^2c^3 - a^2bc^2 = abc^2(bc - a)$

Thus, **factorized form is** $\mathbf{abc^2(bc - a)}$. **Ans.**

(h) Here, greatest common factor is $2ay^2$.

$\therefore \quad 2ay^2 - 6a^2y^2 = 2ay^2(1 - 3a)$

Thus, **factorized form is** $\mathbf{2ay^2(1 - 3a)}$. **Ans.**

4. (a) Here, $(a^2 + b^2)$ is common to both the terms, therefore

$l^2(a^2 + b^2) - m^2(a^2 + b^2) = (a^2 + b^2)(l^2 - m^2)$

$= (a^2 + b^2)(l + m)(l - m) \quad [\because a^2 - b^2 = (a + b)(a - b)]$

Thus,

$\mathbf{l^2(a^2 + b^2) - m^2(a^2 + b^2) = (a^2 + b^2)(l + m)(l - m)}$

Ans.

(b) Here, $(a^2 - 3)$ is common to both the terms, therefore

$x(a^2 - 3) - y(a^2 - 3) = (a^2 - 3)(x - y)$

Thus, $\mathbf{x(a^2 - 3) - y(a^2 - 3) = (a^2 - 3)(x - y)}$ **Ans.**

(c) Here, $(a + b - c)$ is common to both the terms, therefore

$z^2(a + b - c) - y^2(a + b - c) = (a + b - c)(z^2 - y^2)$

$= (a + b - c)(z + y)(z - y) \quad [\because a^2 - b^2 = (a + b)(a - b)]$

Thus, $z^2(a + b - c) - y^2(a + b - c)$

$= \mathbf{(a + b - c)(z + y)(z - y)}$ **Ans.**

(d) Here, $(l^2 - m^3)$ is common to both the terms, therefore

$a^2(l^2 - m^3) - b^2(l^2 - m^3) = (l^2 - m^3)(a^2 - b^2)$

$= (l^2 - m^3)(a + b)(a - b) \quad [\because a^2 - b^2 = (a + b)(a - b)]$

Thus, $\mathbf{a^2(l^2 - m^3) - b^2(l^2 - m^3) = (l^2 - m^3)(a + b)(a - b)}$

Ans.

5. (a) Here, we arrange the terms in suitable groups such that each group has common factor.

Thus, rewriting the expression

$am + yn + ym + an = am + an + ym + yn$

$= a(m+n) + y(m+n)$ [Taking common factor]

$= (m+n)(a+y)$ [Taking $(m+n)$ common]

Thus, $\boldsymbol{am + yn + ym + an = (m+n)(a+y)}$ **Ans.**

(b) $x^2 - yx^2 - ya + y^2a = x^2(1-y) - ya(1-y)$

[Taking common factor]

$= (1-y)(x^2 - ya)$ [Taking $(1-y)$ common]

Thus, $\boldsymbol{x^2 - yx^2 - ya + y^2a = (1-y)(x^2 - ya)}$ **Ans.**

(c) Here, we arrange the terms in suitable groups such that each group has common factor.

Thus, rewriting the expression,

$ax^2 + by^2 + bx^2 + ay^2 = ax^2 + bx^2 + ay^2 + by^2$

$= x^2(a+b) + y^2(a+b)$ [Taking common factor]

$= (a+b)(x^2 + y^2)$ [Taking $(a+b)$ common]

Thus, $\boldsymbol{ax^2 + by^2 + bx^2 + ay^2 = (a+b)(x^2 + y^2)}$ **Ans.**

(d) $9m^2 + 9n^2 - xm^2 - xn^2 = 9(m^2 + n^2) - x(m^2 + n^2)$

[Taking common factor]

$= (m^2 + n^2)(9-x)$ [Taking $(m^2 + n^2)$ common]

Thus, $\boldsymbol{9m^2 + 9n^2 - xm^2 - xn^2 = (m^2 + n^2)(9-x)}$ **Ans.**

6. (a) $625m^2 - 256n^2 = (25m)^2 - (16n)^2$

$= (25m + 16n)(25m - 16n)$ **[Using $a^2 - b^2 = (a+b)(a-b)$]**

Thus, $\boldsymbol{625m^2 - 256n^2 = (25m + 16n)(25m - 16n)}$ **Ans.**

(b) $16a^4 - 9b^4 = (4a^2)^2 - (3b^2)^2$

$= (4a^2 + 3b^2)(4a^2 - 3b^2)$ **[Using $a^2 - b^2 = (a+b)(a-b)$]**

Thus, $\boldsymbol{16a^4 - 9b^4 = (4a^2 + 3b^2)(4a^2 - 3b^2)}$ **Ans.**

(c) $m^4 - 16 = (m^2)^2 - (4)^2 = (m^2 + 4)(m^2 - 4)$

[Using $a^2 - b^2 = (a+b)(a-b)$]

$= (m^2 + 4)[(m)^2 - (2)^2] = (m^2 + 4)(m+2)(m-2)$

Thus, $\boldsymbol{m^4 - 16 = (m^2 + 4)(m + 2)(m - 2)}$ **Ans.**

(d) $144(a-b)^2 - 256(a-b)^2 = (a-b)^2(144-256)$

$= (a-b)^2[(12)^2 - (16)^2]$ [Taking $(a-b)^2$ common]

$= (a-b)(a-b)[(12+16)(12-16)]$

$= -(a-b)(a-b)(28 \times 4) = -112(a-b)(a-b)$

Thus, $\boldsymbol{144(a-b)^2 - 256(a-b)^2 = -112(a-b)(a-b)}$ **Ans.**

(e) $m^6 - \frac{1}{m^6} = (m^3)^2 - \left(\frac{1}{m^3}\right)^2 = \left(m^3 + \frac{1}{m^3}\right)\left(m^3 - \frac{1}{m^3}\right)$

[Using $a^2 - b^2 = (a+b)(a-b)$]

$= \left(m + \frac{1}{m}\right)\left(m^2 + \frac{1}{m^2} - m^2 \times \frac{1}{m^2}\right)$

$\left(m - \frac{1}{m}\right)\left(m^2 + \frac{1}{m^2} + m^2 \times \frac{1}{m^2}\right)$

$= \left(\boldsymbol{m + \frac{1}{m}}\right)\left(\boldsymbol{m - \frac{1}{m}}\right)\left(\boldsymbol{m^2 + \frac{1}{m^2} - 1}\right)\left(\boldsymbol{m^2 + \frac{1}{m^2} + 1}\right)$ **Ans.**

(f) $8a^6 - b^6 = (2a^2)^3 - (b^2)^3 = (2a^2 - b^2)$

$[(2a^2)^2 + 2a^2 \times b^2 + (b^2)^2]$

$\boldsymbol{= (2a^2 - b^{2)}(4a^4 + 2a^2b^2 + b^4)}$ **Ans.**

(g) $x^4 - y^4 + (x+y)(x^2+y^2)$

$= (x^2)^2 - (y^2)^2 + (x+y)(x^2+y^2)$

$= (x^2+y^2)(x^2-y^2) + (x+y)(x^2+y^2)$

$= (x^2+y^2)(x+y)(x-y) + (x+y)(x^2+y^2)$

$\boldsymbol{= (x^2+y^2)(x+y)(x-y+1)}$ **Ans.**

(h) $(4m^2 - 4mn + n^2) - y^2 = [(2m)^2 - 2 \times 2m \times n + (n)^2] - (y)^2$

$= (2m-n)^2 - (y)^2$ **[Using $a^2 - 2ab + b^2 = (a-b)^2$]**

$\boldsymbol{= (2m - n + y)(2m - n - y)}$ **Ans.**

(i) $x^4 - 9 = (x^2)^2 - (3)^2 = (x^2+3)(x^2-3)$

[Using $a^2 - b^2 = (a-b)(a+b)$]

Thus, $\boldsymbol{x^4 - 9 = (x^2+3)(x^2-3)}$ **Ans.**

7. (a) $49x^2 - 112xy + 64y^2 = (7x)^2 - 2 \times 7x \times 8y + (8y)^2$

$= (7x - 8y)^2$ **[$\because (a-b)^2 = a^2 - 2ab + b^2$]**

Thus, $\boldsymbol{49x^2 - 112xy + 64y^2 = (7x - 8y)^2}$ **Ans.**

(b) $4m^2 - 16mn + 16n^2 = (2m)^2 - 2 \times 2m \times 4n + (4n)^2$

$= (2m - 4n)^2$ $[\because (a-b)^2 = a^2 - 2ab + b^2]$

Thus, $\mathbf{4m^2 - 16mn + 16n^2 = (2m - 4n)^2}$ **Ans.**

(c) $25a^2 + 40ab + 16b^2 = (5a)^2 + 2 \times 5a \times 4b + (4b)^2$

$= (5a + 4b)^2$ $[\because (a+b)^2 = a^2 + 2ab + b^2]$

Thus, $\mathbf{25a^2 + 40ab + 16b^2 = (5a + 4b)^2}$ **Ans.**

(d) $4x^2 - 12xy + 9y^2 - 16a^2 = (2x)^2 - 2 \times 2x \times 3y$

$+ (3y)^2 - (4a)^2$

$= (2x - 3y)^2 - (4a)^2$

$= (2x - 3y + 4a)(2x - 3y - 4a)$ $[\because a^2 - b^2 = (a+b)(a-b)]$

Thus,

$\mathbf{4x^2 - 12xy + 9y^2 - 16a^2 = (2x - 3y + 4a)(2x - 3y - 4a)}$

Ans.

(e) $m^4 + 2m^2n^2 + n^4 - p^2 = (m^2)^2 + 2 \times m^2 \times n^2 + (n^2)^2 - (p)^2$

$= (m^2 + n^2)^2 - (p)^2$

$= (m^2 + n^2 + p)(m^2 + n^2 - p)$

[Using $a^2 - b^2 = (a+b)(a-b)$]

Thus, $\mathbf{m^4 + 2m^2n^2 + n^4 - p^2 = (m^2 + n^2 + p)(m^2 + n^2 - p)}$

Ans.

(f) $9x^2 - y^2 - 4yz - 4z^2 = (3x)^2 - (y^2 + 4yz + 4z^2)$

$= (3x)^2 - [(y)^2 + 2 \times y \times 2z + (2z)^2]$

$= (3x)^2 - (y + 2z)^2$

$= (3x + y + 2z)[3x - (y + 2z)]2$ $[\because a^2 - b^2 = (a+b)(a-b)]$

$= (3x + y + 2z)(3x - y - 2z)$

Thus, $\mathbf{9x^2 - y^2 - 4yz - 4z^2 = (3x + y + 2z)(3x - y - 2z)}$ **Ans.**

(g) $x^2 + 18x + 80 = x^2 + 8x + 10x + 80$

$= x(x + 8) + 10(x + 8) = (x + 8)(x + 10)$ **Ans.**

Thus, $\mathbf{x^2 + 18x + 80 = (x + 8)(x + 10)}$ **Ans**

(h) $4m^2 + 12m + 9 = (2m)^2 + 2 \times 2m \times 3 + (3)^2$

$= (2m + 3)^2$ $[\because (a+b)^2 = a^2 + 2ab + b^2]$

Thus, $\mathbf{4m^2 + 12m + 9 = (2m + 3)^2}$ **Ans.**

Multiple Choice Questions

1. (i) $(p+2q-r)\times 3pq = 3pq\times p + 3pq\times 2q - 3pq\times r$

$= 3p^2q + 6pq^2 - 3pqr$

Hence, the answer **(b)** is correct. **Ans.**

(ii) The answer **(b)** is correct. **Ans.**

(iii) $-3x^2 - x + 5 = -3(-2)^2 - (-2) + 5$

$= -3\times 4 + 2 + 5 = -12 + 7 = -5$

Hence, the answer **(b)** is correct. **Ans.**

(iv) $4x^2 - 25 = (2x)^2 - (5)^2 = (2x+5)(2x-5)$

$[\because a^2 - b^2 = (a+b)(a-b)]$

Hence, the answer **(b)** is correct. **Ans.**

(v) The answer **(c)** is correct. **Ans.**

(vi) The answer **(c)** is correct. **Ans.**

(vii) The coefficient of x^2 in the terms $-7x^2y = -7y$

Hence, the answer **(c)** is correct. **Ans.**

(viii) $-1 + x^3 - 2x^2 - 4 = x^3 - 2x^2 - 5$

Hence, the answer **(c)** is correct. **Ans.**

7. Linear Equations In One Variable

Exercise 7.1

1. (a) $-3 - x = -8$

or $-x = -8 + 3$ (Transposing -3 form L.H.S. to R.H.S.)

or $-x = -5$ or $\boldsymbol{x = 5}$ **Ans.**

(b) $3x - 1 = 23$

or $3x = 23 + 1$ (Transposing -1 from L.H.S. to R.H.S.)

or $3x = 24$ or $\frac{3x}{3} = \frac{24}{3}$ (Dividing both sides by 3)

or $\boldsymbol{x = 8}$ **Ans.**

(c) $6x - 16 = 2x$

or $6x - 2x = 16$ (Transposing $2x$ and -16)

or $4x = 16$ or $\frac{4x}{4} = \frac{16}{4}$ (Dividing both sides by 4)

or $\boldsymbol{x = 4}$ **Ans.**

(d) $\frac{1}{3}x - 5 = 2$

or $\frac{1}{3}x = 2 + 5$ (Transposing 5 from L.H.S. of R.H.S.)

or $\frac{1}{3}x = 7$ or $\frac{1}{3}x \times 3 = 7 \times 3$ (Dividing both sides by 3)

or $\boldsymbol{x = 21}$ **Ans.**

(e) $30 - 4x = -34$

or $-4x = -34 - 30$ (Transposing 30 from L.H.S. to R.H.S.)

or $-4x = -64$ or $\frac{-4x}{4} = \frac{-64}{4}$ (Dividing both sides by 4)

$-x = -16$ or $\boldsymbol{x = 16}$ **Ans.**

(f) $-7x - 10 = 3x$

or $-7x - 3x = 10$ (Transposing -10 and $3x$)

or $-10x = 10$ or $\frac{-10x}{10} = \frac{10}{10}$ (Dividing both sides by 10)

or $-x = 1$ or $\boldsymbol{x = -1}$ **Ans.**

(g) $\frac{2}{3}x - \frac{4}{5}x = 4$

Taking L.C.M. of 3 and 5 i.e., 15 and multiply both sides of equation by 15.

$\frac{2}{3}x \times 15 - \frac{4}{5}x \times 15 = 4 \times 15$

or $10x - 12x = 60$

or $-2x = 60$ or $\frac{-2x}{2} = \frac{60}{2}$ (Dividing both sides by 2)

or $-x = 30$ or $\boldsymbol{x = -30}$ **Ans.**

(h) $2x + \frac{3x}{5} = 13$

or $2x \times 5 + \frac{3x}{5} \times 5 = 13 \times 5$ (Multiply both sides are)

or $10x + 3x = 65$ or $13x = 65$

or $\frac{13x}{13} = \frac{65}{13}$ (Dividing both sides by 13)

or $\boldsymbol{x = 5}$ **Ans.**

(i) $\frac{x}{15} + \frac{x}{3} + \frac{x}{5} = 3$

Taking L.C.M. of 15, 3 and 5 i.e., 15 and multiply both sides of equation by 15.

$\Rightarrow \quad \frac{x}{15}\times 15+\frac{x}{3}\times 15+\frac{x}{5}\times 15=3\times 15$

or $\quad x+5x+3x=45 \qquad$ or $9x=45$

or $\quad \frac{9x}{9}=\frac{45}{9} \qquad$ (Dividing both sides by 9)

$\boldsymbol{x=5}$ **Ans.**

(j) $\frac{x}{6}+4=\frac{x}{5}$ or $\frac{x}{6}-\frac{x}{5}=-4 \qquad$ (Transposing 4 and $\frac{x}{5}$)

Taking L.C.M. of 6 and 5 i.e., 30 and multiply both sides of equation by 30.

$\frac{x}{6}\times 30-\frac{x}{5}\times 30=-4\times 30 \qquad$ or $5x-6x=-120$

or $\quad -x=-120 \qquad$ or $\boldsymbol{x=120}$ **Ans.**

(k) $\frac{6x+1}{4}=\frac{7x-3}{3}-2 \qquad$ or $\frac{6x+1}{4}-\frac{7x-3}{3}=-2$

(Transposing $\frac{7x-3}{3}$ from R.H.S. of L.H.S.)

Taking L.C.M. of 4 and 3 i.e., 12 and multiply both sides of equation by 12.

$\left(\frac{6x+1}{4}\right)\times 12-\left(\frac{7x-3}{3}\right)\times 12=-2\times 12$

or $(6x+1)\times 3-(7x-3)\times 4=-24$ or $18x+3-28x+12=-24$

or $\quad -10x+15=-24$

or $\quad -10x=-24-15=-39$ or $-10x=-39$

or $\quad \frac{10x}{10}=\frac{39}{10} \qquad$ (Dividing both sides by 10)

or $\quad x=\frac{39}{10}$ or $\boldsymbol{x=3\frac{9}{10}}$ **Ans.**

(l) $\frac{x-2}{3}-\frac{x-1}{6}=1-x$

Taking L.C.M. of 3 and 6 i.e., 6 and multiply both sides of equation by 6.

$$\left(\frac{x-2}{3}\right)\times 6-\left(\frac{x-1}{6}\right)\times 6=1\times 6-x\times 6$$

or $(x-2)2-x+1=6-6x$ or $2x-4-x+1=6-6x$

or $x-3=6-6x$

or $x+6x=6+3$ (Transposing -3 and $-6x$)

$7x=9$ or $\frac{7x}{7}=\frac{9}{7}$ (Dividing both sides by 7)

or $x=\frac{9}{7}$ or $\boldsymbol{x=1\frac{2}{7}}$ **Ans.**

(m) $\frac{2-x}{6}=\frac{4x+2}{4}-\frac{2x+3}{8}$

Taking L.C.M. of 6, 4 and 8 i.e., 24 and multiply both sides of equation by 24.

$$\left(\frac{2-x}{6}\right)\times 24=\left(\frac{4x+2}{4}\right)\times 24-\left(\frac{2x+3}{8}\right)\times 24$$

or $(2-x)4=(4x+2)6-(2x+3)3$ or $8-4x=24x+12-6x-9$

or $8-4x=18x+3$

or $-4x-18x=3-8$ (Transposing 8 and $18x$)

or $-22x=-5$ or $22x=5$

or $\frac{22x}{22}=\frac{5}{22}$ (Dividing both sides by 22)

$\boldsymbol{x=\frac{5}{22}}$ **Ans.**

(n) $\frac{1}{4}-\frac{1}{6}=\frac{x-3}{12}$

Taking L.C.M. of 4, 6 and 12 i.e., 12 and multiply both sides of equation by 12.

$$\frac{1}{4}\times 12-\frac{1}{6}\times 12=\left(\frac{x-3}{12}\right)\times 12$$

or $3-2=(x-3)$

or $1=x-3$ or $x=1+3$

or $\boldsymbol{x=4}$ **Ans.**

(o) $20-2x-6=6x+18-5x$ or $-2x+14=x+18$

or $-2x-x=18-14$ (Transposing 14 and x)

or $\quad -3x = 4 \text{ or } \dfrac{-3x}{3} = \dfrac{4}{3}$ (Dividing both sides by 3)

or $\quad -x = \dfrac{4}{3} \text{ or } \boldsymbol{x = -1\dfrac{1}{3}}$ **Ans.**

2. (a) $18 - 6x - 6 = 18 - 5x \qquad \text{or } -6x + 12 = 18 - 5x$

or $-6x + 5x = 18 - 12$ (Transposing 12 and $-5x$)

or $-x = 6 \text{ or } x = -6$ **Ans.**

Now, putting the value of $x = -6$

L.H.S. $= 18 - 6x - 6 = 18 - 6 \times (-6) - 6$

$= 18 + 36 - 6 = 54 - 6 = 48$

R.H.S. $= 18 - 5x = 18 - 5 \times (-6) = 18 + 30 = 48$

Thus, **L.H.S. = R.H.S. and verify the answer.** **Proved.**

(b) $5x + 19 = \dfrac{4}{3}x + 24 \text{ or } 5x - \dfrac{4}{3}x = 24 - 19$

(Transposing 19 and $\dfrac{4}{3}x$)

or $\quad 5x - \dfrac{4}{3}x = 5$

or $\quad 5x \times 3 - \dfrac{4}{3}x \times 3 = 5 \times 3$ (Multiply both sides by 3)

or $\quad 15x - 4x = 15 \text{ or } 11x = 15$

or $\quad \dfrac{11x}{11} = \dfrac{15}{11}$ (Divide both sides by 11)

or $\quad x = \dfrac{15}{11} \quad \text{or } x = 1\dfrac{4}{11}$ **Ans.**

Now, putting the value of $x = \dfrac{15}{11}$

L.H.S. $= 5x + 19 = 5 \times \dfrac{15}{11} + 19 = \dfrac{75}{11} + 19 = \dfrac{75 + 209}{11} = \dfrac{284}{11}$

R.H.S. $= \dfrac{4}{3}x + 24 = \dfrac{4 \times 15}{3 \times 11} + 24 = \dfrac{20}{11} + 24 = \dfrac{20 + 264}{11} = \dfrac{284}{11}$

Thus, **L.H.S. = R.H.S. and verify the answer.** **Proved.**

(c) $\dfrac{2x}{a} + \dfrac{2x}{b} = \dfrac{2a^2 - 2b^2}{ab} \Rightarrow \quad \dfrac{2bx + 2ax}{ab} = \dfrac{2(a^2 - b^2)}{ab}$

$$\Rightarrow \frac{2bx+2ax}{ab}\times ab=\frac{2(a^2-b^2)}{ab}\times ab$$

(Multiply both sides by ab)

$$\Rightarrow 2x(a+b)=2(a+b)(a-b) \quad [\because a^2-b^2=(a+b)(a-b)]$$

$$\Rightarrow \frac{2x(a+b)}{2(a+b)}=\frac{2(a+b)(a-b)}{2(a+b)} \text{ [Dividing both sides by } 2(a+b)]$$

$$\boldsymbol{x=a-b}$$ **Ans.**

Now, putting the value of $x=(a-b)$

$$\text{L.H.S.}=\frac{2x}{a}+\frac{2x}{b}=\frac{2(a-b)}{a}+\frac{2(a-b)}{b}$$

$$=\frac{2b(a-b)+2a(a-b)}{ab}$$

$$=\frac{2ab-2b^2+2a^2-2ab}{ab}=\frac{-2b^2+2a^2}{ab}=\frac{2a^2-2b^2}{ab}$$

$=$ R.H.S.

Thus, **L.H.S. = R.H.S. and verify the answer.** **Proved.**

(d) $\frac{17}{2}x-10=\frac{10x}{6}+\frac{5}{2}x$ or $\frac{17}{2}x-\frac{10x}{6}-\frac{5}{2}x=10$

Taking L.C.M. of 2, 6 and 2 i.e., 6 and multiply both sides of equation by 6.

$$\left(\frac{17}{2}x\times 6\right)-\left(\frac{10x}{6}\times 6\right)-\left(\frac{5}{2}x\right)\times 6=10\times 6$$

or $51x-10x-15x=60$ or $51x-25x=60$

or $26x=60$ or $\frac{26x}{26}=\frac{60}{26}$ (Dividing both side by 26)

or $x=\frac{30}{13}$ or $x=2\frac{4}{13}$ **Ans.**

Now, putting the value of $x=\frac{30}{13}$

$$\text{L.H.S.}=\frac{17}{2}x-10=\frac{17}{2}\times\frac{30}{13}-10=\frac{510}{26}-10=\frac{510-260}{26}=\frac{250}{26}$$

$$\text{R.H.S.}=\frac{10x}{6}+\frac{5}{2}x=\frac{10}{6}\times\frac{30}{13}+\frac{5}{2}\times\frac{30}{13}=\frac{300}{78}+\frac{150}{26}$$

$$=\frac{300+450}{78}=\frac{750}{78}=\frac{750\div 3}{78\div 3}=\frac{250}{26}$$

Thus, L.H.S. = R.H.S. and verify the answer. **Proved.**

(e) $\frac{2m+1}{5}-\frac{3(m-1)}{10}=4$ or $\frac{2m+1}{5}-\frac{3m-3}{10}=4$

Taking L.C.M. of 5 and 10 i.e., 10 and multiply both sides of equation by 10.

$\left(\frac{2m+1}{5}\right)\times 10-\left(\frac{3x-3}{10}\right)\times 10=4\times 10$

or $(2m+1)2-(3m-3)=40$

or $4m+2-3m+3=40$ or $m+5=40$

or $m=40-5$ or $m=35$ **Ans.**

Now, putting the value of $m=35$

$\text{L.H.S.}=\frac{2m+1}{5}-\frac{3(m-1)}{10}=\frac{2\times 35+1}{5}-\frac{3(35-1)}{10}$

$=\frac{71}{5}-\frac{102}{10}=\frac{142-102}{10}=\frac{40}{10}=4=\text{R.H.S.}$

Thus, **L.H.S. = R.H.S. and verify the answer.** **Proved.**

(f) $\frac{3x}{4}+\frac{x}{5}=\frac{x}{2}-4$ or $\frac{3x}{4}+\frac{x}{5}-\frac{x}{2}=-4$

(Transposing $\frac{x}{2}$ from L.H.S. to R.H.S.)

Taking L.C.M. of 4, 5 and 2 i.e., 20 and multiply both sides of equation by 20.

$\frac{3x}{4}\times 20+\frac{x}{5}\times 20-\frac{x}{2}\times 20=-4\times 20$

or $15x+4x-10x=-80$ or $19x-10x=-80$

or $9x=-80$ or $\frac{9x}{9}=\frac{-80}{9}$ (Dividing both sides by 9)

or $x=-\frac{80}{9}$ or $x=-8\frac{8}{9}$ **Ans.**

Now, putting the value of $x=\frac{-80}{9}$

$\text{L.H.S.}=\frac{3x}{4}+\frac{x}{5}=\frac{3}{4}\times\frac{-80}{9}+\frac{-80}{5\times 9}=\frac{-240}{36}-\frac{80}{45}$

$=\frac{-240\times 5-80\times 4}{180}=\frac{-1200-320}{180}=\frac{-1520}{180}=\frac{-152}{18}=-\frac{76}{9}$

$$\text{R.H.S.} = \frac{x}{2} - 4 = \frac{-80}{2\times 9} - 4 = \frac{-80}{18} - 4 = \frac{-80-72}{18} = \frac{-152}{18}$$
$$= -\frac{76}{9}$$

Thus, **L.H.S. = R.H.S. and verify the answer.** **Proved.**

(g) $\frac{2x-5}{4} - \frac{3x-5}{6} = \frac{4x-7}{8}$

Taking L.C.M. of 4, 6 and 8 i.e., 24 and multiply both sides of equation by 24.

$$\left(\frac{2x-5}{4}\right)\times 24 - \left(\frac{3x-5}{6}\right)\times 24 = \left(\frac{4x-7}{8}\right)\times 24$$

or $(2x-5)6-(3x-5)4=(4x-7)3$

or $12x-30-12x+20=12x-21$ or $-10=12x-21$

or $-10+21=12x$ (Transposing -21 from R.H.S. to L.H.S.)

or $11=12x$ or $12x=11$

or $\frac{12x}{12}=\frac{11}{12}$ (Dividing both sides by 12) $x=\frac{11}{12}$ **Ans.**

Now, putting the value of $x=\frac{11}{12}$

$$\text{L.H.S.} = \frac{2x-5}{4} - \frac{3x-5}{6} = \frac{2\times\frac{11}{12}-5}{4} - \frac{3\times\frac{11}{12}-5}{6}$$

$$= \frac{\frac{11}{6}-5}{4} - \frac{\frac{11}{4}-5}{6} = \frac{11-30}{6} - \frac{11-20}{4} = \frac{-19}{24} + \frac{9}{24} = \frac{-19+9}{24}$$

$$= \frac{-10}{24}$$

$$\text{R.H.S.} = \frac{4x-7}{8} = \frac{4\times\frac{11}{12}-7}{8} = \frac{\frac{11}{3}-7}{8} = \frac{11-21}{3} = \frac{-10}{3} = \frac{-10}{3}$$
$$= -\frac{10}{24}$$

Thus, **L.H.S. = R.H.S. and verify the answer.** **Proved.**

(h) $\frac{2x}{7} = \frac{x}{9} + 6$

or $\frac{2x}{7} - \frac{x}{9} = 6$ (Transposing $\frac{x}{9}$ from R.H.S. to L.H.S.)

Taking L.C.M. of 7 and 9 i.e., 63 and multiply both the sides of equation by 63)

$$\frac{2x}{7}\times 63-\frac{x}{9}\times 63=6\times 63 \qquad \text{or } 18x-7x=378$$

or $\quad 11x=378 \quad \text{or} \dfrac{11x}{11}=\dfrac{378}{11}$ (Dividing both sides by 11)

$$x=\frac{378}{11} \text{ or } x=34\frac{4}{11}$$ **Ans.**

Now, putting the value of $x=\dfrac{378}{11}$

$$\text{L.H.S.}=\frac{2x}{7}=\frac{2\times 378}{7\times 11}=\frac{756}{7\times 11}=\frac{108}{11}$$

$$\text{R.H.S.}=\frac{x}{9}+6=\frac{378}{9\times 11}+6=\frac{378}{99}+6=\frac{378+594}{99}=\frac{972}{99}=\frac{108}{11}$$

Thus, **L.H.S. = R.H.S. and verify the answer.** **Proved.**

3. (a) $0.8(x-4)=10(4-x)$

$\Rightarrow \quad 0.8x-3.2=40-10x$

$\Rightarrow \quad \dfrac{8x}{10}-\dfrac{32}{10}=40-10x$ (Removing decimals)

$\Rightarrow \dfrac{8x}{10}\times 10-\dfrac{32}{10}\times 10=(40-10x)\times 10$

(Multiply both sides by 10)

$\Rightarrow \quad 8x-32=400-100x$

$\Rightarrow \quad 8x+100x=400+32$ (Transposing -32 and $-100x$)

$\Rightarrow \quad 108x=432$

$\Rightarrow \quad \dfrac{108x}{108}=\dfrac{432}{108}$ (Dividing both sides by 108)

$\Rightarrow \quad x=4$

Hence, $x=4$ **is the solution of the equation.** **Ans.**

(b) $0.78x-0.4=-1.16+0.8x$

or $0.78x-0.8x=-1.16+0.4$ (Transpoing 0.4 and $0.8x$)

or $-0.02x=-0.76$

or $\dfrac{2x}{100}=\dfrac{76}{100}$ (Removing decimals)

or $\dfrac{2x}{100}\times 100=\dfrac{76}{100}\times 100$ (Multiply both sides by 100)

or $2x = 76$ or $\frac{2x}{2} = \frac{76}{2}$ (Divide both sides by 2)

or $x = 38$

Hence, $\boldsymbol{x = 38}$ **is the solution of equation.** **Ans.**

(c) $1.8x + 0.65 = 2.25x + 3.5$

or $1.8x - 2.25x = 3.5 - 0.65$ (Transpoing 0.65 and $2.25x$)

or $-0.45x = 2.85$

or $-\frac{45x}{100} = \frac{285}{100}$ (Removing decimals)

or $\frac{-45x}{100} \times 100 = \frac{285}{100} \times 100$ (Multiply both sides by 100)

or $-45x = 285$

or $\frac{45x}{45} = \frac{-285}{45}$ (Divide both sides by 45)

or $x = \frac{285}{45} = \frac{-285 \div 15}{45 \div 15} = \frac{-19}{3} = -6\frac{1}{3}$

Hence, $\boldsymbol{x = -6\frac{1}{3}}$ **is the solution of equation.**

Ans.

(d) $9x + 4.5(x - 6) = 61.5$

$\Rightarrow 9x + 4.5x - 27 = 61.5$

$\Rightarrow 13.5x = 61.5 + 27$ (Transposing 27 from L.H.S. to R.H.S.)

$\Rightarrow \frac{135x}{10} = \frac{885}{10}$ (Removing decimals)

$\Rightarrow \frac{135x}{10} \times 10 = \frac{885}{10} \times 10$ (Multiply both sides by 10)

$\Rightarrow 135x = 885$

$\Rightarrow \frac{135x}{135} = \frac{885}{135}$ (Dividing both sides by 135)

$\Rightarrow x = \frac{885}{135} = \frac{885 \div 15}{135 \div 15} = \frac{59}{9} = 6\frac{5}{9}$

Hence, $\boldsymbol{x = 6\frac{5}{9}}$ **is the solution of equation.**

Ans.

(e) $\frac{8-x}{x-2} = 4$ or $\frac{8-x}{x-2} \times (x-2) = 4(x-2)$

[Multiply both sides by $(x-2)$]

or $8-x=4x-8$

or $-x-4x=-8-8$ (Transposing 8 and $4x$)

or $-5x=-16$ or $5x=16$

or $\frac{5x}{5}=\frac{16}{5}$ (Divide both sides by 5)

or $x=\frac{16}{5}=3\frac{1}{5}$

Hence, $\boldsymbol{x=3\frac{1}{5}}$ **is the solution of equation.** **Ans.**

(f) $9(5x-2)=4(5x+2)$ or $45x-18=20x+8$

or $45x-20x=8+18$ (Transposing -18 and $20x$)

or $25x=26$

or $\frac{25x}{25}=\frac{26}{25}$ (Divide both sides by 25)

or $x=\frac{26}{25}=1\frac{1}{25}$

Hence, $\boldsymbol{x=1\frac{1}{25}}$ **is the solution of equation.** **Ans.**

(g) $x+\frac{x}{12}=\frac{18}{4}$

or $x\times12+\frac{x}{12}\times12=\frac{18}{4}\times12$ (Multiply both sides by 12)

or $12x+x=54$ or $13x=54$

or $\frac{13x}{13}=\frac{54}{13}$ (Divide both sides by 13)

or $x=\frac{54}{13}=4\frac{2}{13}$

Hence, $\boldsymbol{x=4\frac{2}{13}}$ **is the solution of equation.** **Ans.**

Exercise 7.2

1. Let second number be x.

$\therefore$ First number $=x\times\frac{3}{2}=\frac{3x}{2}$

Sum of the numbers $=x+\frac{3x}{2}=50$

$$x \times 2 + \frac{3x}{2} \times 2 = 50 \times 2 \qquad \text{(Multiply both sides by 2)}$$

$\Rightarrow \quad 2x + 3x = 100$

$\Rightarrow \quad 5x = 100$

$\Rightarrow \quad \frac{5x}{5} = \frac{100}{5}$ (Divide both sides by 5)

or $x = 20$

Thus, first number $= \frac{3x}{2} = \frac{3}{2} \times 20 = 30$

Hence, **the number are 30 and 20.** **Ans.**

2. Let the smaller number be x.

$\therefore$Greater number $= x \times 4 = 4x$

Difference of two numbers $= 4x - x = 60$

$\Rightarrow \quad 3x = 60 \quad \Rightarrow \frac{3x}{3} = \frac{60}{3}$ (Divide both sides by 3)

or $x = 20$

Thus, greater number $= 4x = 4 \times 20 = 80$

Hence, **the numbers are 20 and 80.** **Ans.**

3. Let one number be x.

$\therefore$Second number $= x \times \frac{3}{2} + 5 = \frac{3x}{2} + 5$

Sum of two numbers $= x + \frac{3x}{2} + 5 = 40$

$\Rightarrow \quad x + \frac{3x}{2} = 40 - 5 = 35$

$\Rightarrow \quad 2 \times x + \frac{3x}{2} \times 2 = 35 \times 2$ (Multiply both sides by 2)

$\Rightarrow \quad 2x + 3x = 70$

$\Rightarrow \quad 5x = 70$

$\Rightarrow \quad \frac{5x}{5} = \frac{70}{5}$ (Divide both sides by 5)

or $x = 14$

Thus, second number $= \frac{3x}{2} + 5 = \frac{3 \times 14}{2} + 5 = 21 + 5 = 26$

Hence, **the numbers are 14 and 26.** **Ans.**

4. Let the required number be x, then

$$\frac{1}{5}x+\frac{1}{4}x=36$$

Taking L.C.M. of 5 and 4 i.e. 20 and multiply both the sides by 20.

$$\frac{x}{5}\times 20+\frac{x}{4}\times 20=36\times 20$$

$\Rightarrow \quad 4x+5x=720$

$\Rightarrow \quad 9x=720$

$\Rightarrow \quad \frac{9x}{9}=\frac{720}{9}$ (Divide both sides by 9)

$\Rightarrow \quad x=80$

Hence, **the number is 80.** **Ans.**

5. Let the required number be x, then

$$3x+\frac{4}{3}x=78$$

$\Rightarrow \quad 3x\times 3+\frac{4x}{3}\times 3=78\times 3$ (Multiply both sides by 3)

$\Rightarrow \quad 9x+4x=234$

$\Rightarrow \quad 13x=234$

$\Rightarrow \quad \frac{13x}{13}=\frac{234}{13}$

$\Rightarrow \quad x=18$

Hence, **the number is 18.** **Ans.**

6. Let the two consecutive even numbers be x and $x+2$, then

$$x+x+2=62$$

$\Rightarrow \quad 2x+2=62 \Rightarrow 2x=62-2=60$

$\Rightarrow \quad \frac{2x}{2}=\frac{60}{2} \Rightarrow x=30$

Thus, second number $=x+2=30+2=32$

Hence, **the consecutive even numbers are 30 and 32.** **Ans.**

7. Let the three consecutive numbers be x, $x+2$ and $x+4$.

$$x+x+2+x+4=81$$

$\Rightarrow \quad 3x+6=81$

$\Rightarrow \quad 3x=81-6=75$

$\Rightarrow \quad \frac{3x}{3} = \frac{75}{3}$ (Divide both sides by3)

$\Rightarrow \quad x = 25$

Thus, second number $= x + 2 = 25 + 2 = 27$

Third number $= x + 4 = 25 + 4 = 29$

Hence, **the number are 25, 27 and 29.** **Ans.**

8. Let ones digit be x and tens digit be y.

Then, number $= 10x + y$

First condition, $x + y = 9$ ...(i)

$10x + y + 27 = 10y + x$

$\Rightarrow \quad 10x - x + y - 10y = -27$

$\Rightarrow \quad 9x - 9y = -27$ or $9(x - y) = -27$

or $x - y = \frac{-27}{9}$ or $x - y = -3$ ...(ii)

Add the equations (i) and (ii), we get

$x + y = 9; \quad x - y = -3; \quad 2x = 6 \quad$ or $x = \frac{6}{2} \Rightarrow x = 3$

Let the value of x in equation (i), we have

$x + y = 9 \quad \Rightarrow 3 + y = 9$

or $y = 9 - 3$ or $y = 6$

$\therefore$ The number $= 10x + y = 10 \times 3 + 6 = 30 + 6 = 36$

Hence, **the number is 36.** **Ans.**

9. Let whose number be x.

Then according to question, we get

$4x + 120 = 7x - 102$ or $7x - 4x = 120 + 102$

or $3x = 222$ or $x = 74$

Hence, **required number = 74** **Ans.**

10. Let the four consecutive number be x, $x + 1$, $x + 2$ and $x + 3$.

Then, $x + x + 1 + x + 2 + x + 3 = 78$

or $4x + 6 = 78$ or $4x = 78 - 6 = 72$ or $x = \frac{72}{4}$ or $x = 18$

First number $= x = 18$, Second number $= x + 1 = 18 + 1 = 19$

Third number $= x + 2 = 18 + 2 = 20$, Fourth number $18 + 3 = 21$

Hence, **the four consecutive number are 18, 19, 20 and 21.** **Ans.**

11. Let the Mayur present age be x.

Mayur age will be after 5 years $= (x + 5)$ years

Mayur age will be before 8 years $= (x - 8)$ years

Now, $x+5=2(x-8)$ or $x+5=2x-16$

or $x-2x=-16-5$ or $-x=-21$

or $x=21$

Hence, **the Mayur present age is 21 years.** **Ans.**

12. Let the present age of elder brother $=x$ years

Then, the present age of younger brother $=(x-3)$ years

Five years ago, age of elder brother $=(x+5)$ years

Five years ago age of younger brother $=(x-3-5)$ years

$=(x-8)$ years

$\Rightarrow \quad \frac{2}{5}(x-5)=x-8$ or $2(x-5)=5(x-8)$

or $2x-10=5x-40$ or $2x-5x=-40+10$

or $-3x=-30$ or $x=\frac{-30}{-3} \Rightarrow x=10$ years

$\therefore$ The present age of elder brother $=x=10$ years

$\therefore$ Present age of younger brother $=(x-3)$ years

$=(10-3)$ years $=7$ years

Hence, **the present age of elder brother $=10$ years and younger brother $=7$ years** **Ans.**

13. $\because$ Age of father is 40 years and age of son $=10$ years

Let after x years will age of father be twice the son's age.

$\Rightarrow \quad 40+x=2(10+x)$ or $40+x=20+2x$

or $2x-x=40-20$ or $x=20$

Hence, **after 20 years father age will be twice the son's age.** **Ans.**

14. Let the present age of Gita be x years.

Then the present age of Sita $=3\times x$ years $=3x$ years

After 9 years Gita age will be $=(x+9)$ years

and after 9 years Sita's age will be $=(3x+9)$ years

$\Rightarrow \quad (3x+9)+6=2(x+9)$ or $3x+15=2x+18$

or $3x-2x=18-15$ or $x=3$

$\therefore$ Present age of Gita $=x=3$ years

and present age of Sita $=3x=3\times 3$ years $=9$ years

Hence, **the present age of Sita $=9$ years and present age of Gita $=3$ years.** **Ans.**

15. Let the vertical angle be x.

Then, the equal angles are $x \times \frac{1}{4} = \frac{x}{4}$

We know that the sum of angles of triangle $= 180°$

$\therefore \quad x + \frac{x}{4} + \frac{x}{4} = 180° \quad$ or $\frac{4x + x + x}{4} = 180°$

or $\quad \frac{6x}{4} = 180° \quad$ or $6x = 180° \times 4$

or $\quad x = \frac{180° \times 4}{6} \quad$ or $x = 30° \times 4 = 120°$

$\therefore$ Vertical angle $= x = 120°$

and equal angle $= \frac{x}{4} = \frac{120°}{4} = 30°$

Hence, **the angle are 30°, 30° and 120°.** **Ans.**

16. Let the angles are $4x$, $5x$ and $9x$.

We know that the sum of angles of a triangle $= 180°$

$\therefore 4x + 5x + 9x = 180°$ or $18x = 180° \quad$ or $x = \frac{180°}{18} = 10°$

$\therefore$ First angle $= 4x = 4 \times 10° = 40°$

Second angle $= 5x = 5 \times 10° = 50°$

Third angle $= 9x = 9 \times 10° = 90°$

Hence, **the angle are 40°, 50° and 90°.** **Ans.**

17. We know that the sum of angles of a triangle $= 180°$

$\therefore (3x - 5)° + (5x - 10)° + (9x - 9)° = 180°$

or $\quad 3x - 5° + 5x - 10° + 9x - 9° = 180°$

or $\quad 17x - 24° = 180° \quad$ or $17x = 180° + 24° = 204°$

or $\quad x = \frac{204°}{17} \Rightarrow x = 12°$

First angle $= (3x - 5)° = (3 \times 12 - 5)° = (36 - 5)° = 31°$

Second angle $= (5x - 10)° = (5 \times 12 - 10)° = (60 - 10)° = 50°$

Third angle $= (9x - 9)° = (9 \times 12 - 9)° = (108 - 9)° = 99°$

Hence, **the angles are 31°, 50° and 99°.** **Ans.**

18. Let the second angle $= x$

Then, first angle $= 2x$

and third angle = equal to the sum of both angle $= x + 2x = 3x$

We know that the sum of angles of a triangle $= 180°$

$\therefore \quad x + 2x + 3x = 180^\circ \quad$ or $6x = 180^\circ$

or $x = \dfrac{180^\circ}{6} \quad$ or $x = 30^\circ$

$\therefore$ First angle $= 2x = 2 \times 30^\circ = 60^\circ$, Second angle $= x = 30^\circ$,
Third angle $= 3x = 3 \times 30^\circ = 90^\circ$

Hence, **the angles are 60°, 30° and 90°.** **Ans.**

19. Let the side of square be x metre.

$\because$ Perimeter of the square $= 4x$

$\therefore 64$ meter $= 4x \quad$ or $x = \dfrac{64}{4}$ meter $= 16$ meter

Hence, **the side of square = 16 metre** **Ans.**

20. Let the breadth of the rectangle be x m.

Then, length $= 2 \times x = 2x$ m

$\therefore$ Perimeter of the rectangle $= 2(l + b)$

$\therefore 180\text{ m} = 2(2x + x) \quad$ or $180\text{ m} = 6x \quad$ or $\quad x = \dfrac{180}{6}\text{ m} = 30\text{ m}$

$\therefore$ Breadth of rectangle $= x = 30$ m
and length $= 2x = 2 \times 30$ m $= 60$ m

Hence, **the length of rectangle is 60 m and breadth is 30 m.**
Ans.

21. Let the breadth be x m, then

length $= (x + 15)$ m

$\therefore$ Perimeter of the rectangle $= 2(l + b)$

or $60\text{ m} = 2(x + 15 + x) \quad$ or $60\text{ m} = 2(2x + 15)$

or $60\text{ m} = 4x + 30\text{ m} \quad$ or $4x = 60\text{ m} - 30\text{ m} = 30\text{ m}$

or $x = \dfrac{30}{4}\text{ m} = 7.5\text{ m}$

$\therefore$ Breadth $= x = 7.5$ m and length $= x + 15\text{ m} = 7.5\text{ m} + 15\text{ m} = 22.5\text{ m}$

Hence, **the length of rectangle is 22.5 m and breadth is 7.5 m.** **Ans.**

22. Let the length of the rectangle be x. Then

Breadth $= x \times \dfrac{4}{9} = \dfrac{4x}{9}$

$\because$ Perimeter of the rectangle $= 2(l + b)$

$\therefore 100\text{ m} = 2\left(\dfrac{4x}{9} + x\right) \quad$ or $\dfrac{4x + 9x}{9} = \dfrac{100}{2}\text{ m} = 50\text{ m}$

or $\dfrac{13x}{9} = 50\text{ m} \quad$ or $13x = 50 \times 9\text{ m} = 450\text{ m}$

or $x = \frac{450}{13}$ m $\Rightarrow x = 34\frac{8}{13}$ m

$\therefore$ Length of the rectangle $= 34\frac{8}{13}$ m

and breadth of the rectangle $= \frac{4x}{9} = \frac{4 \times 450}{9 \times 13} = \frac{200}{13}$ m $= 15\frac{5}{13}$ m

Hence, **the length of rectangle is $34\frac{8}{13}$ m and breadth is $15\frac{5}{13}$ m.**

Ans.

23. Let the breadth of the rectangle be x m.

Then, length $= (2x - 20)$ m

$\because$ Perimeter of the rectangle $= 2(l + b)$

$\therefore 80\text{ m} = 2(x + 2x - 20)$ or $80\text{ m} = 2(3x - 20)$ or $80\text{ m} = 6x - 40\text{ m}$

or $6x = 80\text{ m} + 40\text{ m} = 120\text{ m}$ or $x = \frac{120}{6}$ m or $x = 20$ m

$\therefore$ Breadth $= x = 20$ m and length

$= 2x - 20\text{ m} = 2 \times 20\text{ m} - 20\text{ m} = 40\text{ m} - 20\text{ m} = 20\text{ m}$

Hence, **the length and breadth of the rectangle are 20 m and 20 m.** **Ans.**

24. Let the side of the triangle be $9x, 18x$ and $27x$.

$\therefore$ Perimeter of the triangle = Sum of all side

$\therefore$ $54\text{ m} = 9x + 18x + 27x$

or $54\text{ m} = 54x$ or $x = \frac{54}{54}\text{ m} = 1\text{ m}$

$\therefore$ Side of triangle are $9x = 9 \times 1\text{ m} = 9\text{ m}, 18x = 18 \times 1\text{ m} = 18\text{ m}$

and $27x = 27 \times 1\text{ m} = 27\text{ m}$

Hence, **the sides of triangle are 9m, 18 m and 27 m.** **Ans.**

25. Let denominator be x

$\therefore$ Numerator $= x - 6$

Adding 2 to numerator and denominator, then

Numerator $= x - 6 + 2 = x - 4$ and denominator $= x + 2$

Now, $\frac{x-4}{x+2} = \frac{3}{4}$ or $4(x - 4) = 3(x + 2)$

or $4x - 16 = 3x + 6$ or $4x - 3x = 6 + 16$

or $x = 22$

$\therefore x-6=22-6=16$

$\therefore$ **Fraction** $=\dfrac{\mathbf{16}}{\mathbf{22}}$ **Ans.**

Multiple Choice Questions

1. (i) $2z+6=8z-12$ or $2z-8z=-12-6$

or $-6z=-18$ or $z=\dfrac{-18}{-6}$ or $z=3$

Hence, the answer **(a)** is correct. **Ans.**

(ii) The answer **(a)** is correct. **Ans.**

(iii) $p(p-6)=0$ or $p-6=0$ or $p=6$

Hence, the answer **(c)** is correct. **Ans.**

(iv) $2x-8=6$ or $2x=6+8=14$ or $x=\dfrac{14}{2}=7$

Hence, the answer **(d)** is correct. **Ans.**

(v) The answer **(a)** is correct. **Ans.**

(vi) $\dfrac{3x}{2}+6=8+x$ or $\dfrac{3x}{2}-x=8-6$ or $\dfrac{3x-2x}{2}=2$

or $\dfrac{x}{2}=2$ or $x=4$

Hence, the answer **(b)** is correct. **Ans.**

(vii) $x-2=2(x-4)$ or $x-2=2x-8$

or $x-2x=-8+2$ or $-x=-6$ or $x=6$

Hence, the answer **(c)** is correct. **Ans.**

(viii) The answer **(b)** is correct. **Ans.**

8. Ratio, Proportion and Unitary Method

Exercise 8.1

1. (a) $\because$ HCF of 12 and 30 is 6, so we divide numerator and denominator for both by 6.

$\therefore 12:30=\dfrac{12}{30}=\dfrac{12\div6}{30\div6}=\dfrac{2}{5}$, Hence, $12:30=\dfrac{2}{5}=$ **2 : 5** **Ans.**

(b) $\because$ HCF of 16 and 18 is 2, so we divide numerator and denominator for both by 2.

$\therefore 16:18=\dfrac{16}{18}=\dfrac{16\div2}{18\div2}=\dfrac{8}{9}$ Hence, $16:18=\dfrac{8}{9}=$ **8 : 9** **Ans.**

(c) HCF of 12 and 21 is 3, so we divide numerator and denominator for both by 3.

$\therefore 12 : 21 = \frac{12}{21} = \frac{12 \div 3}{21 \div 3} = \frac{4}{7}$

Hence, $12 : 21 = \frac{4}{7} =$ **4 : 7** **Ans.**

(d) HCF of 125 and 140 is 5, so we divide numerator and denominator for both by 5.

$\therefore 125 : 140 = \frac{125}{140} = \frac{125 \div 5}{140 \div 5} = \frac{25}{28}$

Hence, $125 : 140 = \frac{25}{28} =$ **25 : 28** **Ans.**

(e) HCF of 272 and 296 is 8, so we divide numerator and denominator for both by 8.

$\therefore 272 : 296 = \frac{272}{296} = \frac{272 \div 8}{296 \div 8} = \frac{34}{37}$

Hence, $272 : 296 = \frac{34}{37} =$ **34 : 37** **Ans.**

(f) HCF of 4.5 and 9.0 is 4.5, so we divide numerator and denominator for both by 4.5.

$\therefore 4.5 : 9.0 = \frac{4.5}{9.0} = \frac{4.5 \div 4.5}{9.0 \div 4.5} = \frac{1}{2}$, Hence, $4.5 : 9.0 = \frac{1}{2} =$ **1 : 2** **Ans.**

(g) $\frac{3}{4} : \frac{3}{8} = \frac{3 \times 2}{4 \times 2} : \frac{3}{8} = \frac{6}{8} : \frac{3}{8} = \frac{6}{8} \times 8 : \frac{3}{8} \times 8$

$= 6 : 3 = \frac{6}{3} = \frac{6 \div 3}{3 \div 3} = \frac{2}{1} =$ **2 : 1** **Ans.**

(h) HCF of 400 and 1220 is 20, so we divide numerator and denominator for both by 20.

$\therefore \quad 400 : 1220 = \frac{400}{1220} = \frac{400 \div 20}{1220 \div 20} = \frac{20}{61}$

Hence, $400 : 1200 = \frac{20}{61} =$ **20 : 61** **Ans.**

2. (a) $\because$ 1 m = 100 cm, $\quad 3.5 \text{ m} = 3.5 \times 100 \text{ cm} = 350 \text{ cm}$

$\therefore 25 \text{ cm} : 3.5 \text{ m} = 25 : 350 = \frac{25}{350} = \frac{25 \div 25}{350 \div 25} = \frac{1}{14} = 1 : 14$

Hence, **ratio of 25 cm to 3.5 m is 1 : 14.** **Ans.**

(b) $33\text{ m} : 1.1\text{ m} = \frac{33}{1.1} = \frac{330}{11} = \frac{330 \div 11}{11 \div 11} = \frac{30}{1} = 30 : 1$

Hence, **ratio of 33 m 1.1 m is 30 : 1.** **Ans.**

(c) $\because$ $1\text{ km} = 1000\text{ m}$

$\therefore 5000\text{ m} : 1\text{ km} = 5000\text{ m} : 1000\text{ m} = \frac{5000}{1000} = \frac{5000 \div 1000}{1000 \div 1000} = \frac{5}{1}$

$= 5 : 1$

Hence, **ratio of 5000 m to 1 km is 5 : 1.** **Ans.**

(d) $\because$ $1\text{ kg} = 1000\text{ g}$

$\therefore 250\text{ g} : 1\text{ kg} = 250\text{ g} : 1000\text{ g} = \frac{250}{1000} = \frac{250 \div 250}{1000 \div 250} = \frac{1}{4} = 1 : 4$

Hence, **ratio of 250 g to 1 kg is 1 : 4.** **Ans.**

(e) $\because$ $1\text{ kg} = 1000\text{ g}$, $35\text{ kg} = 35 \times 1000\text{ g} = 35000\text{ g}$

$\therefore 3750\text{ g} : 35\text{ kg} = 3750\text{g} : 35000\text{ g} = \frac{3750}{35000} = \frac{3750 \div 1250}{35000 \div 1250}$

$= \frac{3}{28} = 3 : 28$

Hence, **ratio of 3750 g to 35 kg is 3 : 28.** **Ans.**

(f) $\because$ ₹ $1 = 100$ paise, ₹ $5 = 5 \times 100$ paise $= 500$ paise

$\therefore 40$ paise : ₹ $5 = 40$ paise : 500 paise

$= \frac{40}{500} = \frac{40 \div 20}{500 \div 20} = \frac{2}{25} = 2 : 25$

Hence, **ratio of 40 paise to ₹ 5 is 2 : 25.** **Ans.**

(g) ₹ 2000 : ₹ $100000 = \frac{2000}{100000} = \frac{2000 \div 2000}{100000 \div 2000} = \frac{1}{50} = 1 : 50$

Hence, **ratio of ₹ 2000 to ₹ 100000 is 1 : 50.** **Ans.**

(h) $\because$ $1\text{ hour} = 60\text{ minutes}$

$\therefore$ 35 minutes : 1 hour $= 35$ minutes : 60 minutes

$= \frac{35}{60} = \frac{35 \div 5}{60 \div 5} = \frac{7}{12} = 7 : 12$

Hence, **ratio of 35 minutes to 1 hour is 7 : 12.** **Ans.**

(i) $\because$ 1 week = 7 days

$\therefore$ 5 days : 1 week $= 5$ days : 7 days $= \frac{5}{7} = 5 : 7$

Hence, **ratio of 5 days to a week is 5 : 7.** **Ans.**

3. We have, $a : b = 3 : 4$ and $b : c = 12 : 18$

or $\quad \frac{a}{b} = \frac{3}{4}$ and $\frac{b}{c} = \frac{12}{18}$

Now, $\frac{a}{c} = \left(\frac{a}{b} \times \frac{b}{c}\right) = \frac{3}{4} \times \frac{12}{18} = \frac{36}{72} = \frac{36 \div 36}{72 \div 36} = \frac{1}{2} = 1 : 2$

Hence, $\boldsymbol{a : c = 1 : 2}$ **Ans.**

4. We have, $a : b = 5 : 7$ and $b : c = 21 : 20$

or $\quad \frac{a}{b} = \frac{5}{7}$ and $\frac{b}{c} = \frac{21}{20}$

Now, $\frac{a}{c} = \left(\frac{a}{b} \times \frac{b}{c}\right) = \frac{5}{7} \times \frac{21}{20} = \frac{105}{140} = \frac{105 \div 35}{140 \div 35} = \frac{3}{4} = 3 : 4$

Hence, $\boldsymbol{a : c = 3 : 4}$ **Ans.**

5. We have, $a : b = 11 : 13$ and $b : c = 26 : 29$

or $\frac{a}{b} = \frac{11}{13}$ and $\frac{b}{c} = \frac{26}{29}$

Now, $\frac{a}{c} = \left(\frac{a}{b} \times \frac{b}{c}\right) = \frac{11}{13} \times \frac{26}{29} = \frac{286}{377} = \frac{286 \div 13}{377 \div 13} = \frac{22}{29} = 22 : 29$

Hence, $\boldsymbol{a : c = 22 : 29}$ **Ans.**

6. $\because \quad a : b = 5 : 9$ and $b : c = 9 : 10$

$\therefore \quad \frac{a}{b} = \frac{5}{9}$ and $\frac{b}{c} = \frac{9}{10}$

$\therefore \quad \frac{a}{c} = \frac{a}{b} \times \frac{b}{c} = \frac{5}{9} \times \frac{9}{10} = \frac{5}{10} = 5 : 10$

$\because \quad a : b = 5 : 9$ and $a : c = 5 : 10$

$\therefore \boldsymbol{a : b : c = 5 : 9 : 10}$ **Ans.**

7. $\because a : b = 7 : 8$ and $b : c = 24 : 25$

$\therefore \quad \frac{a}{b} = \frac{7}{8}$ and $\frac{b}{c} = \frac{24}{25}$

$\therefore \quad \frac{a}{c} = \frac{a}{b} \times \frac{b}{c} = \frac{7}{8} \times \frac{24}{25} = \frac{21}{25}$

$\therefore \quad a : c = 21 : 25$

or $\quad a : b = 7 : 8$ or $a : b = 21 : 24$

$\therefore \quad \boldsymbol{a : b : c = 21 : 24 : 25}$ **Ans.**

8. $\because a : b = 12 : 13$ and $b : c = 39 : 41$

$\therefore \quad \frac{a}{b} = \frac{12}{13}$ and $\frac{b}{c} = \frac{39}{41}$

$\therefore \quad \frac{a}{c} = \frac{a}{b} \times \frac{b}{c} = \frac{12}{13} \times \frac{39}{41} = \frac{36}{41}$

$\because \quad a : b = 12 : 13$ and $a : c = 36 : 41$

$\therefore \quad a : b = 36 : 39$ and $a : c = 36 : 41$

$\therefore \quad \boldsymbol{a : b : c = 36 : 39 : 41}$ **Ans.**

9. We have, $3 : 5 = \frac{3}{5}$ or $5 : 6 = \frac{5}{6}$

LCM of 5 and $6 = 30$

$\therefore \frac{3}{5} = \frac{3 \times 6}{5 \times 6} = \frac{18}{30}$ and $\frac{5}{6} = \frac{5 \times 5}{6 \times 5} = \frac{25}{30}$

But $25 > 18$ Since, $\frac{25}{30} > \frac{18}{30}$

$\therefore \frac{5}{6} > \frac{3}{5}$

Hence, **5 : 6 > 3 : 5.** **Ans.**

10. We have, $\frac{1}{2} : \frac{1}{3} = \frac{\frac{1}{2}}{\frac{1}{3}} = \frac{1 \times 3}{2 \times 1} = \frac{3}{2}$ and $\frac{1}{3} : \frac{1}{4} = \frac{\frac{1}{3}}{\frac{1}{4}} = \frac{4}{3}$

L.C.M. of 2 and $3 = 6$

$\therefore \quad \frac{3}{2} = \frac{3 \times 3}{2 \times 3} = \frac{9}{6}$ and $\frac{4}{3} = \frac{4 \times 2}{3 \times 2} = \frac{8}{6}$

But $9 > 8$ Since, $\frac{9}{6} > \frac{8}{6}$

$\therefore \quad \frac{1}{2} : \frac{1}{3} > \frac{1}{3} : \frac{1}{4}$

Hence, $\boldsymbol{\frac{1}{2} : \frac{1}{3} > \frac{1}{3} : \frac{1}{4}}$ **Ans.**

11. We have, $\frac{2}{3} : \frac{3}{4} = \frac{\frac{2}{3}}{\frac{3}{4}} = \frac{2 \times 4}{3 \times 3} = \frac{8}{9}$ and $\frac{3}{4} : \frac{4}{5} = \frac{\frac{3}{4}}{\frac{4}{5}} = \frac{3 \times 5}{4 \times 4} = \frac{15}{16}$

L.C.M. of 9 and $16 = 144$

$\therefore \frac{8}{9} = \frac{8 \times 16}{9 \times 16} = \frac{128}{144}$ and $\frac{15 \times 9}{16 \times 9} = \frac{135}{144}$

But $135 > 128$

Since, $\frac{135}{144} > \frac{128}{144}$, $\quad \therefore \frac{3}{4} : \frac{4}{5} > \frac{2}{3} : \frac{3}{4}$

Hence, $\mathbf{\frac{3}{4} : \frac{4}{5} > \frac{2}{3} : \frac{3}{4}}$. **Ans.**

12. Sum of the terms of the ratio $= 1 + 2 = 3$

$\therefore$ First share $= ₹\ 900 \times \frac{1}{3} = ₹\ 300 \times 1 = ₹\ 300$

and second share $= ₹\ 900 \times \frac{2}{3} = ₹\ 300 \times 2 = ₹\ 600$

Hence, **required parts are ₹ 300 and ₹ 600.** **Ans.**

13. Sum of the terms of the ratio $= 2 + 3 + 5 = 10$

$\therefore$ Raju share $= ₹\ 10000000 \times \frac{2}{10} = ₹\ 1000000 \times 2 = ₹\ 2000000$

$\therefore$ Ram share $= ₹\ 10000000 \times \frac{3}{10} = ₹\ 1000000 \times 3 = ₹\ 3000000$

$\therefore$ Ravi share $= ₹\ 10000000 \times \frac{5}{10} = ₹\ 1000000 \times 5 = ₹\ 5000000$

Hence, **Raju share = ₹ 2000000, Ram share = ₹ 3000000, and Ravi share = ₹ 5000000** **Ans.**

14. Sum of the terms of the ratio $= 3 + 5 + 7 = 15$

$\therefore$ Length of first piece $= 300 \times \frac{3}{15}\ \text{m} = 20 \times 3\ \text{m} = 60\ \text{m}$

$\therefore$ Length of second piece $= 300 \times \frac{5}{15}\ \text{m} = 20 \times 5\ \text{m} = 100\ \text{m}$

$\therefore$ Length of third piece $= 300 \times \frac{7}{15}\ \text{m} = 20 \times 7\ \text{m} = 140\ \text{m}$

Hence, **the length of each piece is 60 m, 100 m and 140 m.** **Ans.**

15. Sum of the terms of the ratio $= \frac{1}{2} + \frac{1}{3} = \frac{1 \times 3}{2 \times 3} + \frac{1 \times 2}{3 \times 2}$

[L.C.M. of 2 and 3 is 6]

$$= \frac{3}{6} + \frac{2}{6} = \frac{5}{6}$$

$$\therefore \text{Sweets receive by Om} = 3 \times \frac{\frac{1}{2}}{\frac{5}{6}} \text{ kg} = 3 \times \frac{1 \times 6}{2 \times 5} \text{ kg}$$

$$= \frac{3 \times 1 \times 6}{2 \times 5} \text{ kg} = \frac{18}{10} \text{ kg} = 1.8 \text{ kg}$$

Hence, **the sweets receive by Om = 1.8 kg** **Ans.**

16. Sum of the terms of the ratio $= \frac{1}{15} + \frac{1}{12} + \frac{1}{10}$

$= \frac{1 \times 4}{15 \times 4} + \frac{1 \times 5}{12 \times 5} + \frac{1 \times 6}{10 \times 6}$ [L.C.M. of 15, 12 and 10 is 60]

$= \frac{4}{60} + \frac{5}{60} + \frac{6}{60} = \frac{4+5+6}{60} = \frac{15}{60}$

$$\therefore \text{Amit share} = 1500 \times \frac{\frac{1}{15}}{\frac{15}{60}} \text{ g} = 1500 \times \frac{1 \times 60}{15 \times 15} \text{ g}$$

$$= \frac{1500 \times 60}{15 \times 15} \text{ g} = 400 \text{ g}$$

$$\therefore \text{Punit share} = 1500 \times \frac{\frac{1}{12}}{\frac{15}{60}} \text{ g} = 1500 \times \frac{60}{12 \times 15} \text{ g}$$

$$= \frac{1500 \times 60}{12 \times 15} \text{ g} = 500 \text{ g}$$

$$\therefore \text{Krishan share} = 1500 \times \frac{\frac{1}{10}}{\frac{15}{60}} \text{ g} = 1500 \times \frac{60}{10 \times 15} \text{ g}$$

$$= \frac{1500 \times 60}{10 \times 15} = 600 \text{ g}$$

Hence, **Amit get 400 g grapes, Punit get 500 g grapes and Krishan get 600 g grapes.** **Ans.**

17. Sum of the terms of the ratio $= 3 + 7 = 10$

$\therefore$ Marks obtained by Rampal $= 300 \times \frac{3}{10} = 30 \times 3 = 90$ marks

$\therefore$ Marks obtained by Puran $= 300 \times \frac{7}{10} = 30 \times 7 = 210$ marks

Hence, **Rampal 90 marks and Puras obtained 210 marks. Ans.**

18. Sum of the weight of the two sumo $= 480$ kg

Sum of the terms of the ratio $= 5 + 7 = 12$

$\therefore$ Weight of first sumo $= 480 \times \frac{5}{12}$ kg $= 40 \times 5$ kg $= 200$ kg

And weight of second sumo $= 480 \times \frac{7}{12}$ kg

$= 40 \times 7$ kg $= 280$ kg

Hence, **the weight of sumo wrestlers are 200 kg and 280 kg. Ans.**

Exercise 8.2

1. We know that $a : b :: c : d$ in proportion, if

product of extreme $(a \times d)$ = Product of means $(b \times c)$

(a) Here, $a \times d = 3 \times 12 = 36$ and $b \times c = 4 \times 9 = 36$

$\because$ Product of extrems = Product of means

$\therefore \quad a \times d = b \times c$

i.e. $\quad 36 = 36$

Hence, **3, 4, 9 and 12 are in proportion. Ans.**

(b) Here, $a \times d = 7 \times 12 = 84$ and $b \times c = 4 \times 21 = 84$

$\because$ Product of extrems = Product of means

$\therefore \quad a \times d = b \times c$

i.e. $\quad 84 = 84$

Hence, **7, 4, 21 and 12 are in proportion. Ans.**

(c) Here, $a \times d = 3 \times 9 = 27$ and $b \times c = 5 \times 7 = 35$

$\because$ Product of extrems $\neq$ Product of means

$\therefore \quad a \times d \neq b \times c$ i.e. $27 \neq 35$

Hence, **3, 5, 7 and 9 are not in proportion. Ans.**

(d) Here, $a \times d = \frac{1}{4} \times \frac{1}{14} = \frac{1}{56}$ and $b \times c = \frac{1}{7} \times \frac{1}{8} = \frac{1}{56}$

$\because$ Product of extrems = Product of means

$\therefore \quad a \times d = b \times c$

i.e. $\frac{1}{56} = \frac{1}{56}$

Hence, $\frac{1}{4}, \frac{1}{7}, \frac{1}{8}$ **and** $\frac{1}{14}$ **are in proportion.** **Ans.**

2. (a) Since, the given numbers are in proportion.

$\because$ Product of extremes = product of means

$\therefore \quad 3 \times 12 = 4 \times x \quad$ or $36 = 4x$

$x = \frac{36}{4} = 9$

Hence, $\boldsymbol{x = 9}$ **Ans.**

(b) Since, the given numbers are in proportion.

$\because$ Product of extremes = Product of means

$\therefore \quad 4 \times x = 9 \times 16$

or $4x = 9 \times 16$

or $x = \frac{9 \times 16}{4} = 36$

Hence, $\boldsymbol{x = 36}$ **Ans.**

(c) Since, the given numbers are in proportion.

$\because$ Product of extremes = Product of means

$\therefore \quad \frac{1}{2} \times \frac{1}{6} = \frac{1}{3} \times \frac{1}{x}$

or $\frac{1}{12} = \frac{1}{3x}$

or $3x = 12$ [By cross-multiplication]

or $x = \frac{12}{3} = 4$

Hence, $\boldsymbol{x = 4}$ **Ans.**

(d) Since, the given numbers are in proportion.

$\because$ Product of extremes = Product of means

$\therefore 2 \times x = 4 \times 15 \quad$ or $2x = 4 \times 15$

$x = \frac{4 \times 15}{2} = 30$

Hence, $\boldsymbol{x = 30}$ **Ans.**

3. Let the fourth proportional be x then,

(a) $5 : 25 :: 6 : x$

$\because$ Product of extremes = Product of means

$\therefore \quad 5 \times x = 25 \times 6$

or $\quad x = \dfrac{25 \times 6}{5} = 5 \times 6 = 30$

Hence, **the fourth proportional is 30.** **Ans.**

(b) $7 : 3 :: 42 : x$

$\because$ Product of extremes = Product of means

$\therefore \quad 7 \times x = 3 \times 42$

or $\quad x = \dfrac{3 \times 42}{7} = 3 \times 6 = 18$

Hence, **the fourth proportional is 18.** **Ans.**

(c) $\dfrac{1}{3} : \dfrac{1}{8} :: \dfrac{1}{15} : x$

$\because$ Product of extremes = Product of means

$\therefore \dfrac{1}{3} \times x = \dfrac{1}{8} \times \dfrac{1}{15}$

or $\quad x = \dfrac{3}{8 \times 15} = \dfrac{1}{8 \times 5} = \dfrac{1}{40}$

Hence, **the fourth proportional is $\dfrac{1}{40}$.** **Ans.**

(d) $12 : 6 :: 84 : x$

$\because$ Product of extremes = Product of means

$\therefore \quad 12 \times x = 6 \times 84$

or $\quad x = \dfrac{6 \times 84}{12} = 6 \times 7 = 42$

Hence, **the fourth proportional is 42.** **Ans.**

4. (a) Let x be the mean proportional between 2 and 8.

$\therefore 2 : x :: x : 8$

$\because$ Product of extremes = Product of means

$\therefore 2 \times 8 = x \times x \quad$ or $x^2 = 16 \Rightarrow x = \sqrt{16}$ or $x = 4$

Hence, **4 is the mean proportional between 2 and 8.** **Ans.**

(b) Let x be the mean proportional between 7 and 28, then

$7 : x :: x : 28$

$\because$ Product of extremes = Product of means

$\therefore \quad 7 \times 28 = x \times x \quad$ or $x^2 = 196$

or $\quad x = \sqrt{196}$ or $x = 14$

Hence, **14 is the mean proportional between 7 and 28.**

Ans.

(c) Let x the mean proportional between 15 and 25, then

$15 : x :: x : 25$

$\because$ Product of extremes = Product of means

$\therefore \quad 15 \times 25 = x^2 \quad$ or $x^2 = 375$

or $\quad x = \sqrt{375} \quad$ or $\quad x = 5\sqrt{15}$

Hence, $\mathbf{5\sqrt{15}}$ **is the mean proportional between 15 and 25.**

Ans.

(d) Let x be the mean proportional between 40 and 50, then

$40 : x :: x : 50$

$\because$ Product of extremes = Product of means

$\therefore \quad 40 \times 50 = x \times x \quad$ or $x^2 = 2000$

$x = \sqrt{2000} \quad$ or $x = 20\sqrt{5}$

Hence, $\mathbf{20\sqrt{5}}$ **is the mean proportional between 40 and 50.**

Ans.

5. Let x be the third proportional to 24 and 12.

Then 24, 12 and x are in continued proportional i.e. $24 : 12 :: 12 : x$

$\because$ Product of extremes = Product of means

$\therefore 24 \times x = 12 \times 12 \quad$ or $x = \dfrac{12 \times 12}{24} \quad$ or $x = 6$

Hence, **the third continued proportional to 24 and 12 is 6.**

Ans.

6. We know that, if a, b, c are in continued proportional, then

$a : b :: b : c$

Here, $\quad 7 : 35 : 35 : x$

$\because$ Product of extremes = Product of means

$\therefore 7 \times x = 35 \times 35 \quad$ or $x = \dfrac{35 \times 35}{7} = 5 \times 35 = 175$

Hence, $\boldsymbol{x = 175}$ **Ans.**

7. We know that, if a, b, c are in continued proportional, then

$a : b :: b : c$

Here, $2 : 4 :: 4 : x$

$\because$ Product of extremes = Product of means

$\therefore 2 \times x = 4 \times 4$ or $x = \dfrac{4 \times 4}{2}$ or $x = 2 \times 4 = 8$

Hence, $\boldsymbol{x = 8}$ **Ans.**

8. Let x the third proportional to 4 and 12.

Then, 4, 12 and x are in continued proportional i.e. $4 : 12 :: 12 : x$

$\because$ Product of extremes = Product of means

$\therefore 4 \times x = 12 \times 12$ or $x = \dfrac{12 \times 12}{4}$ or $x = 3 \times 12 = 36$

Hence, **the third continued proportional to 4 and 12 is 36.** **Ans.**

9. We know that a week has 7 days. Let wrestler's eat x kg fruits, therefore

$\because$ Ratio of fruits = Ratio of days

$5 : x :: 2 : 7$

$\because$ Product of extremes = Product of means

$\therefore 5 \times 7 = x \times 2$ or $2x = 35$ or $x = \dfrac{35}{2} = 17.5$

Hence, **wrestler eat 17.5 kg fruits in a week.** **Ans.**

10. Let the cost of 7 kg sugar be x. Therefore,

$\because$ Ratio of sugar = Ratio of ₹

$2 : 7 :: 58 : x$

$\because$ Product of extremes = Product of means

$\therefore \quad 2 \times x = 7 \times 58$

or $x = ₹ \dfrac{7 \times 58}{2}$ or $x = ₹\ 29 \times 7$; $x =$ ₹ 203

Hence, **the cost of 7 kg sugar is ₹ 203.** **Ans.**

11. Let the number of girls be x.

$\because$ Ratio of boys and girls = Ratio of the number of the boys and girls.

$4 : 5 :: 24 : x$

$\because$ Product of extremes = Product of means

$$4 \times x = 5 \times 24$$

or $$x = \frac{5 \times 24}{4} = 5 \times 6 = 30$$

Hence, **the number of girls are 30.** **Ans.**

12. Let Arun covered x km distance.

$\because$ Ratio of hours = Ratio of distance

$$2 : 14 :: 5 : x$$

$\therefore$ Product of extremes = Product of means

$$2 \times x = 14 \times 5$$

or $$x = \frac{14 \times 5}{2} \text{ km} = 7 \times 5 \text{ km} = 35 \text{ km}$$

Hence, **Arun covered 35 km distance in 14 hours.** **Ans.**

Exercise 8.3

1. $\because$ The cost of 50 g almonds = ₹ 50

$\therefore$ The cost of 1 g almonds = ₹ $\frac{50}{50}$

$\therefore$ The cost of 1 kg (1000 g) almonds = ₹ $\frac{50}{50} \times 1000 =$ ₹ 1000

Hence, **the cost of 1 kg almonds = ₹ 1000** **Ans.**

2. $\because$ The cost of 6 hankies = ₹ 180

$\therefore$ The cost of 1 hankie = ₹ $\frac{180}{6}$

$\therefore$ The cost of 30 such hankies = ₹ $\frac{180}{6} \times 30 =$ ₹ $180 \times 5 =$ ₹ 900

Hence, **the cost of 30 hankies = ₹ 900** **Ans.**

3. $\because$ 10 g olives cost = ₹ 25

$\therefore$ 1 g olives cost = ₹ $\frac{25}{10} =$ ₹ 2.5

$\therefore$ Quantitiy of olives which can be purchase for ₹ 1000 $= \frac{1000}{2.5}$

$$= \frac{1000 \times 10}{25} \text{g} = 40 \times 10 \text{ g} = 400 \text{ g}$$

Hence, **400 g of olives can be bought for ₹ 1000.**

4. $\because$ 1 dozen $=12$

$\therefore$ The cost of 12 (dozen) oranges = ₹ 48

$\therefore$ The cost of 1 orange = ₹ $\frac{48}{12}$

$\therefore$ The cost of 60 oranges = ₹ $\frac{48}{12}\times 60 =$ ₹ $4\times 60 =$ ₹ 240

Hence, **cost of 60 oranges = ₹ 240.** **Ans.**

5. Distance cover in 4 hours by train $=120\times 4$ km $=480$ km

Now, speed of the train $=80$ km/hour

$\therefore$ Time taken by the train $=\frac{480}{80}$ hours $=6$ hours

Hence, **the time taken by the train = 6 hours** **Ans.**

6. $\because$ The weighs of 30 cm ruler of steel $=50$ g

$\therefore$ The weigh of 1 cm ruler of steel $=\frac{50}{30}$ g

$\therefore$ The weighs of 100 cm (1 m) ruler of steel $=\frac{50}{30}\times 100$ g

$$=\frac{50\times 10}{3}\text{ g}=\frac{500}{3}\text{ g}=166\frac{2}{3}\text{ g}$$

Hence, **the weight of a metre scale in 166 $\frac{2}{3}$ g.** **Ans.**

7. $\because$ Distance covers by a car in 5 litres of petrol $=80$ km

$\therefore$ Distance cover by a car in 1 litres of petrol $=\frac{80}{5}$ km

$\therefore$ Distance cover by a car in 3 litres of petrol $=\frac{80}{5}\times 3$ litres

$$=16\times 3\text{ km}=48\text{ km}$$

Hence, **48 km distance can covered a car in 3 litres petrol.** **Ans.**

8. $\because$ 50 labours dig a well in 30 days

$\therefore$ 1 labour dig a well in (50×30) days

$\therefore$ 40 labour dig a well $=\frac{50\times 30}{40}$ days $=\frac{75}{2}$ days $=37\frac{1}{2}$ days

Hence, **in 37 $\frac{1}{2}$ days will the work last.** **Ans.**

9. $\because$ Speed of the car $= 40$ km/h, time takes $= 5$ hours

$\therefore$ Total distance of a journey $= 40 \times 5$ km $= 200$ km

$\because$ Speed of the car $= 50$ km/hour

$\therefore$ Time taken by the cars $= \dfrac{\text{Distance}}{\text{Speed}} = \dfrac{200}{50}$ hours $= 4$ hours

Hence, **the time taken by the car = 4 hours** **Ans.**

10. $\because$ Whitewash a house in 4 days $= 3$ men

$\therefore$ Whitewash a house in 1 day $= 3 \times 4$ men

$\therefore$ Whitewash a house in 3 days $= \dfrac{3 \times 4}{3}$ men $= 4$ men

Hence, **required persons 4 men.** **Ans.**

Multiple Choice Questions

1. (i) The H.C.F. of 8 and 168 is 8.

$\therefore \quad \dfrac{8}{168} = \dfrac{8 \div 8}{168 \div 8} = \dfrac{1}{21}$

Hence, the answer **(a)** is correct. **Ans.**

(ii) The H.C.F. of 6 and 123 is 3.

$\therefore \quad \dfrac{6}{123} = \dfrac{6 \div 3}{123 \div 3} = \dfrac{2}{41}$

Hence, the answer **(b)** is correct. **Ans.**

(iii) The H.C.F. of 16 and 64 is 16.

$\therefore \quad \dfrac{16}{64} = \dfrac{16 \div 16}{64 \div 16} = \dfrac{1}{4}$

Hence, the answer **(d)** is correct. **Ans.**

(iv) H.C.F. of 4 and 64 is 4.

$\therefore \quad \dfrac{4}{64} = \dfrac{4 \div 4}{64 \div 4} = \dfrac{1}{16}$

Hence, the answer **(d)** is correct. **Ans.**

(v) 25 cm : 2 m $= 25$ cm : 200 cm **[$\because$ 1 m = 100 cm]**

$\therefore \quad \dfrac{25}{200} = \dfrac{25 \div 25}{200 \div 25} = \dfrac{1}{8} = 1 : 8$

Hence, the answer **(b)** is correct. **Ans.**

(vi) 3 kg : 300 g $= 3000$ g : 300 g **[$\because$ 1 kg = 1000 g]**

$$= \frac{3000\text{g}}{300\text{g}} = \frac{10}{1} = 10 : 1$$

Hence, the answer **(a)** is correct. **Ans.**

(vii) 30 paise : ₹ 5 = 30 paise : 500 paise **[∵ 1 ₹ = 100 paise]**

$$= \frac{30}{500} = \frac{3}{50} = 3 : 50$$

Hence, the answer **(b)** is correct. **Ans.**

(viii) 30 minutes : 1 hour = 30 minutes : 60 minutes

[∵ 1 hr = 60 min]

$$= \frac{30\,\text{minutes}}{60\,\text{minutes}} = \frac{3}{6} = \frac{1}{2} = 1 : 2$$

Hence, the answer **(a)** is correct. **Ans.**

9. Percentage and Its Applications

Exercise 9.1

1. (a) $80\% = \frac{80}{100} = \mathbf{\frac{4}{5}}$ **Ans.**

(b) $0.65\% = \frac{0.65}{100} = \frac{65}{100 \times 100} = \mathbf{\frac{13}{2000}}$ **Ans.**

(c) $26\frac{2}{3}\% = \frac{80}{3}\% = \frac{80}{3 \times 100} = \frac{8}{3 \times 10} = \mathbf{\frac{4}{15}}$ **Ans.**

(d) $0.78\% = \frac{0.78}{100} = \frac{78}{100 \times 100} = \frac{39}{50 \times 100} = \mathbf{\frac{39}{5000}}$ **Ans.**

2. (a) $4 : 1 = \frac{4}{1} = \left(\frac{4}{1} \times 100\right)\% = \mathbf{400\%}$ **Ans.**

(b) $\frac{8}{25} = \left(\frac{8}{25} \times 100\right)\% = (8 \times 4)\% = \mathbf{32\%}$ **Ans.**

(c) $\frac{3}{25} = \left(\frac{3}{25} \times 100\right)\% = (3 \times 4)\% = \mathbf{12\%}$ **Ans.**

(d) $\frac{5}{8} = \left(\frac{5}{8} \times 100\right)\% = \left(\frac{5 \times 25}{2}\right)\% = \frac{125}{2}\% = \mathbf{62\frac{1}{2}\%}$ **Ans.**

3. (a) 45% of ₹ 80 = ₹ $\frac{45}{100} \times 80$ = ₹ $\frac{45 \times 8}{10}$ = ₹ 9×4 = ₹ **36** **Ans.**

(b) 30% of $30\text{ m} = \frac{30}{100} \times 30\text{ m} = 3 \times 3\text{ m} = \mathbf{9\ m}$ **Ans.**

(c) 18% of $2.5\text{ kg} = \frac{18}{100} \times 2.5\text{ kg} = \frac{18 \times 25}{100 \times 10}\text{ kg} = \frac{9}{20}\text{ kg}$

$= \frac{9}{20} \times 1000\text{ g} = \mathbf{450\ g}$ **Ans.**

4. (a) ₹ $11.40 = 1140$ paise

Let $x\%$ of 1140 paise $= 38$ paise [$\because$ ₹ $1 = 100$ paise]

$\Rightarrow \quad \frac{x}{100} \times 1140 = 38$ or $x = \frac{38 \times 100}{1140}$

$x = \frac{10}{3}\% = 3\frac{1}{3}\%$

Hence, $\mathbf{3\frac{1}{3}\%}$ **of ₹ 11.40 is 38 paise.** **Ans.**

(b) Let $x\%$ of $2\text{ kg} = 7\text{ g}$

or $\frac{x}{100} \times 2000\text{ g} = 7\text{ g}$ [$\because$ $1\text{ kg} = 1000\text{ g}$]

or $x = \frac{7 \times 100}{2000}$ or $x = \frac{7}{20}\%$

Hence, $\mathbf{\frac{7}{20}\%}$ **of 2 kg is 7 g.** **Ans.**

5. Required marks will be pass $= 262 + 200 = 462$ marks

Let the total marks be x.

$\therefore \quad x \times 66\% = 462$ or $x \times \frac{66}{100} = 462$

or $x = \frac{462 \times 100}{66} = 7 \times 100 = 700$ marks

Hence, **the total marks be 700.** **Ans.**

6. Let the total marks be x.

For Amit:- Passing marks $= x$ of $56\% + 110$ ...(i)

For Sumit:- Passing marks $= x$ of $74\% - 34$ ...(ii)

For the equation (i) and (ii),

x of $56\% + 110 = x$ of $74\% - 34$

or $x \times \frac{56}{100} + 110 = x \times \frac{74}{100} - 34$

or $\frac{56x}{100} + 110 = \frac{74x}{100} - 34$

or $\frac{74x}{100} - \frac{56x}{100} = 110 + 34$

or $\frac{74x - 56x}{100} = 144$

or $18x = 144 \times 100$ [By cross- mutliplication]

$$x = \frac{144 \times 100}{18}$$

$$x = 800$$

Hence, **the total marks is 800.** **Ans.**

7. Saving increased $= 40\% - 20\% = 20\%$ **Ans.**

8. The population of town increases during first year

$$= \frac{18000 \times 20}{100} = 3600$$

Population of town after 1 year $= 18000 + 3600 = 21600$

The population town increases during second year.

$$= \frac{21600 \times 40}{100} = 8640$$

Population of town after 2 years $= 21600 + 8640 =$ **30240** **Ans.**

9. $\therefore$Percentage of passed students $= 65\%$

$\therefore$Percentage of failure students $= (100 - 65)\% = 35\%$

Thus, 35% of students $= 840$

Let total students be x. Then, $x \times 35\% = 840$ or $x \times \frac{35}{100} = 840$

or $x = \frac{840 \times 100}{35} = 2400$

Hence, **the total number of students is 2400.** **Ans.**

10. Let the number be x, then

15% of $x = 28\%$ of $650 - 38$ or $15 \times \frac{x}{100} = \frac{28}{100} \times 650 - 38$

or $\frac{15x}{100} = \frac{28 \times 650}{100} - 38$ or $\frac{15x}{100} = 182 - 38 = 144$

or $15x = 144 \times 100$ or $x = \dfrac{144 \times 100}{15} = 960$

Hence, **the number is 960.** **Ans.**

11. $\because$ Percentage of nitrate $= 75\%$

Percentage of sulpher $= 20\%$

$\therefore$ Percentage of charcoal $= 100\% - (75 + 20)\%$

$= (100 - 95)\% = 5\%$

$\because$ Total quantity of gun powder $= 120$ kg

$\therefore$ Quantity of charcoal $= 120$ kg of $5\% = 120 \times \dfrac{5}{100}$ kg $= 6$ kg

Hence, **the quantity of charcoal is 6 kg.** **Ans.**

12. $\because$ Percentage spends in machinery $= 40\%$

Percentage spends in building $= 15\%$

Percentage spends in raw material $= 25\%$

Percentage spends in furnture $= 5\%$

$\therefore$ Percentage of balance sawing $= 100\% - (40 + 15 + 25 + 5)\%$

$= (100 - 85)\% = 15\%$

Let the total money be initially had be x, then

x of $15\% =$ ₹ 1305 or $x \times \dfrac{15}{100} =$ ₹ 1305

or $15x =$ ₹ 1305×100 or $x =$ ₹ $\dfrac{1305 \times 100}{15} =$ ₹ 8700

Hence, **the total money is ₹ 8700.** **Ans.**

Exercise 9.2

1. C.P. = ₹ 460 and S.P. = ₹ 484

$\therefore$ Gain $=$ S.P. $-$ C.P. $=$ ₹ $(484 - 460) =$ ₹ 24

$\therefore$ Gain $\% = \dfrac{\text{gain} \times 100}{\text{C.P.}} = \dfrac{24 \times 100}{460}\% = \dfrac{120}{23}\% = 5\dfrac{5}{23}\%$ **Ans.**

2. C.P. = ₹ 320 and S.P. = ₹ 144

$\therefore$ Loss = ₹ $(320 - 144) =$ ₹ 176

Loss $\% = \dfrac{\text{loss} \times 100}{\text{C.P.}}\% = \dfrac{176 \times 100}{320}\%$

$= \dfrac{176 \times 5}{16}\% = 11 \times 5\% =$ **55%** **Ans.**

3. Let the C.P. of one articles be ₹ x.

$\therefore$C.P. of 20 articles = ₹ $20x$

Given S.P. of 18 articles = C.P. of 20 articles = ₹ $20x$

S.P. of one articles = ₹ $\frac{20}{18}x$

$$\text{Gain} = \text{S.P.} - \text{C.P.} = ₹\left(\frac{20}{18}x - x\right) = ₹\left(\frac{20x - 18x}{18}\right) = ₹\frac{2x}{18}$$

$$\therefore \text{Gain \%} = \left(\frac{\text{Gain}}{\text{C.P.}} \times 100\right)\% = \left(\frac{2x}{18 \times x} \times 100\right)\% = \frac{100}{9}\% = 11\frac{1}{9}\%$$ **Ans.**

4. S.P. of watch = ₹ 4140 and Loss = 10%

$$\text{C.P.} = \left(\frac{\text{S.P.} \times 100}{100 - \text{loss \%}}\right) = \frac{4140 \times 100}{100 - 10}$$

$$= \frac{4140 \times 100}{90} = ₹\ 46 \times 100 = ₹\ 4600$$

Now, he sell watch at 10% gain

$$\therefore \text{S.P.} = \frac{100 + \text{Gain \%}}{100} \times \text{C.P.} = \frac{100 + 10}{100} \times ₹\ 4600 = ₹\ \frac{110}{100} \times 4600$$

= ₹ 110×46 = ₹ **5060** **Ans.**

5. $\therefore$Let the S.P. of 1 book = ₹ x

$\therefore$S.P. of 200 books = ₹ $200x$

Profit = S.P. of 80 books = ₹ $80x$

C.P. = S.P. − Profit = ₹ $(200x - 80x)$ = ₹ $120x$

$$\therefore \text{Profit \%} = \left(\frac{80x}{120x} \times 100\right)\% = \frac{200}{3}\% = 66\frac{2}{3}\%$$ **Ans.**

6. Let the cost price of Sonu's watch = ₹ x

$\because$ Sonu get 5% gain.

$$\therefore \text{Gain} = ₹\ x \text{ of } 5\% = ₹\ x \times \frac{5}{100} = ₹\ \frac{x}{20}$$

$$\therefore \text{S.P.} = ₹\left(x + \frac{x}{20}\right) = ₹\left(\frac{20x + x}{20}\right) = ₹\ \frac{21x}{20}$$

This S.P. of Sonu the cost price to Rohit.

$$\therefore \text{C.P} > \text{of watch for Rohit} = \frac{21x}{20}$$

Now, profit $=10\% = ₹\left(\frac{21x}{20}\text{ of }10\%\right) = ₹\left(\frac{21x}{20}\times\frac{10}{100}\right) = ₹\frac{21x}{200}$

$\therefore$S.P. of watch $= ₹\left(\frac{21x}{20}+\frac{21x}{200}\right) = ₹\left(\frac{210x+21x}{200}\right) = ₹\frac{231x}{200}$

Now, according to question,

$$\frac{231x}{200} = ₹\,1155$$

$$x = ₹\,\frac{1155\times200}{231} = ₹\,5\times200 = ₹\,1000$$

Hence, **the cost price of Sonu's watch = ₹ 1000** **Ans.**

7. Cost price 15 kg of rice $= ₹\,15\times60 = ₹\,900$

Cost price 15 kg of another rice $= ₹\,15\times70 = ₹\,1050$

$\therefore$Total cost price $= ₹\,(900+1050) = ₹\,1950$

S.P. of mixture $= ₹\,30\times67.50 = ₹\,2025$

$\because$ S.P. > C.P.

$\therefore$Gain $= ₹\,(2025-1950) = ₹\,75$ **Ans.**

Gain $\% = \left(\frac{\text{Profit}}{\text{C.P.}}\times100\right)\% = \left(\frac{75}{1950}\times100\right)\% = \frac{50}{13}\% = 3\frac{11}{13}\%$ **Ans.**

8. Let C.P. of one radio $= ₹\,x$

Gain $= ₹\,x\times\frac{20}{100} = ₹\,\frac{x}{5}$, Now $₹\,x + ₹\,\frac{x}{5} = ₹\,8000$

or $6x = ₹\,8000\times5 \Rightarrow x = ₹\,\frac{40000}{6} = ₹\,\frac{20000}{3}$

$\therefore$C.P. of other radio $= ₹\,16000 - ₹\,\frac{20000}{3} = ₹\,\frac{28000}{3}$

And S.P. of other radio $= ₹\,8000$

$\therefore$Loss $= ₹\,\frac{28000}{3} - ₹\,8000 = ₹\,\frac{4000}{3}$

$\therefore$Loss percentage $= ₹\,\frac{4000}{3}\times100\times\frac{3}{28000}\% = \frac{100}{7}\% = \mathbf{14\frac{2}{7}\%}$

Ans.

9. Let C.P. of transistor = ₹ x

Gain = 16%

$\therefore$ Gain = ₹ $x \times \frac{16}{100}$ = ₹ $\frac{4x}{25}$

$\therefore$ S.P. of transister = ₹ x + ₹ $\frac{4x}{25}$ = ₹ $\frac{29x}{25}$

According to question,

$$₹\ \frac{29x}{25} + ₹\ 40 = ₹\ x + ₹\ x \times \frac{40}{100}$$

$$\Rightarrow \quad \frac{₹\ 29x + ₹\ 1000}{25} = \frac{₹\ 140x}{100}$$

$$\Rightarrow \quad ₹\ 116x + ₹\ 4000 = ₹\ 140x$$

$$\Rightarrow \quad 24x = ₹\ 4000$$

$$\Rightarrow \quad x = \frac{₹\ 4000}{24} = ₹\ \mathbf{166\frac{2}{3}}$$ **Ans.**

10. $\because$ C.P. of 4 pencils = ₹ 10

$\therefore$ C.P. of 1 pencil = ₹ $\frac{10}{4}$ = ₹ 2.50

$\because$ S.P. of 5 pencils = ₹ 16

$\therefore$ S.P. of 1 pencil = ₹ $\frac{16}{5}$ = ₹ 3.20

Gain = S.P. − C.P. = ₹ 3.20 − ₹ 2.50 = ₹ 0.70

$$\therefore \text{Gain \%} = \left(\frac{\text{Profit}}{\text{C.P.}} \times 100\right)\%$$

$$= \left(\frac{0.70}{2.50} \times 100\right)\% = \left(\frac{70}{250} \times 100\right)\% = 28\%$$

Hence, **the gain percent = 28%** **Ans.**

11. In first condition :

$$₹\ 800 \text{ of } \frac{3}{4} = ₹\ 800 \times \frac{3}{4} = ₹\ 600$$

$\because$ C.P. = ₹ 600, Loss = 10%

$\therefore$ S.P. $= ₹\left(\frac{100-\text{Loss}\%}{100}\right)\times$ C.P.

$= ₹\frac{100-10}{100}\times 600 = ₹\frac{90}{100}\times 600 = ₹\ 540$

In second condition :

Remaining sugar $= ₹\ (800-600) = ₹\ 200$

Gain $= 10\%$

$\therefore$ S.P. $= \left(\frac{100+\text{gain}\%\times}{100}\right)$ C.P.

$= ₹\left(\frac{100+10}{100}\right)\times 200 = ₹\frac{110}{100}\times 200 = ₹\ 220$

In first condition, shopkeeper loss $= ₹\ (600-540) = ₹\ 60$

In second condition, shopkeeper gain $= ₹\ (220-200) = ₹\ 20$

$\therefore$ Loss $= ₹\ (60-20) = ₹\ 40$

Loss $\% = \left(\frac{\text{Loss}}{\text{C.P.}}\times 100\right)\% = \frac{40}{800}\times 100\% = \mathbf{5\%}$ **Ans.**

12. C.P. of 22 books $= ₹\ 20$ S.P. of 20 books $= ₹\ 22$

S.P. of 22 books $= ₹\frac{22}{20}\times 22 = ₹\ 24.20$

Profit $= ₹\ (24.20 - ₹\ 20) = ₹\ 4.20$

Profit $= \left(\frac{\text{Profit}}{\text{C.P.}}\times 100\right)\% = \frac{4.20}{20}\times 100\% = \frac{420\times 100}{20\times 100}\% = 21\%$

Hence, **the profit percent = 21%** **Ans.**

13. Let the C.P. of 1 g tea be ₹ 1.

$\therefore$ C.P. of 1000 g $= ₹\ 1000$

S.P. $= \left(\frac{100-6}{100}\times 1000\right) = ₹\frac{94}{100}\times 1000 = ₹\ 940$

$\therefore$ Weight profit in 2 kg $= 2000\text{ g} - 1800\text{ g} = 200\text{ g}$

or profit in 1 kg $= \frac{200}{2}\text{ g} = 100\text{ g}$

$\therefore$ Profit $= ₹\ 100$ Net profit $= ₹\ 100 - ₹\ 60 = ₹\ 40$

Profit $\% = \frac{40\times 100}{1000}\% = 4\%$

Ans.

14. Total cost price of 200 watches = ₹ $800 \times 200 =$ ₹ 160000

Total profit = ₹ $160000 \times \frac{40}{100} =$ ₹ 64000

C.P. of 20 watches = ₹ $800 \times 20 =$ ₹ 16000

Profit of 20 watches = ₹ $16000 \times \frac{5}{100} =$ ₹ 800

$\therefore$ Remaining profit = ₹ 64000 − ₹ 800 = ₹ 63200

$\therefore$ Profit in 1 watch = ₹ $\frac{63200}{(200-20)} =$ ₹ $\frac{63200}{180} =$ ₹ $\frac{3160}{9}$

$\therefore$ S.P. of 1 watch = ₹ $800 +$ ₹ $\frac{3160}{9} =$ ₹ $\frac{10360}{9} =$ ₹ $\mathbf{1151\frac{1}{9}}$ **Ans.**

15. Let the C.P. of one article be ₹ 1.

C.P. of 10 articles = ₹ 10

Given, S.P. of 15 articles = C.P. of 10 articles = ₹ 10

$\therefore$ S.P. of one article = ₹ $\frac{10}{15}$

Loss = C.P. − S.P. = ₹ $\left(1-\frac{10}{15}\right) =$ ₹ $\left(\frac{15-10}{15}\right) =$ ₹ $\frac{5}{15}$

Loss % = $\left(\frac{\text{Loss}}{\text{C.P.}} \times 100\right)\% = \frac{5}{15 \times 1} \times 100\%$

$= \frac{100}{3}\% = 33\frac{1}{3}\%$

Hence, **the loss % = $\mathbf{33\frac{1}{3}\%}$** **Ans.**

16. $\because$ S.P. of the coat = ₹ 930 and gain = 5%

$\therefore$ Cost price = $\left(\frac{100}{100+\text{Gain}}\right) \times$ S.P.

$= ₹ \left(\frac{100}{100+5}\right) \times 930 =$ ₹ $\frac{100}{105} \times 930 =$ ₹ $\frac{6200}{7} =$ ₹ $885\frac{5}{7}$

Hence, **the cost price of the coat is ₹ $\mathbf{885\frac{5}{7}}$.** **Ans.**

Exercise 9.3

1. M.P. = ₹ 400 and discount = 20%

Discount = ₹ 400 of 20% = ₹ $400 \times \frac{20}{100} =$ ₹ 80

$\therefore$ S.P. = M.P. − Discount = ₹ $(400-80) =$ ₹ 320

Hence, **the S.P. is ₹ 320.** **Ans.**

2. S.P. = ₹ 900 and discount = 25%
Let the M.P. be ₹ x.
$\therefore$ M.P. − Discount = S.P.
$\therefore \quad x - \frac{25x}{100} = ₹\ 900 \quad$ or $\frac{100x - 25x}{100} = ₹\ 900$
or $\frac{75x}{100} = ₹\ 900 \qquad$ or $75x = ₹\ 900 \times 100$
$x = ₹\ \frac{900 \times 100}{75} = ₹\ 1200$
Hence, the M.P. is ₹ 1200. **Ans.**

3. Let C.P. of goods be ₹ 100.
And profit = ₹ 52
$\therefore$ S.P. = 100 + ₹ 52 = ₹ 152
Let M.P = ₹ x
Discount % = 20%
Discount = $\frac{x \times 20}{100} = ₹\ \frac{x}{5}$
S.P. = $x - \frac{x}{5} = ₹\ \frac{4x}{5}$
$\frac{4x}{5} = 152 \quad x = ₹190$ **required % = 90%** **Ans.**

4. Discount = ₹ $300 \times \frac{20}{100} = ₹\ 60$
Discount = ₹ 300 − 216 = 84
Remaining discount = ₹84 − ₹ 60 = ₹
$\therefore$ Percentage = $\frac{₹\ 24 \times 100}{240} = 10\%$ **Ans.**

5. Gain percent = 45% M.P − ₹480
Discount = $\frac{480 \times 20}{100} = ₹96$ S.P = ₹ 384
C.P = $\frac{100}{100 + 10} \times 384 = 331$
Profit % = $\frac{480 - 331}{331} \times 100 = 45\%$ **Ans.**

Exercise 9.4

1. $\because$ P = ₹ 212.50, R = 15% and T = 8 years
$\therefore$ S.I. = $\frac{P \times T \times R}{100} = ₹\ \frac{212.50 \times 8 \times 15}{100} = ₹\ \frac{21250 \times 8 \times 15}{10000} = ₹\ 255$
Hence **the S.I. is ₹ 255** **Ans**

2. $\because P = ₹\,17000,\ A = ₹\,31535,\ R = 9\frac{1}{2}\% = \frac{19}{2}\%$

$$\text{S.I.} = A - P = ₹\,31535 - ₹\,17000 = ₹\,14535$$

$$\text{S.I.} = \frac{P \times T \times R}{100} \text{ or } T = \frac{\text{S.I.} \times 100}{P \times R}$$

$$T = \frac{14535 \times 100 \times 2}{17000 \times 19} = \frac{171}{19} = 9 \text{ years}$$

Hence, **the time is 9 years.** **Ans.**

3. Interest get to bank

$$\text{S.I.} = \frac{P \times T \times R}{100} = ₹\,\frac{4200 \times 1 \times 16}{100} = ₹\,672$$

Interest get to post office.

$$\text{S.I.} = \frac{P \times T \times R}{100} = ₹\,\frac{1400 \times 1 \times 6}{100} = ₹\,84$$

Total interest = ₹ 672 + ₹ 84 = ₹ **756** **Ans.**

4. Let ₹ x lent at 5% interest and ₹ $(8000 - x)$ be lent at 4%.

$$\Rightarrow \quad \frac{x \times 1 \times 5}{100} + \frac{(8000 - x) \times 1 \times 4}{100} = ₹\,390$$

$$\Rightarrow \quad \frac{5x}{100} + \frac{32000 - 4x}{100} = ₹\,390$$

$$\Rightarrow \quad \frac{5x + 32000 - 4x}{100} = ₹\,390$$

$$\Rightarrow \quad \frac{x + 32000}{100} = ₹\,390$$

$$\Rightarrow \quad x + 32000 = 390 \times 100 \text{ [By cross-multiply]}$$

$$\Rightarrow \quad x = ₹\,39000 - ₹\,32000$$

$$\Rightarrow \quad x = ₹\,7000$$

Amount lent at 4% = ₹ $(8000 - x)$ = ₹ $(8000 - 7000)$ = ₹ 1000

Hence, **man give ₹ 1000 lent at 4%.** **Ans.**

5. $\because$ Amount of 4 years = ₹ 2990

Amount of $5\frac{1}{2}$ years = ₹ 3282.50

$\therefore$ S.I. of $1\frac{1}{2}$ years = Amount of $5\frac{1}{2}$ years − Amount of 4 years.

$= ₹\ 3282.50 - ₹\ 2990 = ₹\ 292.50$

S.I. of 1 year $= ₹\ \dfrac{292.50}{3/2} = ₹\ \dfrac{292.5 \times 2}{3} = ₹\ \dfrac{585}{3} = ₹\ 195$

S.I. of 4 years $= ₹\ 195 \times 4 = ₹\ 780$

$\therefore$ $P =$ Amount of 4 years $-$ Interest of 4 years

$= ₹\ 2990 - ₹\ 780 = ₹\ 2210$

$$R = \frac{\text{S.I.} \times 100}{P \times T} = \frac{780 \times 100}{2210 \times 4} = \frac{150}{17} = 8\frac{14}{17}\%$$

Hence, $\boldsymbol{P} = ₹\ \mathbf{2210}$ **and** $\boldsymbol{R} = \mathbf{8\frac{14}{17}\%}$ **Ans.**

6. Let P be ₹ x.

Thus, S.I. $= ₹\ x \times \dfrac{5}{8} = ₹\ \dfrac{5x}{8}$, $T = 12\dfrac{1}{2}$ years $= \dfrac{25}{2}$ years.

$$\text{S.I.} = \frac{P \times T \times R}{100}$$

or $T = \dfrac{\text{S.I.} \times 100}{P \times T} = \dfrac{5x \times 100 \times 2}{8 \times x \times 25} = 5\%$

Hence, **the rate per cent per annum is 5%.** **Ans.**

7. $P = ₹\ 5000$, $T = 8$ years, S.I. $= ₹\ 2000$

$\therefore$ $\text{S.I.} = \dfrac{P \times R \times T}{100}$ or $R = \dfrac{\text{S.I.} \times 100}{P \times T}$

$$R = \frac{2000 \times 100}{5000 \times 8}\% \quad \text{or } R = 5\%$$

Hence, **the rate of interest is 5%.** **Ans.**

8. $P = ₹\ 20000$, $R = 5\%$

and $T = 2$ years 3 months $= 2\dfrac{3}{12}$ years $= 2\dfrac{1}{4}$ years $= \dfrac{9}{4}$ years.

$$\text{S.I.} = \frac{P \times R \times T}{100} = ₹\ \frac{20000 \times 5 \times 9}{100 \times 4}$$

S.I. $= ₹\ 2250$

Amount (A) $= P + \text{S.I.} = ₹\ 20000 + 2250 = 22250$

Hence, **the amount ₹ 22250 return farmer had to return.** **Ans.**

9. The day on which borrow money is taken counted and the day on barrow money returned is not counted for interest purpose.

i.e. 18^{th} March is included and 26^{th} October is excluded.

Thus, number of days from 18^{th} March, 2015 to 26^{th} October, 2015 are March $= 31 - 17 = 14$ days, April $= 30$ days, May $= 31$ days, June $= 30$ days, July $= 31$ days, August $= 31$ days, September $= 30$ days, October $= 25$ days

Total days $= 14 + 30 + 31 + 30 + 31 + 31 + 30 + 25 = 222$ days

$$= \frac{222}{365} \text{ years}$$

$P = ₹\ 8000$, $R = 8\%$

$$\text{S.I.} = ₹\ \frac{8000 \times 8}{100} \times \frac{222}{365} = ₹\ \frac{128 \times 222}{73} = ₹\ \frac{28416}{73} = ₹\ 389.26$$

Hence, **₹ 389.26 has to be paid.** **Ans.**

10. Principal $= ₹\ P$, Amount $= ₹\ 2P$

$T = 5$ years

$\therefore$ S.I. $=$ Amount $-$ Principal $= ₹\ 2P - ₹\ P = ₹\ P$

$$R = \frac{\text{S.I.} \times 100}{P \times T} = \frac{P \times 100}{P \times 5} = 20\%$$

Again, Principal $= P$, Amount $= 4P$, $R = 20\%$

S.I. $=$ Amount $-$ Principal $= ₹\ 4P - ₹\ P = ₹\ 3P$

$$T = \frac{\text{S.I.} \times 100}{P \times R} = \frac{3P \times 100}{P \times 20} = \textbf{15 years.}$$

Ans.

11. **For Om:-** $P = ₹\ 25000$, $R = 5\%$, $T = 4$ years

$$\text{S.I.} = \frac{P \times T \times R}{100} = ₹\ \frac{25000 \times 4 \times 5}{100} = ₹\ 5000$$

Amount $= P +$ S.I. $= ₹\ 25000 + ₹\ 5000 = ₹\ 30000$

Thus, **after 4 years Om return ₹ 30000.**

For Mayur:- $P = ₹\ 25000$, $R = 7\%$, $T = 4$ years

$$\text{S.I.} = \frac{P \times T \times R}{100} = ₹\ \frac{25000 \times 7 \times 4}{100} = ₹\ 7000$$

Amount $= ₹\ 25000 + ₹\ 7000 = ₹\ 32000$

Thus, after 4 years Mayur return ₹ 32000

Money earned by Om $= ₹\ 32000 - ₹\ 30000 = ₹\ 2000$

Hence, **after final transaction Om earned ₹ 2000.** **Ans.**

12. $P = ₹\ 400, T = 7 \text{ months} = \frac{7}{12} \text{ years}$

$R = 8 \text{ paise/ ₹/month} = 8 \times 12 \text{ paise/ ₹/year}$

$= 96\% \text{ per year}$

$$\text{S.I.} = \frac{P \times T \times R}{100} = ₹\ \frac{400 \times 7 \times 96}{100 \times 12} = 7 \times 32 = ₹\ 224$$

Hence, **the simple interest is ₹ 224.** **Ans.**

Multiple Choice Questions

1. (i) Let $x\%$ of $750 = 90$ or $x \times \frac{1}{100} \times 750 = 90$

or $x = \frac{90 \times 100}{750}$ or $x = 12\%$

Hence, the answer **(d)** is correct. **Ans.**

(ii) $5 : 1 = \left(\frac{5}{1} \times 100\%\right) = 500\%$

Hence, the answer **(c)** is correct. **Ans.**

(iii) $3 \text{ kg} : 300 \text{ g} = 3000 \text{ g} : 300 \text{ g}$ **[$\because$ 1 kg = 1000 g]**

$$= \frac{3000 \text{g}}{300 \text{g}} = \frac{10}{1} = 10 : 1$$

Hence, the answer **(b)** is correct. **Ans.**

(iv) 50% of $1 \text{ km} = 50 \times \frac{1}{100} \times 1000 \text{ m}$ **[$\because$ 1 km = 1000 m]**

$$= \frac{50 \times 1000}{100} \text{ m} = 500 \text{ m}$$

Hence, the answer **(c)** is correct. **Ans.**

(v) Sum of the ratio $= 2 + 3 = 5$

$\therefore$ The A share $= ₹\ 720 \times \frac{2}{5} = ₹\ 144 \times 2 = ₹\ 288$

Hence, the answer is **(a)** correct. **Ans.**

(vi) C.P. $= ₹\ 520$, S.P. $= ₹\ 650$

$\therefore$ Profit $= ₹\ 650 - ₹\ 520 = ₹\ 130$

$$\text{Profit } \% = \frac{\text{Profit} \times 100}{\text{C.P.}} = \frac{₹\ 130 \times 100}{₹\ 650} = 20\%$$

Hence, the answer **(b)** is correct. **Ans.**

(vii) $0.45 = \frac{45}{100} = \frac{45 \div 5}{100 \div 5} = \frac{9}{20}$

Hence, the answer **(a)** is correct. **Ans.**

(viii) $\because$ Worker paid in 10 days = ₹ 1500

$\therefore$ Worker paid in 1 day = ₹ $\frac{1500}{10}$ = ₹ 150

$\therefore$ Worker paid in 7 days = ₹ 150×7 = ₹ 1050

Hence, the answer **(c)** is correct. **Ans.**

10. Understanding Shapes

Exercise 10.1

1. (a) Since $\angle AOB$ is less than 90°, hence it is an acute angle. **Ans.**

(b) Since $\angle AOB$ is 90°, hence it is a right angle. **Ans.**

(c) Since $\angle AOB$ is 180°, hence it is a straight angle. **Ans.**

(d) Since $\angle AOB$ is between 180° and 360°, hence it is a reflex angle. **Ans.**

(e) since $\angle AOB$ is 360°, hence it is a complete angle. **Ans.**

2. Since a and b are a linear pair of angle,
therefore $a + b = 180°$. Hence

(a) If $a = 45°$, $b = 180° - 45° = 135°$

Hence, $\boldsymbol{b = 135°}$ **Ans.**

(b) If $a = 90°$, $b = 180° - 90° = 90°$

Hence, $\boldsymbol{b = 90°}$ **Ans.**

(c) If $a = 120°$, $b = 180° - 120° = 60°$

Hence, $\boldsymbol{b = 60°}$ **Ans.**

(d) If $a = 60°$, $b = 180° - 60° = 120°$

Hence, $\boldsymbol{b = 120°}$ **Ans.**

3. We know that, two angle are said to be complementary angles, if the sum of their magnitudes is 90°.
therefore, $a + b = 90°$

(a) If $a = 25°$, then $b = 90° - 25° = 65°$

Hence, complements angles of 25° is **65°** angle. **Ans.**

(b) If $a = 60°$, then $b = 90° - 60° = 30°$

Hence, complementary angle of 60° is **30°** angle. **Ans.**

(c) If $a = 70°$, then $b = 90° - 70° = 20°$

Hence, complements angle of $70°$ is **20°** angle. **Ans.**

(d) If $a = 90°$, then $b = 90° - 90° = 0°$

Hence, complementary angle of $90°$ is **0°** angle. **Ans.**

4. We know that, two angles are said to be supplementary, if the sum of their magnitudes is $180°$. Therefore $a + b = 180°$

(a) If $a = 60°$, then $b = 180° - 60° = 120°$

Hence, supplementary angle of $60°$ is **120°** angle. **Ans.**

(b) If $a = 90°$, then $b = 180° - 90° = 90°$

Hence, supplementary angle of $90°$ is **90°** angle. **Ans.**

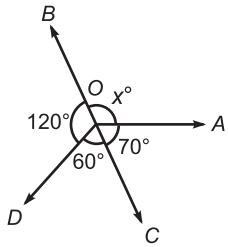
(c) If $a = 120°$, then $b = 180° - 120° = 60°$

Hence, supplementary angle of $120°$ is **60°** angle. **Ans.**

(d) If $a = 150°$, then $b = 180° - 150° = 30°$

Hence, supplementary angle of $150°$ is **30°** angle. **Ans.**

5. (a) In the figure:



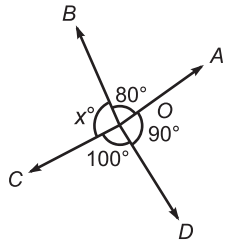
$\angle AOC$ and $\angle AOB$ are a linear pair of angle, therefore

$$\angle AOC + \angle AOB = 180°$$

or $$70° + x° = 180° \text{ or } x° = 180° - 70° = 110°$$

Hence, **the value of x is 110°.** **Ans.**

(b) In the figure, $\angle AOB$, $\angle BOC$, $\angle COD$ and $\angle DOA$ are complete angles therefore



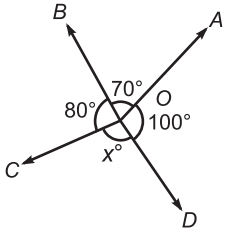
$$\angle AOB + \angle BOC + \angle COD + \angle DOA = 360°$$

$$80° + x° + 100° + 90° = 360°$$

or $x° + 270° = 360°$ or $x = 360° - 270° = 90°$

Hence, **the value of x is 90°.** **Ans.**

(c) In the figure, $\angle AOB$, $\angle BOC$, $\angle COD$ and $\angle DOA$ are complete angle, therefore



$\angle AOB + \angle BOC + \angle COD + \angle DOA = 360°$

$70° + 80° + x° + 100° = 360°$

or $250° + x = 360° \Rightarrow x = 360° - 250° = 110°$

Hence, **the value of $x = 110°$** **Ans.**

(d) Sum of the all angles = complete angle

$\therefore \quad 2x + x + 2x + 3x + 4x = 360°$

or $12x = 360°$ or $x = \dfrac{360°}{12} = 30°$

Hence, **the value of $x = 30°$** **Ans.**

(e) Sum of the all angles = Complete angle

$\therefore \quad x + 5x + 4x + 5x + 3x = 360°$

$18x = 180°$ or $x = \dfrac{360°}{18} = 20°$

Hence, **the value of $x = 20°$** **Ans.**

(f) Sum of the all angles = Complete angle

$\therefore \quad x + 6x + 7x + 5x + 5x = 360°$

$24x = 360°$ or $x = \dfrac{360°}{24} = 15°$

Hence, **the value of $x = 15°$** **Ans.**

(g) Since vertically opposite angles equal.

So, $\angle BOD = \angle AOC$ (Vertically opposite angles)

$\therefore \quad \angle BOD = \angle AOC$

Thus, $40° = x$ or $x = 40°$

Hence, **the value of x is 40°.** **Ans.**

(h) Since, vertically opposite angles are equal.

So, $\angle BOD = \angle AOC$ (Vertically opposite angles)

$\therefore 40° - x = x + 10°$ or $x + x = 40° - 10° = 30°$

$2x = 30°$ or $x = \frac{30°}{2} = 15°$

Hence, **the value of $x = 15°$** **Ans.**

(i) $2(3x + 5x + x) = 360°$

$\Rightarrow \quad 9x = 180°$

$\Rightarrow \quad x = 20°$ **Ans.**

6. Name all pairs of angles having one common arm, but their interiors are different. They are adjacent angles. We can name these adjacent angles as

$\angle POQ$ and $\angle QOR$; $\angle QOR$ and $\angle ROS$

$\angle POQ$ and $\angle QOS$; $\angle POR$ and $\angle ROS$ **Ans.**

7. Let the angles be $7x°$ and $11x°$.

Since the two angles are supplementary.

$\therefore \quad 7x° + 11x° = 180°$ or $18x° = 180°$

or $x = \frac{180°}{18} = 10°$

$\therefore$ The required angles are $7x° = 7 \times 10° = 70°$ and

$11x° = 11 \times 10° = 110°$

Hence, **the angels are 70° and 110°.** **Ans.**

8. Let one of the angles be $x°$, then the other angle will be $x° + 40°$.

Since the two angles are supplementary.

$\therefore \quad x° + (x° + 40°) = 180°$ or $2x° + 40° = 180°$

or $2x° = 180° - 40° = 140°$

$x = \frac{140°}{2} = 70°$

$\therefore \quad x + 40° = 70° + 40° = 110°$

Hence, **the angles are 70° and 110°.** **Ans.**

9. Let the angles be $2x$ and $7x$.

$\because$ The given angels are complementary.

$\therefore \quad 2x° + 7x° = 90°$ or $9x° = 90°$

$x° = \frac{90°}{9} =$

$\therefore$ The required angles are $2x° = 2 \times 10° = 20°$ and

$7x° = 7 \times 10° = 70°$

Hence, **the angles are 20° and 70°.** **Ans.**

10. Let one of the angle be $x°$, then the other angle will be $x + 30°$.

$\because$ The given angle are complementary.

$\therefore \quad x° + (x° + 30°) = 90°$ or $2x° + 30° = 90°$

or $2x° = 90° - 30° = 60°$ or $x° = \dfrac{60°}{2} = 30°$

$\therefore$ The required angle $x = 30°$ and $x + 30° = 30° + 30° = 60°$

Hence, **the angles are 30° and 60°.** **Ans.**

11. (a) In the figure, the angles $\angle AOP$, $\angle POQ$, $\angle QOR$ and $\angle ROB$ are linear angles.

$\therefore \quad \angle AOP + \angle POQ + \angle QOR + \angle ROB = 180°$

or $x° + 3x° + 4x° + x° = 180°$

or $9x° = 180°$ or $x° = \dfrac{180°}{9} = 20°$

Hence, **the value of x is 20°.** **Ans.**

(b) Since, OA and OB are opposite rays and OC stands on BOA, therefore $\angle AOC$ and $\angle BOC$ form in linear pair.

Hence, $\angle BOC + \angle AOC = 180°$

$\therefore \quad x + 5x = 180°$ or $6x = 180°$

or $x = \dfrac{180°}{6} \Rightarrow x = 30°$

Hence, $\boldsymbol{x = 30°}$ **Ans.**

(c) Since, vertically opposite angles are equal.

So, $\angle DOB = \angle AOC$ (Vertically opposite angles)

$\therefore \quad a = 45° \Rightarrow a = 45°$

Now, $\angle DOB$ and $\angle BOC$ form in linear pair.

Hence, $\angle DOB + \angle BOC = 180°$

$\therefore \quad 45° + b = 180°$ or $b = 180° - 45° \Rightarrow b = 135°$

Again, vertically opposite angles are equal.

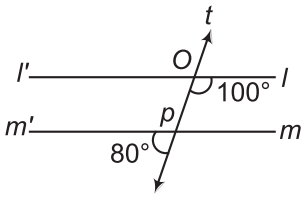
So, $\angle BOC = \angle DOA$

$\therefore \quad b = c$ or $135° = c$ or $c = 135°$

Hence, $\boldsymbol{a = 45°, b = 135°}$ **and** $\boldsymbol{c = 135°}$. **Ans.**

Exercise 10.2

1.



$\because \quad \angle l'OP = 180° - 100° = 80°$

And $\angle m'PO = 180° - 80° = 100°$

$\therefore \quad l \parallel m$ **Proved.**

2. Since $AB \parallel CD$ and t_1 and t_2 are two transversals.

$\therefore x = 180° - 60° = \mathbf{120°}$ (Coinheritor Angles)

and $y = 180° - 110° = \mathbf{70°}$ (linear pairs) **Ans.**

3. Two pair of alternate angles are: $\angle$**3, $\angle$8 and $\angle$4, $\angle$5** **Ans.**

Two pairs fo corresponding angles are: $\angle 1, \angle 2$ and $\angle 8, \angle 5$. **Ans.**

Two pairs of co-interior angles are: $\angle 3, \angle 5$ and $\angle 4, \angle 8$ **Ans.**

4. We have $\angle 3 = 70°$

Since, $\angle 3 = \angle 1$ (Vertically opposite angles)

$\therefore \quad \angle 1 = 70°$ $\angle 1 = \angle 5$ (Corresponding angles)

$\therefore \angle 5 = 70°$ $\angle 2 = 180° - \angle 1$ (Linear pairs)

$\angle 2 = 180° - 70° = 110°$

$\angle 2 = \angle 4$ (Vertically opposite angles)

$\therefore \angle 4 = 110°$ $\angle 5 = \angle 7$ (Vertically opposite angles)

$\therefore \angle 5 = 70°, \angle 8 = 180° - \angle 5$ (Linear pairs)

$\therefore \angle 8 = 180° - 70° = 110°$

$\angle 6 = \angle 8$ $\therefore \angle 8 = 110°$ (Vertically opposite angle)

Hence, $\angle 1 = \angle 3 = \angle 5 = \angle 7 = 70°$ and $\angle 2 = \angle 4 = \angle 6 = \angle 8 = 110°$ **Ans.**

5. $\because AD \parallel BC$

In the triangle ABC,

By sum-angle property of triangle,

$60° + 50° + y° = 180°$ or $110° + y° = 180°$

$\therefore y° = 180° - 110° \quad \Rightarrow y° = 70°$

$\angle x = 180° - (60° + 70°)$ or $\angle x = 180° - 130° = 50°$

Hence, $\angle \boldsymbol{x} = \mathbf{50°}$ **and** $\angle \boldsymbol{y} = \mathbf{70°}$ **Ans.**

6. $\because m \parallel n$

And $l \parallel m$

$\therefore l \parallel n$ **Proved.**

7. $\because l \parallel m$

And $m \parallel n$

$\therefore l \parallel n$ **Proved.**

8. Since $AB \parallel CD$ and CD is transversal.

$\angle A = 70°$ (Alternate angles)

$\angle C = 180° - (60° + 70°) = 180° - 130° = 50°$

$\angle B = 180° - (70° + 70°) = 180° - 120° = 60°$

Hence, $\angle \boldsymbol{A} = \mathbf{70°}$, $\angle \boldsymbol{B} = \mathbf{60°}$ and $\angle \boldsymbol{C} = \mathbf{50°}$ **Ans.**

9. (a) Complementary of $30° = 90° - 30° = \mathbf{60°}$ **Ans.**

(b) Complementary of $50° = 90° - 50° = \mathbf{40°}$ **Ans.**

(c) Complementary of $80° = 90° - 80° = \mathbf{10°}$ **Ans.**

(d) Complementary of $90° = 90° - 90° = \mathbf{0°}$ **Ans.**

10. (a) Supplementary of $70° = 180° - 70° = \mathbf{110°}$ **Ans.**

(b) Supplementary of $120° = 180° - 120° = \mathbf{60°}$ **Ans.**

(c) Supplementary of $30° = 180° - 30° = \mathbf{150°}$ **Ans.**

(d) Supplementary of $50° = 180° - 50° = \mathbf{130°}$ **Ans.**

11. Since, BO and OA are opposite rays and OC stands on BOA therefore $\angle AOC$ and $\angle BOC$ form in linear pairs.

Here, $\angle AOC + \angle BOC = 180°$

$x + 110° = 180°$

$\therefore \quad x = 180° - 110° = 70°$

Hence, $\boldsymbol{x} = \mathbf{70°}$ **Ans.**

12. $y + 2y + 3y = 180°$ [Linear pairs]

or $6y = 180°$

or $y = \dfrac{180°}{6} = 30°$

Hence, $\boldsymbol{y} = \mathbf{30°}$ **Ans.**

13. Let the smaller angle $= x°$

Then, the other angle $= 2x°$

By the definition of complementary angles.

$x° + 2x° = 90°$ or $3x° = 90°$ or $x° = \frac{90°}{3} = 30°$

$\therefore 2x° = 2 \times 30° = 60°$

Hence, **the required angles are 30° and 60°.** **Ans.**

14. Let one of the angles be $x°$, then other angle will be $x° + 20°$.

Since the two angles are supplementary.

$\therefore \quad x° + (x + 20)° = 180°$ or $2x° + 20° = 180°$

or $2x° = 180° - 20° = 160°$

$$x = \frac{160°}{2} = 80°$$

$\therefore \quad x + 20° = 80° + 20° = 100°$

Hence, **the angles are 80° and 100°.** **Ans.**

15. We have, $\angle 7 = 80°$

Since, $\angle 7 = \angle 3$ (Corresponding angles)

$\therefore \quad \angle 3 = 80° \quad \because \angle 3 = \angle 1$ (Vartical opposite angle)

$\therefore \quad \angle 1 = 80°$ and $\angle 1 = \angle 5$ (Corresponding angles)

$\therefore \quad \angle 5 = 80°$ and $\angle 2 = 180° - \angle 1$ (Linear pairs)

$\therefore \quad \angle 2 = 180° - 80° = 100°$

$\angle 2 = \angle 4$ (Vertically opposite angles)

$\therefore \quad \angle 4 = 100°$ and $\angle 2 = \angle 6$ (Corresponding angles)

$\therefore \quad \angle 6 = 100°$ and $\angle 6 = \angle 8$ (Vertically opposite angles)

$\therefore \quad \angle 8 = 100°$

Hence, $\angle \mathbf{1} = \angle \mathbf{3} = \angle \mathbf{5} = \angle \mathbf{7} = \mathbf{80°}$ and

$\angle \mathbf{2} = \angle \mathbf{4} = \angle \mathbf{6} = \angle \mathbf{8} = \mathbf{100°}$ **Ans.**

16. $z = 120°$ (Vertically opposite angles)

$\therefore \quad y + 120° = 180°$ (Linear pairs)

$\therefore \quad y = 180° - 120° = 60°$

$\therefore \quad x = y$ (Vertically opposite angles)

$\therefore \quad x = 60°$

Hence, $\boldsymbol{x = 60°}$, $\boldsymbol{y = 60°}$ and $\boldsymbol{z = 120°}$ **Ans.**

17. (a) Since sum of the all complete angles $= 360°$

$\therefore \quad x + x + 10° + x + 20° + x + 30° = 360°$

or $\quad 4x + 60° = 360° \quad$ or $4x = 360° - 60° = 300°$

$$x = \frac{300°}{4} = 75°$$

Hence, $\quad \boldsymbol{x = 75°}$,

$x + 10° = 75° + 10° = \mathbf{85°}$,

$x + 20° = 75° + 20° = \mathbf{95°}$,

$x + 30° = 75° + 30° = \mathbf{105°}$ **Ans.**

(b) Since vertically opposite angles are equal.

$\therefore \quad \boldsymbol{x = 50°}$ **Ans.**

(c) Since vertically opposite angles are equal.

$\therefore \quad 3x - 10° = 2x + 30° \quad$ or $3x - 2x = 30° + 10°$

$\boldsymbol{x = 40°}$ **Ans.**

18. (a) Since sum of the all complete angles $= 360°$

$\therefore \quad y + 2y + y + 10° + y - 10° = 360°$

or $\quad 5y + 10° - 10° = 360°$ or $5y = 360°$

$$y = \frac{360}{5} = 72°$$

Hence, $\quad \boldsymbol{y = 72°}$,

$2y = 2 \times 72° = \mathbf{144°}$,

$y + 10° = 72° + 10° = \mathbf{82°}$,

and $y - 10° = 72° - 10° = \mathbf{62°}$ **Ans.**

(b) Since sum of all complete angle $= 360°$

$\therefore \quad x + x + 10° + x + 20° + x + 30° = 360°$

or $\quad 4x + 60° = 360°$ or $4x = 360° - 60° = 300°$

or $\quad x = \frac{300°}{4} = 75°$

Hence, $\quad x = 75°$,

$x + 10° = 75° + 10° = \mathbf{85°}$,

$x + 20° = 75° + 20° = \mathbf{95°}$,

and $x + 30° = 75° + 30° = \mathbf{105°}$ **Ans.**

Multiple Choice Questions

1. (i) The complement of $38° = 90° - 38° = 52°$

Hence, the answer **(b)** is correct. **Ans.**

(ii) The complement of $40° = 90° - 40° = 50°$

Hence, the answer **(b)** is correct. **Ans.**

(iii) The complement of $70° = 90° - 70° = 20°$

Hence, the answer **(b)** is correct. **Ans.**

(iv) The complement of $60° = 90° - 60° = 30°$

Hence, the answer **(b)** is correct. **Ans.**

(v) The supplement of $70° = 180° - 70° = 110°$

Hence, the answer **(b)** is correct. **Ans.**

(vi) The supplement of $85° = 180° - 85° = 95°$

Hence, the answer **(b)** is correct. **Ans.**

(vii) The supplement of $72° = 180° - 72° = 108°$

Hence, the answer **(d)** is correct. **Ans.**

(viii) The supplement of $65° = 180° - 65° = 115°$

Hence, the answer **(d)** is correct. **Ans.**

11. Properties of Triangles

Exercise 11.1

1. (a) Three collinear points can join to form a triangle. **False**

(b) The triangle divides to plane into three regions. **True**

(c) A scalene triangle has all three sides of different length. **True**

(d) A triangle can have more than one obtuse angle. **False**

(e) The sum of two sides of a triangle is always greater than the third side. **True**

2. (a) The **sum** of two sides of a triangle is always greater than the third side.

(b) **Triangular region** is the boundary region along with the interior region of a triangle.

(c) An isosceles triangle, has **two** sides and **two** angles equal.

(d) A triangle has **six** elements.

(e) An **exterior** angle is equal to the sum of interior opposite angles.

(f) A triangle cannot have more than **one** obtuse angle.

(g) A triangle with all equals angles is known as **equilateral** triangle.

(h) In acute triangle, all the angles are **less** than 90°.

3. (a) Here, two sides are equal in length, so it is an **isosceles triangle.** **Ans.**

(b) Here, all the sides of a triangle are equal in length, so it is an **equilateral triangle.** **Ans.**

(c) Here, all three sides are of unequal lengths, so it is a **scalene triangle.** **Ans.**

(d) Here, two sides are equal in length, so it is an **isosceles triangle.** **Ans.**

4. (a) Here, all the angles of a triangle are less than 90°, so it is an **Acute-angled triangle.** **Ans.**

(b) Here, one of the angles is a right-angle, i.e. 90°, so it is a **right-angled triangle.** **Ans.**

(c) Here, one of the angles is obtuse, i.e., greater than 90°, so it is an **obtuse-angled triangle.** **Ans.**

(d) Here, all the angles of a triangle are less than 90°, so it is **an acute-angled triangle.** **Ans.**

(e) Here, all the angles of a triangle are equal i.e. 60° or less than 90°, so it is an **equilateral triangle** or **acute-angled triangle.** **Ans.**

(f) Here, one of the angles is a right angle, i.e. 90°, so it is a **right-angled triangle.** **Ans.**

5. In a triangle,we know that sum of two sides of a triangle is always greater than the third side.

(a) $\because$ 5 cm + 4 cm > 2 cm $\Rightarrow$ 9 cm > 2 cm true

or 2 cm + 4 cm > 5 cm $\Rightarrow$ 6 cm > 5 cm true

and 5 cm + 2 cm > 4 cm $\Rightarrow$ 7 cm > 4 cm true

$\therefore$ The sum of two sides is greater than the third side, so triangle is **possible.** **Ans.**

(b) $\because$ 3 cm + 5 cm > 6 cm $\Rightarrow$ 8 cm > 6 cm true

or 5cm + 6 cm > 3 cm $\Rightarrow$ 11 cm > 3 cm true

6 cm + 3 cm > 5 cm $\Rightarrow$ 9 cm > 5 cm true

$\therefore$ The sum of two sides is greater than the third sides, so triangle is **possible.** **Ans.**

(c) Let $\angle A = 110°$, $\angle B = 50°$ and $\angle C = 60°$

We know that $\angle A + \angle B + \angle C = 180°$ [Angle sum property]

$$110° + 50° + 60° \neq 180°$$

or $$220° \neq 180°$$

As, L.H.S. $\neq$ R.H.S.

So, **this pair does not represent a triangle.** **Ans.**

(d) Let $\angle A = 110°$, $\angle B = 110°$, $\angle C = 30°$

We know that, $\angle A + \angle B + \angle C = 180°$ [Angle sum property]

$$110° + 110° + 30° \neq 180°$$

$$250° \neq 180°$$

or L.H.S. $\neq$ R.H.S.

So, **this pair does not represent a triangle.** **Ans.**

(e) $\because$ 5 cm + 6 cm > 3 cm $\Rightarrow$ 11 cm > 3 cm true

6 cm + 3 cm > 5 cm $\Rightarrow$ 9 cm > 5 cm true

3 cm + 5 cm > 6 cm $\Rightarrow$ 8 cm > 6 cm true

$\therefore$ The sum of two sides is greater than the third side, so triangle is **possible.** **Ans.**

(f) Let $\angle A = 45°$, $\angle B = 45°$, $\angle C = 90°$

We know that, $\angle A + \angle B + \angle C = 180°$ [Angle sum property]

or $$45° + 45° + 90° = 180°$$

or $$180° = 180°$$

As, L.H.S. = R.H.S.

So, **these angles represent a triangle.** **Ans.**

(g) Let $\angle A = 70°$, $\angle B = 70°$, $\angle C = 70°$

we know that $\angle A + \angle B + \angle C = 180°$ [Angle sum property]

$$70° + 70° + 70° \neq 180°$$

or $$210° \neq 180°$$

As, L.H.S. $\neq$ R.H.S.

So, **these angles does not represent a triangle.** **Ans.**

(h) Let $\angle A = 30°$, $\angle B = 40°$ and $\angle C = 110°$

We know that $\angle A + \angle B + \angle C = 180°$ [Angle sum property]

or $$30° + 40° + 110° = 180°$$

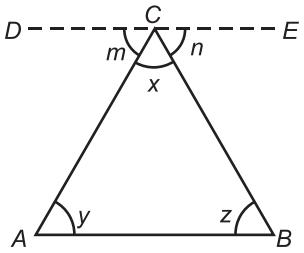
or $$180° = 180°$$

As, L.H.S. = R.H.S.

So, **these angles represent a triangle.** **Ans.**

6. ΔABC, draw $DE \parallel AB$

mark $\angle DCA = m$ and $\angle BCE = n$



As, $DE \parallel AB$ and AC being transversely

$\angle m = \angle y$ [Alternate angles]

Similarly, $\angle z = \angle n$ [Alternate angles]

Also, $\angle m + \angle x + \angle n = 180°$ [Straight angles]

$\therefore \angle y + \angle x + \angle z = 180°$ [Substituting $\angle m = \angle y$; $\angle n = \angle z$]

or $\angle x + \angle y + \angle z = 180°$

Hence, $\boldsymbol{x° + y° + z° = 180°}$ **Ans.**

7. $\because LM = MO$ and $LN = NM$

$\therefore \angle LOM = \angle MLO$ and $\angle NML = \angle NLM$

$\therefore \angle NML = \angle NLM$

$$= \frac{1}{2} \times (180° - 60°) = \frac{1}{2} \times 120° = 60°$$

(a) $\therefore \angle NLM = \mathbf{60°}$

(b) $\therefore \angle LOM = \frac{1}{2} \times (180° - 120°) = \frac{1}{2} \times 60° = \mathbf{30°}$ **Ans.**

8. In ΔPQR,

$\angle PQR + \angle PRQ + \angle QPR = 180°$

or $\angle PQR + \angle PQR + 50° = 180°$ [$\because PQ = PR$ and $\angle QPR = 50°$]

or $2\angle PQR = 180° - 50° = 130°$

or $$\angle PQR = \frac{130°}{2} = 65°$$

or $\angle PQR = \angle PRQ = 65°$ ...(i)

In ΔQSR,

$\angle SQR + \angle SRQ + \angle QSR = 180°$

or $\angle SQR + \angle SQR + 110° = 180°$ [$\because QS = SR$ and $\angle QSR = 110°$]

or $2\angle SQR = 180° - 110° = 70°$

or $\angle SQR = \frac{70^\circ}{2} = 35^\circ$

$\therefore \quad \angle SQR = \angle SRQ = 35^\circ$ ...(ii)

$\therefore \quad \angle PQS = \angle PQR - \angle SQR = 65^\circ - 35^\circ = 30^\circ$

And $\angle SRT = \angle QRT - \angle SRQ = 180^\circ - 35^\circ = 145^\circ$

Hence, $\boldsymbol{\angle PQS = 30^\circ}$ **and** $\boldsymbol{\angle SRT = 145^\circ}$ **Ans.**

9. According to figure,

$\angle MAB + \angle BAC + \angle NBC + \angle ABC + \angle ACP + \angle ACB$
$= 3 \times 180^\circ$

or $\angle MAB + \angle NBC + \angle ACP + (\angle BAC + \angle ABC + \angle ACB)$
$= 540^\circ$

or $\angle MAB + \angle NBC + \angle ACP + 180^\circ = 540^\circ$

$[\because \angle BAC + \angle ABC + \angle ACB = 180^\circ]$

or $\angle MAB + \angle NBC + \angle ACP = 540^\circ - 180^\circ = 360^\circ$

Hence, $\boldsymbol{\angle MAB + \angle NBC + \angle ACP = 360^\circ}$ **Proved.**

10. According to figure, $\angle XPZ = 180^\circ - 120^\circ = 60^\circ$

In ΔXPZ, $\angle ZXP + \angle XPZ + \angle XZP = 180^\circ$

or $\angle ZXP + 60^\circ + 2x^\circ = 180^\circ$

or $\angle ZXP + 2x^\circ = 180^\circ - 60^\circ = 120^\circ$

or $\angle ZXP + 2x^\circ = 120^\circ$

$\therefore \quad \angle ZXP + 2 \times 30^\circ = 120^\circ$

or $\angle ZXP = 120^\circ - 60^\circ = 60^\circ$

Hence, $\boldsymbol{\angle ZXP = 60^\circ}$ **Ans.**

11. $\because CA \parallel ED$ and $FE \parallel AB$

$\therefore x^\circ + 120^\circ = 180^\circ \Rightarrow x^\circ = 180^\circ - 120^\circ = 60^\circ$

And $z^\circ = \angle C = 80^\circ$

And $y^\circ = 180^\circ - 60^\circ - 80^\circ = 180^\circ - 140^\circ = 40^\circ$

Hence, $\boldsymbol{x^\circ = 60^\circ}$**,** $\boldsymbol{y^\circ = 40^\circ}$ **and** $\boldsymbol{z^\circ = 80^\circ}$ **Ans.**

12. In the adjoing figure,

$y^\circ + 110^\circ = 180^\circ \Rightarrow y^\circ = 180^\circ - 110^\circ = 70^\circ$

In ΔXYZ, $x^\circ + y^\circ + 50^\circ = 180^\circ$

$\Rightarrow x^\circ + 70^\circ + 50^\circ = 180^\circ$

$\Rightarrow x^\circ = 180^\circ - 120^\circ = 60^\circ$

Hence, $\boldsymbol{x^\circ = 60^\circ}$ **and** $\boldsymbol{y = 70^\circ}$ **Ans.**

13. In ΔTPS, $\angle TPS = 50° + 30° = 80°$

And $\angle TSR = 25° + 80° = \mathbf{105°}$ **Ans.**

14. Sum of terms of ratio $= 2 + 3 + 4 = 9$

Sum of the angles $= 180°$

$\therefore$ Angle are $180° \times \frac{2}{9}, 180° \times \frac{3}{9}$ and $180° \times \frac{4}{9}$

(i.e.) 40°, 60°, 80°

Hence, **the angles are 40°, 60° and 80°.** **Ans.**

15. By angle-sum property.

$$(10x - 5)° + (15x - 10°) + (25x - 5)° = 180°$$

or $10x - 5° + 15x - 10° + 25x - 5° = 180°$

or $50x - 20° = 180°$

or $50x = 180° + 20° = 200°$

or $x = \frac{200°}{50} \Rightarrow x = 4°$

Now, $(10x - 5)° = (10 \times 4 - 5)° = (40 - 5)° = 35°$

$(15x - 10)° = (15 \times 4 - 10)° = (60 - 10)° = 50°$

And $(25x - 5)° = (25 \times 4 - 5)° = (100 - 5)° = 95°$

Hence, **the angle are 35°, 50° and 95°.** **Ans.**

16. Let the two equal angles $= x$ each

By angle-sum property of triangles, $70° + x + x = 180°$

$$70° + 2x = 180° \Rightarrow 2x = 180° - 70° = 110°$$

$$x = \frac{110°}{2} \Rightarrow x = 55°$$

Hence, **the other two angles are 55° and 55°.** **Ans.**

17. Let the interior opposite angles be x.

We know that,

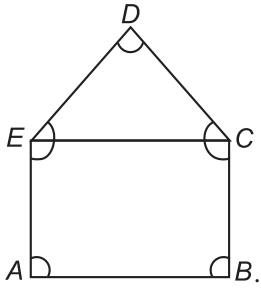
Exterior angle = Sum of interior opposite angles

$110° = x° + x°$ [$\because$ opposite interior angles are equal]

$110° = 2x°$ or $x° = \frac{110°}{2} \Rightarrow x = 55°$

Hence, **the angles are 55° and 55°.** **Ans.**

18. Meet EC,



In figure $ABCE$ is a rectangle.

$$\angle A + \angle B + \angle C + \angle E = 360° \quad ...(i)$$

In ΔCDE,

$$\angle E + \angle D + \angle C = 180° \quad ...(ii)$$

Adding (i) and (ii), we get

$$\angle A + \angle B + \angle C + \angle E + \angle E + \angle D + \angle C = 360° + 180°$$

$$\Rightarrow \angle EAB + \angle ABC + (\angle BCE + \angle DCE) + \angle CDE + (\angle DEC + \angle AEC) = 540°$$

$$\Rightarrow \angle EAB + \angle ABC + \angle BCD + \angle CDE + \angle DEA = \mathbf{540°} \quad \textbf{Ans.}$$

19. Let the equal angles be x.

The, vertex angle $= x \times \frac{1}{4} = \frac{x}{4}$

By angle-sum property of triangles, $x + x + \frac{x}{4} = 180°$

or $2x + \frac{x}{4} = 180°$ or $\frac{8x + x}{4} = 180°$

or $\frac{9x}{4} = 180°$ or $x = \frac{180° \times 4}{9}$ or $x = 80°$

$\therefore$ Equal angle are $= x = 80°$ and vertex angle $= \frac{x}{4} = \frac{80°}{4} = 20°$

Hence, **the angles are 80°, 80° and 20°.** **Ans.**

20. Let the angle be x.

Then, other angle $= x \times \frac{2}{3} = \frac{2x}{3}$

By angle-sum property of triangles, $x + \frac{2x}{3} + 90° = 180°$

or $\frac{3x+2x}{3}=180°-90°=90°$ or $\frac{5x}{3}=90°$

or $x=\frac{90°\times 3}{5}$ or $x=18°\times 3$ or $x=54°$

$\therefore$ Angle $=x=54°$ and $\frac{2x}{3}=\frac{2\times 54°}{3}=36°$

Hence, **the angle are 36°, 54° and 90°.** **Ans.**

21. Let the angles be $3x$ and $4x$.

We know that,

Sum of interior opposite angles = Exterior angle

$\therefore$ $3x+4x=140°$ or $7x=140°$

or $x=\frac{140°}{7}=20°$

$\therefore$ Angles $=3x=3\times 20°=60°$ and $4x=4\times 20°=80°$

Now, by angle-sum property of triangle.

Let third angle be y, then

$60°+80°+y=180°$ or $140°+y=180°$

or $y=180°-140°=40°$

Hence, **the angles are 60°, 80° and 40°.** **Ans.**

Exercise 11.2

1. (a) In an isosceles triangle, two angles are equal. **True**

(b) Every equilateral triangle is also isosceles. **True**

(c) If one of the base angles in an isosceles triangle is 45°, then it is a right-angled triangle. **True**

(d) In a right-angled triangle, the hypotenuse is the longest side. **True**

(e) (1, 2, 3) is a Pythagorean triplet. **False**

2. In the figure, ΔADE is right-angled with $\angle D=90°$

$AD=10$ m and $DE=10$ m $+14$ m $=24$ m

Thus, by Pythagores theorem,

$AE^2=AD^2+DE^2$ or $AE^2=(10)^2+(24)^2$

or $AE^2=100+576=676$ or $AE=\sqrt{676}$ m or $AE=26$ m

Hence, **the length of AE is 26 m.** **Ans.**

3. In ΔBCD,

$\because BD = BC$ and $\angle B = 90°$

$\therefore x° = \frac{1}{2}(180° - 90°) = \frac{1}{2} \times 90° = 45°$

In ΔABD, ΔABD is an rquilateral triangle

$\therefore \angle ABD = 60°$

Now $y° = \frac{1}{2} \times (180° - 90° - 60°) = \frac{1}{2} \times 30° = 15°$

And $z° = 60° - 15° = 45°$

Hence, $\boldsymbol{x° = 45°}$, $\boldsymbol{y° = 15°}$ **and** $\boldsymbol{z° = 45°}$ **Ans.**

4. In ΔPQR,

$\because PQ = QR$

$\therefore \angle QPR = \angle QRP = \frac{1}{2} \times (180° - 90°) = \frac{1}{2} \times 90° = 45°$

Now in ΔPQS,

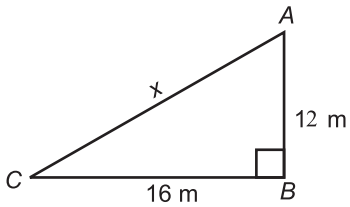
$$\angle QPS + \angle PSQ + \angle SQP = 180°$$

or $$(45° + x°) + 30° + 90° = 180°$$

or $$x° = 180° - 165° = 15°$$

Hence, $$\boldsymbol{x° = 15°}$$ **Ans.**

5. Let the distance between the top of pole and the top of shadow be x m.

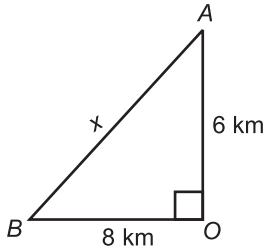


$$x^2 = (16\,\text{m})^2 + (12\,\text{m})^2 = 256\,\text{m}^2 + 144\,\text{m}^2 = 400\,\text{m}^2$$

or $$x = \sqrt{400\,\text{m}^2},\ x = 20\ \text{m}$$

Hence, **the distance between the top of pole and the top of shadow is 20 m.** **Ans.**

6. Let the distance between A and B be x km.



Using Pythagoras theorem,

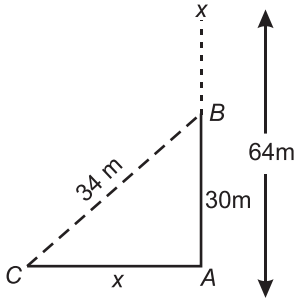
$$x^2 = (8\text{ km})^2 + (6\text{ km})^2$$

or $$x^2 = 64\text{ km}^2 + 36\text{ km}^2 = 100\text{ km}^2$$

$$x = \sqrt{100\text{ km}^2} \text{ or } x = 10\text{ km}$$

Hence, **10 km far is *A* from *B* now.** **Ans.**

7. Let distance of foot from the tip of pole touches the ground be x.



$\because$ Height of pole, $AX = 64\text{ m}$ and height $AB = 30\text{ m}$

$\therefore$ $BC = AX - AB = (64 - 30)\text{ m} = 34\text{ m}$

Now, using Pythagoras theorem,

$BC^2 = AB^2 + AC^2$ or $(34\text{ m})^2 = (30\text{ m})^2 + (x)^2$

or $1156\text{ m}^2 = 900\text{ m}^2 + x^2$ or $x^2 = (1156 - 900)\text{ m}^2 = 256\text{ m}^2$

or $$x = \sqrt{256\text{ m}^2} \text{ or } x = 16\text{ m}$$

Hence, the distance of foot from the top of pole tuches the ground is 16 m. **Ans.**

8. Let the vertical angle $= x°$

Then, each of the base angle $= 2x° + 5$

By angle-sum property,

$x° + 2x° + 5 + 2x° + 5 = 180°$ or $5x° + 10 = 180°$

or $5x° = 180° - 10° = 170°$

or $x° = \frac{170°}{5} = 34°$

Vertical angle $= x° = 34°$

Each of the base angle $= 2x° + 5 = 2 \times 34° + 5° = 68° + 5° = 73°$

Hence, **the angles are 34°, 73° and 73°.** **Ans.**

9. Let the each base angle be x.

By angle-sum property,

$x + x + 106° = 180°$ or $2x + 106° = 180°$

or $2x = 180° - 106° = 74°$ or $x = \frac{74°}{2} = 37°$

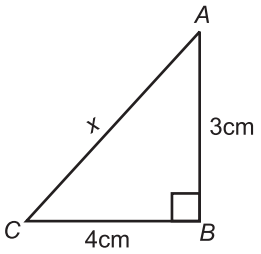
Hence, **the base angles are 37° and 37°.** **Ans.**

10. $y° = \frac{1}{2} \times (180° - 50°) = \frac{1}{2} \times 130° = 65°$

$x° = \frac{1}{2} \times 65° = 32\frac{1}{2}°$

Hence, $\boldsymbol{x° = 32\frac{1}{2}°}$ **and** $\boldsymbol{y° = 65°}$**.** **Ans.**

11. Let the length of third side be x.



In the right-angled triangle,

$AB = 3$ cm, $BC = 4$ cm and $AC = x$ cm

By Pythagoras theorem,

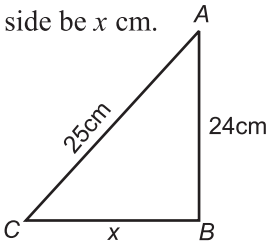
$AC^2 = AB^2 + BC^2$

$x^2 = (3\text{ cm})^2 + (4\text{ cm})^2$ or $x^2 = 9\text{ cm}^2 + 16\text{ cm}^2 = 25\text{ cm}^2$

or $x = \sqrt{25\text{cm}^2}$ or $x = 5$ cm

Hence, **the length of third side is 5 cm.** **Ans.**

12. Let the length of other side be x cm.



In the triangle ABC,

Hypotenuse $(AC) = 25$ cm, one side $AB = 24$ m and other side $BC = x$ cm

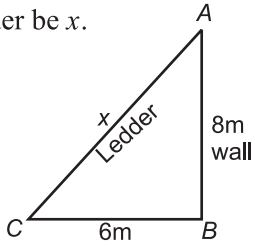
$$AC^2 = AB^2 + BC^2 \text{ or } (25 \text{ cm})^2 = (24 \text{ cm})^2 + (x)^2$$

or $$x^2 = 625 \text{ cm}^2 - 576 \text{ cm}^2 = 49 \text{ cm}^2$$

or $$x^2 = 49 \text{ cm}^2 \text{ or } x = \sqrt{49 \text{cm}^2} = 7 \text{ cm}$$

Hence, **the other side is 7 cm.** **Ans.**

13. Let the length of leader be x.



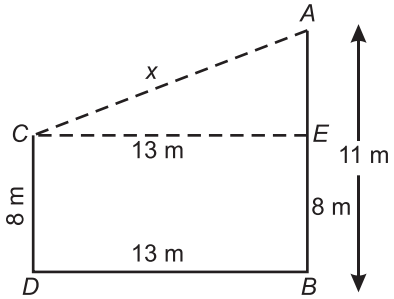
$$AC^2 = AB^2 + BC^2$$

$$x^2 = (8 \text{ m})^2 + (6 \text{ m})^2 \text{ or } x^2 = 64 \text{ m}^2 + 36 \text{ m}^2 = 100 \text{ m}^2$$

$$\text{or } x = \sqrt{100 \text{ m}^2} = 10 \text{ m}$$

Hence, **the length of leader is 10 m.** **Ans.**

14. In the figure, two pole are standing, one $(AB) = 11$ m and $CD = 8$ m



$\because AB = 11\,\text{m}$

$\therefore AE = AB - BE = (11-8)\,\text{m} = 3\,\text{m}$ and $BD = CE = 13\,\text{m}$

The top of poles are A and C.

Let the distance their tops A and C (AC) be x m.

In ΔAEC, by Pythagoras theoram,

$AC^2 = AE^2 + CE^2$ or $x^2 = (3\,\text{m})^2 + (13\,\text{m})^2$

or $x^2 = 9\,\text{m}^2 + 169\,\text{m}^2 = 178\,\text{m}^2$ or $x = \sqrt{178\,\text{m}^2} = 13.34\,\text{m}$

Hence, **the distance between two poles is 13.34 m.** **Ans.**

15. We know three positive integers a, b and c in this particular order and said to be pythagorean triplets, it

$$c^2 = a^2 + c^2$$

(a) Here, $a = 3$, $b = 4$ and $c = 5$

Now, $c^2 = a^2 + b^2$ or $(5)^2 = (3)^2 + (4)^2$

$25 = 9 + 16$ or $25 = 25$

Thus, $c^2 = a^2 + b^2$

Hence, **3, 4 and 5 are Pythagorean triplets.** **Ans.**

(b) Here, $a = 4$, $b = 6$ and $c = 7$

Now, $c^2 = a^2 + b^2$ or $(7)^2 = (4)^2 + (6)^2$

$49 = 16 + 36$ or $49 \neq 52$

Thus, $c^2 \neq a^2 + b^2$

Hence, **4, 6 and 7 are not Pythagorean triplets.** **Ans.**

(c) Here, $a = 5$, $b = 6$ and $c = 10$

Now, $c^2 = a^2 + b^2$ or $(10)^2 = (5)^2 + (6)^2$

or $100 = 25 + 36$ or $100 \neq 61$

Thus, $c^2 \neq a^2 + b^2$

Hence, **5, 6 and 10 are not Pythagorean triplets.** **Ans.**

(d) Here, $a = 5$, $b = 11$ and $c = 12$

Now $c^2 = a^2 + b^2$ or $(12)^2 = (5)^2 + (11)^2$

or $144 = 25 + 121$ or $144 \neq 146$

Thus, $c^2 \neq a^2 + b^2$

Hence, **5, 11 and 12 are not Pythagorean triplets.** **Ans.**

(e) Here $a = 12$, $b = 16$ and $c = 20$

Now, $c^2 = a^2 + b^2$ or $(20)^2 = (12)^2 + (16)^2$

or $400 = 144 + 256$ or $400 = 400$

Thus, $c^2 = a^2 + b^2$

Hence, **12, 16 and 20 are Pythagorean triplets.** **Ans.**

(f) Here, $a = 14$, $b = 16$ and $c = 22$

Now, $c^2 = a^2 + b^2$ or $(22)^2 = (14)^2 + (16)^2$

$484 = 196 + 256$ or $484 \neq 452$

Thus, $c^2 \neq a^2 + b^2$

Hence, **14, 16 and 22 are not Pythagorean triplets.** **Ans.**

16. Distance $AC = AB + BC$

In the ΔABE, $AE = 6\text{ m}$ and $BE = 10\text{ m}$

By Pythagorean theorem

$BE^2 = AB^2 + AE^2$ or $(10\text{ m})^2 = AB^2 + (6\text{ m})^2$

$100\text{ m}^2 = AB^2 + 36\text{ m}^2$ or $AB^2 = 100\text{ m}^2 - 36\text{ m}^2 = 64\text{ m}^2$

$AB = \sqrt{64\text{ m}^2}$ or $AB = 8\text{ m}$

Now, In the ΔBCD, $BD = 13\text{ m}$, $DC = 12\text{ m}$

By Pythagorean theorem,

$BD^2 = BC^2 + DC^2$ or $(13\text{ m})^2 = BC^2 + (12\text{ m})^2$

or $169\text{ m}^2 = BC^2 + 144\text{ m}^2$ or $BC^2 = 169\text{ m}^2 - 144\text{ m}^2 = 25\text{ m}^2$

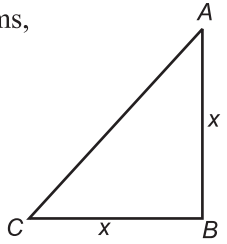
or $BC = \sqrt{25\text{ m}^2}$ or $BC = 5\text{ m}$

$\therefore$ $AC = AB + BC = 8\text{ m} + 5\text{ m} = 13\text{ m}$

Hence, **the distance of *AC* is 13 m.** **Ans.**

17. Let the two equal side be x.

By Pythagoras theorems,



$AC^2 = AB^2 + BC^2$ or $72\text{ m}^2 = x^2 + x^2$ or $72\text{ m}^2 = 2x^2$

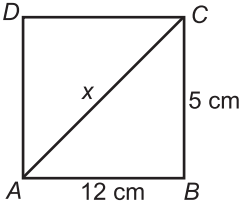
or $x^2 = \frac{72}{2}\text{ m}^2 = 36\text{ m}^2$ or $x = \sqrt{36}\text{ m} = 6\text{ m}$

Hence, **the equal sides are 6m and 6 m.** **Ans.**

Multiple Choice Questions

1. (i) The exterior angle of a triangle cannot be measure 180°.

Hence, the answer **(a)** is correct. **Ans.**



(ii) Let the length of the diagonal be x cm.

By Pythagoras theorem,

$AC^2 = AB^2 + BC^2$

or $x^2 = (12\text{ cm})^2 + (5\text{ cm})^2$

or $x^2 = 144\text{ cm}^2 + 25\text{ cm}^2 = 169\text{ cm}^2$

or $x = \sqrt{169\text{cm}^2} = 13\text{ cm}$

Hence, the answer **(c)** is correct. **Ans.**

(iii) The measure of each angle of an equilateral triangle is 60°.

Hence, the answer **(b)** is correct. **Ans.**

(iv) Let the third angle be x.

By angle-sum property, $30° + 80° + x° = 180°$

or $110° + x° = 180°$ or $x° = 180° - 110° = 70°$

Hence, the answer **(c)** is correct. **Ans.**

(v) Answer **(b)** is correct. **Ans.**

(vi) Let the other interior opposite angle be x.

$\because$ Sum of interior opposite angle be x.

$\because$ Sum of interior opposite angles = Exterior angle.

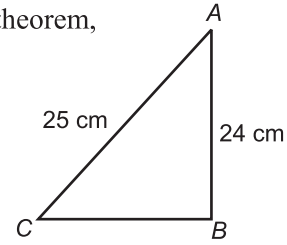
$\therefore$ $20° + x = 60°$ or $x = 60° - 20° = 40°$

Hence, the answer **(c)** is correct. **Ans.**

(vii) Answer **(c)** is correct. **Ans.**

(viii) Let the length of other side be x.

By Pythagoras theorem,



$25^2 = 24^2 + x^2$ or $625 = 576 + x^2$

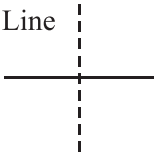
or $x^2 = 625 - 576 = 49$ or $x = \sqrt{49\text{ cm}} = 7\text{ cm}$

Hence, the answer **(c)** is correct. **Ans.**

12. Symmetry (Reflectional and Rotational)

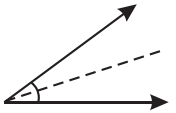
Exercise 12.1

1. (a) Line



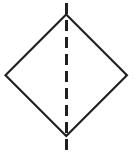
One line of symmetry.

(b) Angle



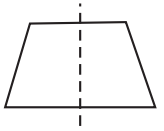
One line of symmetry.

(c) Kite



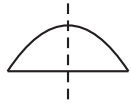
One line of symmetry.

(d) Trapezium



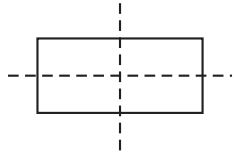
One line of symmetry.

(e) Semicircle



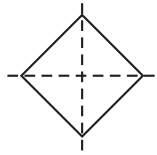
One line of symmetry.

(f) Rectangle



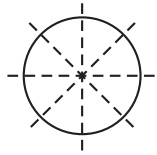
Two lines of symmetry.

(g) Rhombus



Two line of symmetry.

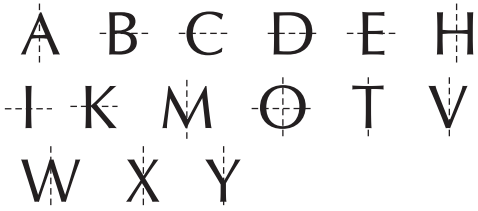
(h) Circle



many lines of symmetry.

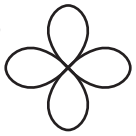
2. Do yourself. **3.** Do yourself.

4. The letters of English alphabet which symmetrical are following :

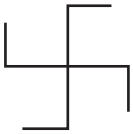


Exercise 12.2

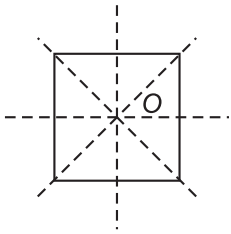
1. (a)  The order of rotational symmetry is **3.** **Ans.**

(b)  The order of rotational symmetry is **4.** **Ans.**

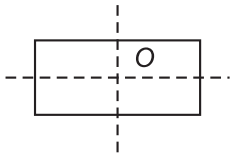
(c)  The order of rotational symmetry is **3.** **Ans.**

(d)  The order of rotational symmetry is **4.** **Ans.**

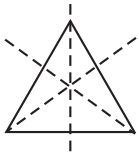
2. (a) Yes, a square has line of symmetry as well as rotational symmetry of order 4.



(b) Yes, a rectangle has line of symmetry as well as rotational symmetry of order 2.



(c) Yes an equilateral triangle has line of symmetry as well as rotational symmetry of order 3.



(d) An isosceles triangle has line of symmetry, but it has no rotational symmetry.

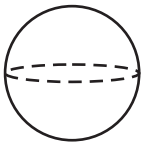
3. Do yourself.
4. **Rotational symmetry :** If a figure fits into itself more than once during a rotation by 360°, it is said **rotational symmetry.**
5. **Order of rotational symmetry :** The number of times the figure fits into itself during a complete rotation is called **order of rotational symmetry.**

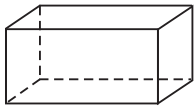
Multiple Choice Questions

1. (i) (c), (ii) (a), (iii) (d), (iv) (b), (v) (b), (vi) (c), (vii) (c), (viii (a).

13. Visualising solid shapes

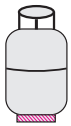
Exercise 13.1

1. (a) ⟶ (iv)  Sphere

(b) ⟶ (iii)  Cuboid

(c) ⟶ (i)  Cone

(d) ⟶ (ii)  Cylinder

2. (a) ⟶ (iii)  Cylinder

(b) ⟶ (i)  Cone

(c) ⟶ (ii)  Sphere

(d) ⟶ (iv)  Pyramid

3.

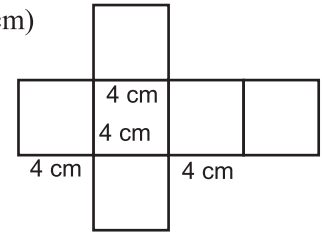
Solid	Number of face	Number of vertical	Number of edges
(a) Cuboid	6	8	12
(b) Cube	6	8	12
(c) Cylinder	3	0	2
(d) Cone	2	1	1
(e) Sphere	1	0	0

4. (a) Two examples of cuboid : (i) book, (ii) box. **Ans.**
(b) Two examples of cube : (i) ice cube, (ii) sugar cube **Ans.**
(c) Two examples of cylinder : (i) gas cylinder, (ii) chalk box. **Ans.**
(d) Two examples of cone : (i) ice-cream, (ii) clown's cap **Ans.**
(e) Two examples of sphere : (i) ball, (ii) balloon.

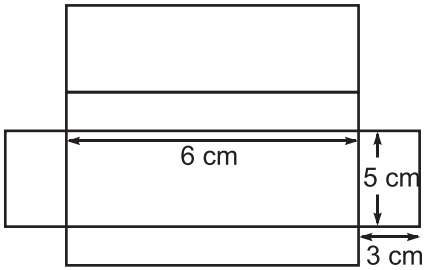
5. Eular's formula $V + F - E = 2$
(a) Cuboid $8 + 6 - 12 = 14 - 12 = \mathbf{2}$ **Ans.**
(b) Cube $8 + 6 - 2 = 14 - 12 = \mathbf{2}$ **Ans.**

Exercise 13.2

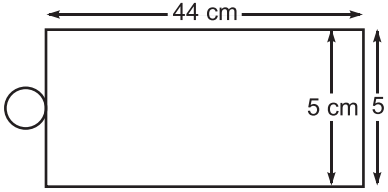
1. (a) Cube (Side = 4 cm)



(b) Cuboid ($l = 6$ cm, $b = 5$ cm, $c = 3$ cm)



(c) Cylinder ($r = 7$ cm, $h = 5$ cm)



2. Do yourself. **3.** Do yourself.

Multiple Choice Questions

1. (i) (a), (ii) (a), (iii) (c), (iv) (c), (v) (b), (vi) (c), (vii) (c), (viii) (a).

14. Congruency of Triangles

Exercise 14.1

1. (a) Two right-angled triangles with equal hypotenuse and one of the two angles equal are congruent. **True**

(b) If two figures overlap each other exactly, they are congruent. **True**

(c) Two congruent figures must have same position. **True**

(d) Two quadrilateral cannot be congruent. **False**

(e) Two congruent circles have their diameters equal. **True**

(f) Two triangle having all three angles equal are congruent. **False**

2. (a) RHS stands for **right-angle**, **hypotenuse** and **side**.

(b) Two line segments are congruent if they have equal **length**.

(c) Two triangles are congruent, if their two angles and the **one** side is equal.

(d) If all the three **sides** of two triangles are equal, then they are congruent.

(e) Two triangles are congruent, if their two sides and **one** angle is equal.

(f) Two rectangle are congruent, if they have equal **length** and **breadth**.

(g) Two squares having equal side length are **congruent**.

3. (a) $AB = 5$ cm and $CD = 4.5$ cm

$AB \neq CD$

Hence, ***AB* is not congruent to *CD*.** **Ans.**

(b) In square $ABCD$ and square $PQRS$.

$AB = PQ$ [Each side are equal]

$BC = QR$ [Each sides are equal]

$DC = SR$ [Each side are equal]

$AD = PS$

Thus, by SSS condition of congruency, square ***ABCD*** ≅ **square *PQRS***

Hence, **square *ABCD*** ≅ **square *PQRS*** **Ans.**

(c) In the ΔABC and ΔDEF,

$\angle CAB = \angle FDE$ [Both angles are 60°]

$AB = DE$ [Sides]

and $\angle CBA = \angle FED$ [Both angles are 70°]

Thus, by ASA condition of congruency,

Δ***ABC*** ≅ Δ***DEF*** **Ans.**

(d) In rectangle $ACBD$ and rectangle $ABCD$

$\angle DAB = \angle BAC$ [Each 90°]

$AB = AB$ [Side]

$\angle ABC = \angle ACD$ [Each 90°]

Thus, by ASA condition of congruency, rectangle ***ABCD*** ≅ **rectangle *ABCD*** **Ans.**

(e) Here, in Ist circle, radius = 2 cm,

And second circle, radius $= \frac{4\text{cm}}{2} = 2$ cm **Ans.**

(f) In ΔABC and ΔPRQ,

$\angle ABC = \angle PRQ$ [Each 90°]

$BC = QR$ [Side]

But, $AC \neq PQ$ [Side]

Hence, Δ***ABC* is not congruent to Δ*PRQ*.** **Ans.**

4. (a)$\angle PON = \angle AOB$ and $\angle AOP = \angle BON$

[$\because$ Both angles are 60°]

Ans.

(b) $\angle WXY = \angle YXZ$ [$\because$ Both angles are 60°] **Ans.**

(c) $\angle NLM = \angle NLK$ [$\because$ Both angles are 90°] **Ans.**

(d) In ΔABC and ΔDEF

$AB = DF = 5$ cm [Side]

$AC = DE = 4$ cm [Side]

and $BC = EF = 7$ cm [Side]

Thus, By *SSS* condition of congruency,

$\Delta \boldsymbol{ABC} \cong \Delta \boldsymbol{DEF}$ **Ans.**

(e) In ΔRSP and ΔRQS, $PR = QR$ [Side]

$\angle RSP = \angle RSQ$ [Each 90°]

$RS = RS$ [Common side]

Thus, by *RHS* condition of congruency,

$\Delta \boldsymbol{RSP} \cong \Delta \boldsymbol{QRS}$ **Ans.**

(f) In ΔABC and ΔDEF, $\angle ABC = \angle DEF$ [Each 105°]

$BC = EF = 5$ cm [Side]

and $\angle BCA = \angle DFE$ [Each 55°]

Thus, by *ASA* condition of congruency,

$\Delta \boldsymbol{ABC} \cong \Delta \boldsymbol{DEF}$ **Ans.**

(g) In ΔABC and ΔCDE, $AB = DE$ [Side]

$\angle ABC = \angle CED$ [Each 60°]

and $BC = CE$ [Side]

Thus, by *SAS* condition of congruency,

$\Delta \boldsymbol{ABC} \cong \Delta \boldsymbol{CDE}$ **Ans.**

(h) In ΔABC and ΔPQR, $\angle BAC = \angle QPR = 60°$

$\angle ABC = \angle RQP = 70°$

$\angle ACB = \angle QRP = 50°$

$AB = PQ = 3$ cm

$BC = QR = 4$ cm

And $\boldsymbol{AC = PR = 5}$ **cm** **Ans.**

5. In ΔALM and ΔANM

$\because$ $AL \perp MB$ and $AN \perp MC$

$\therefore$ $\angle ALM = \angle ANM = 90°$

And $AL = AN$ (Given)

$AM = AM$ (Common)

$\therefore \quad \Delta ALM \cong \Delta ANM$ (By RHS congruency)

$\therefore \quad \angle AML = \angle AML$ (C.R.C.T.)

Hence, ***MA* is the bisector of $\angle BMC$.** **Proved.**

6. In ΔPQS and ΔQPR

$\angle PRQ = \angle PSQ = 90°$

$QR = PS$ (Given)

And $PQ = PQ$ (Common)

$\therefore \quad \Delta PQS \cong \Delta QPR$ (By RHS congruency) **Proved.**

7. In ΔKMN and ΔLMN,

$\because \quad \angle MNK = \angle MNL = 90°$

$\angle MKL = \angle MLK$

And $MN = MN$ (Common)

$\therefore \quad \Delta KMN \cong \Delta LMN$ (By AS.A congruency)

$\therefore \quad \angle KMN = \angle LMN$ (C.R.C.T.)

Hence, ***MN* is bisects the angle *KML*.** **Proved.**

8. $\because \quad \Delta BAC \cong \Delta EDF$

$\therefore \quad BA = ED = 4$ cm (C.R.C.T.)

$AC = DF = 5$ cm (C.R.C.T.)

$\therefore \quad \angle A = \angle D = 120°$ (C.R.C.T.)

$\angle B = \angle E = 30°$ (C.R.C.T.)

$\angle C = \angle F = 180° - 120° - 30° = 180° - 150° = 30°$

Hence, $\angle D = 120°$, $\angle E = 30°$, $\angle F = 30°$, $ED = 4$ cm and $DF = 5$ cm **Ans.**

9. In ΔPSQ and ΔPSR

$\because$ S is the mid-point of QR.

$\therefore \quad SQ = RS = \frac{1}{2} RQ$

$\because \quad PS \perp QR$

$\therefore \quad \angle PSQ = \angle PSR = 90°$

And $PS = PS$ (Common)

$\therefore \quad \Delta PSQ \cong \Delta PSR$ (S.A.S congruency) **Proved.**

10. In ΔSUV and ΔTUV,

$\because$ $US = UT$ (Given)

$\angle VUT = \angle VUS$

And $VU = VU$ (Common)

$\therefore$ $\Delta SUV \cong \Delta TUV$ (By SAS congruency)

$\therefore$ $SV = VT = \frac{1}{2} ST$

Hence, $\boldsymbol{SV = \frac{1}{2} ST}$

11. In ΔEAB and ΔECD

$\because$ $AE = EC$

And $AB = DC$

$\because$ $AB \parallel DC$

$\therefore$ $\angle ABE = \angle EDC$ (Alternate Angles)

$\therefore$ $\boldsymbol{\Delta EAB \cong \Delta ECD}$ (By S.A.S congruency) **Proved.**

12. (a) In ΔABD and ΔBAC

$\because$ $BD = AC$

$\angle ADB = \angle ACB$

And $AB = AB$ (Common)

$\therefore$ $\boldsymbol{\Delta ABD \cong \Delta BAC}$ (By S.A.S congruency) **Proved.**

(b) In ΔAED and ΔBEC

$\because$ $AE = BE$

$\angle ADE = \angle ECB$

And $\angle AED = \angle BEC$

$\therefore$ $\boldsymbol{\Delta AED \cong \Delta BEC}$ (By A.S.A congruency) **Proved.**

13. In ΔQNM and ΔPMN

$\because$ $\angle P = \angle Q$

$\angle QMN = \angle MNP$

And $MN = MN$ (Common)

$\therefore$ $\Delta QNM \cong \Delta PMN$ (By A.S.A congruency)

$\therefore$ $\boldsymbol{MQ = NP}$ (By C.P.C.T) **Proved.**

14. $\because$ $\Delta ABC \cong \Delta QPR$

$\angle P = \angle B = 80°$

$\angle Q = \angle A = 40°$

$\angle R = \angle C = 60°$

$PQ = AB = 5$ cm

$QR = AC = 6\text{ cm}$

And $\boldsymbol{RP = CB = 4\text{ cm}}$ **Ans.**

15. $\because \Delta ABC$ is an equilateral triangle.

$\therefore \quad AB = BC = CA$

$\because \quad BE \perp AC$

$\therefore \quad CE = AE = \frac{1}{2} AC$

$\because \quad AD \perp BC$

$\therefore \quad BD = DC = \frac{1}{2} BC$

Now in ΔBEA and ΔBEC

$\because \quad AE = EC$

$\angle AEB = \angle BEC = 90°$

And $BE = BE$ (Common)

$\therefore \quad \Delta BEA \cong \Delta BEC$ (By S.A.S congruency)

Now, in ΔADB and ΔADC

$\because \quad BD = DC$

$\angle ADB = \angle ADC = 90°$

And $AD = AD$ (Common)

$\therefore \quad \Delta ADB \cong \Delta ADC$ (By S.A.S congruency)

$\because \Delta BEA = \Delta BEC = \Delta ADB = \Delta ADC$

$\therefore \quad \boldsymbol{\Delta BEA \cong \Delta ADC}$ **Proved.**

16. In ΔSQR and ΔPQR

$\because \quad QS = QP$

And $QR \perp PS$

$\therefore \quad \angle QRS = \angle QRP$

And $QR = QR$

$\therefore \quad \boldsymbol{\Delta SQR \cong \Delta PQR}$ (By R.H.S congruency) **Proved.**

17. See Q.No. 15.

18. $\because E$ is the mid point of AC and BD.

$\therefore \quad AE = EC$ and $DE = BE$

$\because \quad BD \neq AC$

(a) Yes, $\angle CDB = \angle DBA$ **Ans.**

(b) No, $\angle CDB = \angle CAB$ **Ans.**

(c) Yes, $DC \parallel AB$ **Ans.**

(d) Yes, $DC = AB$ **Ans.**

19. (a) $\Delta ABE \cong \Delta CDE$ **Ans.**

(b) $\Delta CEB \cong ADE$ **Ans.**

20. (a) $\because$ $ABCD$ is a rectangle.

$\therefore$ $AB = DC$ and $AB \parallel DC$

$AD = BC$ and $AD \parallel BC$

$AC = BD$ Hence, $AC = BD$ **Proved.**

(b) In $\Delta DAB \cong \Delta BCD$

$\because$ $AD = BC$

$AB = DC$ And $\angle BAD = \angle BCD$

$\therefore$ $\boldsymbol{\Delta DAB \cong \Delta BCD}$ **Proved.**

(c) In ΔDAB and ΔCBA

$AD = BC$

$\angle DAB = \angle ABC$; $AB = AB$ (Common)

$\therefore$ $\boldsymbol{\Delta DAB \cong \Delta CBA}$ **Proved.**

Exercise 14.2

1. Let ABC be an equilateral triangle.

$\therefore$ $AB = AC$

$\therefore$ $AE = BE = \frac{1}{2}AB$

$AD = CD = \frac{1}{2}AC$

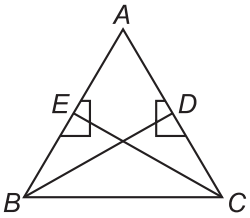
$\therefore$ $AE = BE = AD = CD$

$\therefore$ $\Delta ABD \cong \Delta BCD$

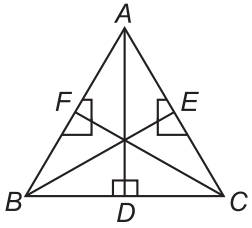
And $\Delta AEC \cong \Delta BEC$

Hence, $\Delta ABD \cong \Delta BCE$

$\therefore$ $\boldsymbol{BD = EC}$ **Proved.**



2. Let ΔABC be an equilateral triangle.



AD, BE and CF are altitudes of triangle.

$\therefore \Delta AFC \cong DBCF \cong DABD \cong \Delta ACD \cong \Delta ABE \cong \Delta BEC$

Hence, $\boldsymbol{AD = BE = CF}$ **Proved.**

3. Let ABC be an isosceles triangle.

Let AD be the altitude on BC.

$\therefore$ In ΔABD and ΔACD,

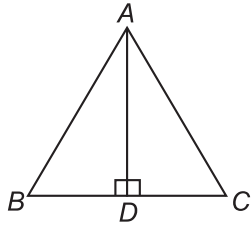
$AB = AC$

$\angle ADB = \angle ADC$

And $AD = AD$ (Common)

$\therefore \Delta ABD \cong \Delta ACD$

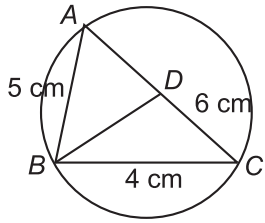
$\therefore BD = DC = \frac{1}{2} BC$



Hence, ***D* is the mid point of the base.** **Proved.**

4. First we draw a ΔABC, when $AB = 5$ cm, $BC = 4$ cm and $AC = 6$ cm. Now make a bisator of the hypotenuse and meet to B.

Now, draw a circle with radius $\frac{6}{2}$ cm $= 3$ cm and D is a centre.



5. Here incentre of a triangle LMN is O. The foot perpendicular from O on side LM is D.

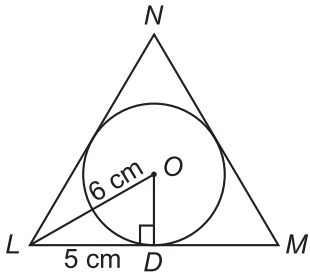
In ΔOLD, $\angle ODL = 90°$

Hence, $OL = 6$ cm, $LD = 5$ cm

$\therefore OD = \sqrt{(6\text{cm})^2 - (5\text{cm})^2}$

$= \sqrt{(36-25)}\ \text{cm}^2 = \sqrt{11\text{cm}^2} = 3.3$ cm

Hence, radius of the circle formed inside the triangle is 3.3 cm.

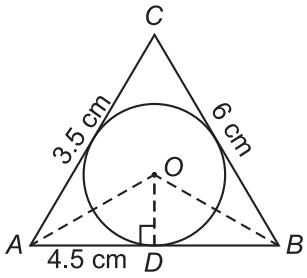


6. First we draw a ΔABC where $BC = 6$ cm, $AB = 4.5$ cm and $AC = 3.5$ cm.

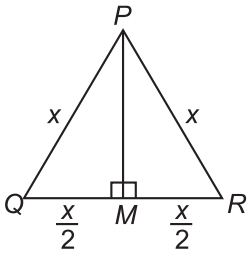
Now bisect $\angle A$ and $\angle B$.

Draw OD perpendicular to AB.

Taking radius OD and draw a circle with centre O.



7. $\because$ PQR is an equilateral triangle.



$\therefore$ $PQ = QR = RP$

Let $PQ = QR = RP = x$

$\therefore$ $QM = MR = \dfrac{x}{2}$

Now is ΔPQM,

$$x^2 + \left(\frac{x}{2}\right)^2 = 18\ \text{cm}^2$$

or $$x^2 + \frac{x^2}{4} = 18\ \text{cm}^2$$

or $$4x^2 + x^2 = 72\ \text{cm}^2$$

or $$5x^2 = 72\ \text{cm}^2$$

or $$x^2 = \frac{72}{5}\ \text{cm}^2$$

or $$x^2 = 14.4\ \text{cm}^2$$

or $$x = \sqrt{14.4\ \text{cm}^2} = 3.8\ \text{cm}$$

$\therefore$ $PQ = QR = RP = \mathbf{3.8\ cm}$ **Ans.**

8. $\because$ The centroid of a triangle divides the median in ratio 2 : 1.

$\therefore$ $CG : GD = 2 : 1$

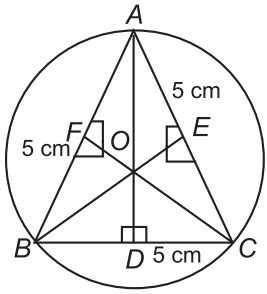
$3\ \text{cm} : GD = 2 : 1$

$\therefore$ $2GD = 3\ \text{cm}$

$\therefore$ $GD = \dfrac{3\,\text{cm}}{2} = 1.5\ \text{cm}$

Hence, $GD = 1.5\ \text{cm}$ **Ans.**

9. First we draw an equilateral ΔABC.



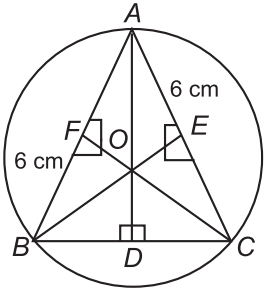
Now we draw AD, BE and CF are altitudes respectively.

We see that centroid, ortho-centre, circum centre and the incestre are coincide. **Ans.**

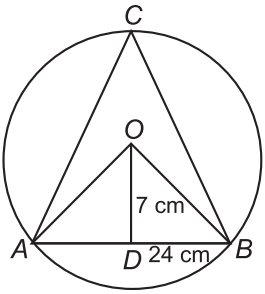
10. First we draw an isosceles triangle with equal side $AB = AC = 6$ cm.

Now draw its centroid, ortho-centre circum-centre and the insentre.

Yes, they all lie on the median to the base of triangle.



11.



$OB = \sqrt{(12^2 - 7^2)\,\text{cm}^2} = \sqrt{(144 + 49)\,\text{cm}^2} = \sqrt{193\,\text{cm}^2} = 13.89\,\text{cm}$

Hence, radius of the circum-centre of ΔABC is 13.89 cm **Ans.**

12. According to figure.

$$PR = 2 \times 5\,\text{cm} = 10\,\text{cm}$$

$QR = 6$ cm

$\therefore PQ = \sqrt{PR^2 - QR^2} = \sqrt{(10\text{cm})^2 - (6\text{cm})^2}$

$= \sqrt{100\,\text{cm}^2 - 36\,\text{cm}^2} = \sqrt{64\,\text{cm}^2} = 8\,\text{cm}$

Hence, the length of $PQ = 8$ cm **Ans.**

13. (a) True, (b) False, (c) True, (d) False, (e) True.

Multiple Choice Questions

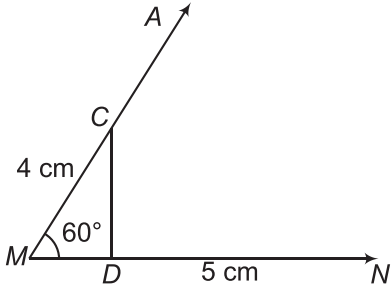
1. (i) (a), (ii) (d), (iii) (d), (iv) (b), (v) (b), (vi) (c), (vii) (b), (viii) (a).

15. Practical Geometry

Exercise 15

1. **Given :** $MN = 5$ cm, $\angle AMN = 60°$ and $MC = 4$ cm.

   Steps of construction:



   (i) First we draw a line segment $MN = 5$ cm.

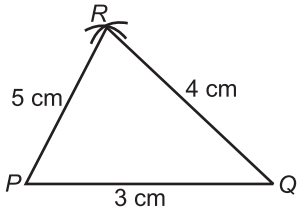
   (ii) With the help of protactor draw $\angle AMN = 60°$.

   (iii) Then mark a point C on MN i.e. MA at C with $MC = 4$ cm.

   (iv) Now draw $CD \perp MN$.

2. **Given :** $PQ = 3$ cm, $QR = 4$ cm an $RP = 5$ cm

   Steps of construction :



   (i) Draw a line segment $PQ = 3$ cm.

   (ii) With Q as centre and radius equal to $QR = 4$ cm, mark an arc on one side of PQ.

   (iii) With P as centre and radius equal to $PR = 5$ cm, draw another arc intersecting the first arc at R.

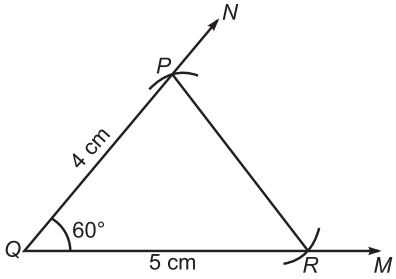
   (iv) Join RQ and PR.

   ΔPQR is the required triangle.

3. **Given :** $PQ = 4$ cm, $QR = 5$ cm,

   $\angle PQR = 5$ cm,

Steps of construction :



(i) Draw any $\angle PQR = 60°$.

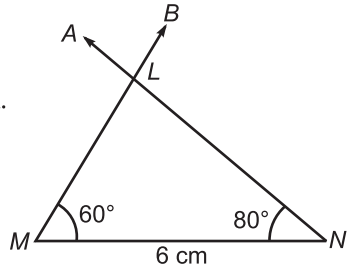
(ii) With Q as centre and radius equal to $QR = 5$ cm, mark an arc on ray QM.

(iii) With Q as centre and radius equal to $PQ = 4$ cm, cut another arc on ray QN.

(iv) Join the two arcs. Δ***PQR* is the required triangle.**

4. Given : $MN = 6$ cm, $\angle LMN = 60°$ and $\angle MNL = 80°$

Steps of construction :



(i) Draw a line segment $MN = 6$ cm.

(ii) Draw angle $\angle LMN = 60°$.

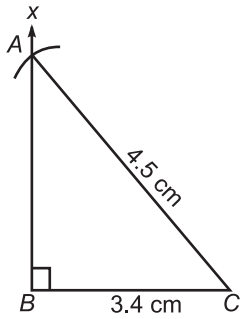
(iii) Draw $\angle MNL = 80°$ on the other side.

Let MB and NA intersect at L.

Then Δ***LMN* is the required triangle.**

5. Given : $AC = 4.5$ cm, $BC = 3.4$ cm, $B =$ right angled

Steps of construction :



(i) Draw a line segment $BC = 3.4$ cm.

(ii) Draw any angle $\angle XBC = 90°$ at B.

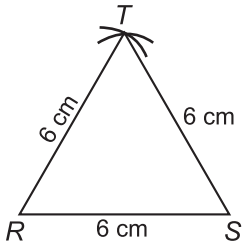
(iii) With C as centre and radius equal to $AC = 4.5$ cm, mark an arc intersecting the ray BX at A.

(iv) Join AC.

Hence, ΔABC **is the required triangle.**

6. Given : $RS = RT = ST = 6$ Cm

Steps of construction :



(i) Draw a line segment $RS = 6$ cm.

(ii) With R as centre and radius equal to $RT = 6$ cm, make an arc on side of AR.

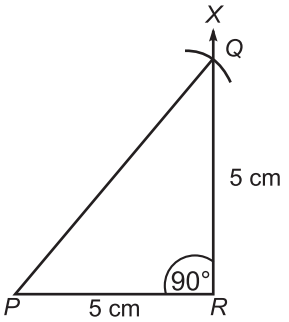
(iii) With S as centre and radius equal to $ST = 6$ cm, draw another arc intersecting the first arc at T.

(iv) Join TS and TR.

ΔRST **is the required triangle.**

7. Given : $PR = QR = 5$ cm and $\angle R = 90°$.

Steps of construction :



(i) Draw a line segment $PR = 5$ cm.

(ii) Draw any angle $\angle XRP = 90°$ at R.

(iii) With R as centre and radius equal to $RQ = 5$ cm, mark an arc intersecting the ray RX at Q. Meet P and Q.

ΔPQR is the required triangle.

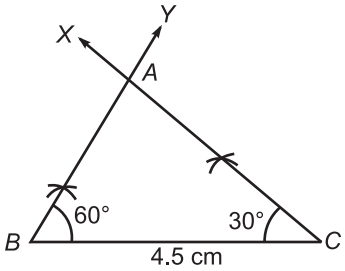
8. First of all we shall find the $\angle C$.

We know that $\angle A + \angle B + \angle C = 180°$ [Angle sum property]

$$90° + 60° + \angle C = 180°$$
$$150° + \angle C = 180° - 150°$$
$$\angle C = 180° - 150°$$
$$\angle C = 30°$$

$\therefore$ We have now, $\angle B = 60°$, $\angle A = 90°$ and $\angle C = 30°$ and $BC = 4.5$ cm

Steps of construction :



(i) Draw a line segment $BC = 4.5$ cm.

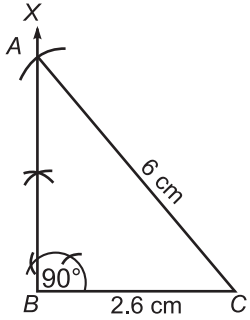
(ii) Construct $\angle CBY$ and $\angle BCX$ of 60° and 30° respectively.

(iii) Mark A at the point where BY and CX meet.

(iv) Thus, we find the required ΔABC.

9. **Given :** $B = 90°$, hypotenuse $AC = 6$ cm and $BC = 2.6$ cm.

Steps of construction :



(i) Draw a line segment $BC = 2.6$ cm.

(ii) At B draw $\angle XBC = 90°$.

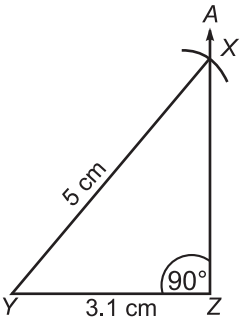
(iii) With centre C and radius $AC = 6$ cm, draw an arc cutting BX at A.

(iv) Join AC.

Now, ΔABC **the right-angled triangle.**

10. Given : $\angle Z = 90°$, $XY = 5$ cm and $YZ = 3.1$ cm

Steps of Construction :



(i) Draw a line segment $YZ = 3.1$ cm.

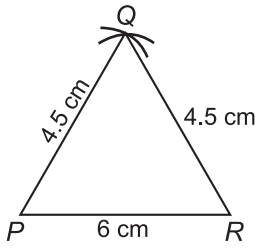
(ii) Draw any angle $\angle AZY = 90°$ at Z.

(iii) With Y as centre and radius equal to $XY = 5$ cm, make an arc intersecting the ray ZA at X.

Now, ΔXYZ is the required triangle.

11. Given : $PQ = QR = 4.5$ cm and $PR = 6$ cm.

Steps of construction :



(i) Draw a line segment $PR = 6$ cm.

(ii) With P as centre and radius to $PQ = 4.5$ cm mark an arc on one side of PR.

(iii) With R as centre and radius equal to $QR = 4.5$ cm, draw another arc intersecting the first arc at Q.

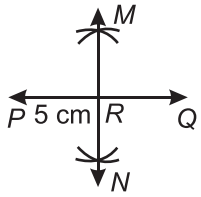
(iv) Join QP and QR.

Thus, ΔPQR is the required triangle.

12. Do yourself.

13. **Given :** $PQ = 5$ cm.

Steps of construction :



(i) Draw a line segment $PQ = 5$ cm.

(ii) With P as centre and radius more than $\frac{1}{2}PQ$.

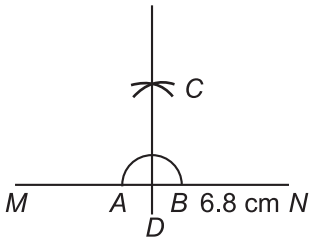
(iii) With same radius and Q as centre, cut the two arc formed in step (i) at MN.

(iv) Join MN.

(iv) MN formed bisects the segment PQ at R.

Measure it, each part $PR = RQ = 2.5$ cm.

14. **Steps of construction :**



(i) Draw a line segment $MN = 6.8$ cm.

(ii) Point C bisect the segment MN at D.

(iii) With D as centre and any radius an arc AB.

(iv) With A as centre and radius equal to more than half AB, draw an arc on one side of MN.

(v) With B as centre and radius equal to radius in step (ii), cut the arc drawn in step (ii) at point C.

(vi) Join DC.

(vii) DC is the required perpendicular line, i.e., $\angle CDN = 90°$.

Multiple Choice Questions

1. (i) (c), (ii) (b), (iii) (a), (iv) (b).

16. Mensuration

Exercise 16.1

1. Let the side of a square is x.

Then area of the square $= x \times x = x^2$

New side of square $= x + x \times \dfrac{25}{100} = x + \dfrac{x}{4} = \dfrac{5x}{4}$

$\therefore$ Area of the new square $= \dfrac{5x}{4} \times \dfrac{5x}{4} = \dfrac{25x^2}{16}$

Area increased $= \dfrac{25x^2}{16} - x^2 = \dfrac{25x^2 - 16x^2}{16} = \dfrac{9x^2}{16}$

$\therefore$ increased percent $= \dfrac{9x^2 \times 100}{16 \times x^2} = \dfrac{900}{16}\% = \dfrac{225}{4}\% = 56\dfrac{1}{4}\%$

Hence, **increased area percent $= 56\dfrac{1}{4}\%$.** **Ans.**

2. (a) $\because$ Length (l) $= 145$ m and breadth (b) $= 8$ m

$\therefore$ Area of rectangular $= l \times h = 145\text{ m} \times 8\text{ m} = 1160\text{ m}^2$

Hence, **the area of rectangular field is 1160 m^2.** **Ans.**

(b) $\because$ Length $= 20$ and perimeter $= 60$ m

$\therefore$ Perimeter of rectangular pield $= 2(l + b) = 60$ m

or $\quad 2(20 + b) = 60\text{ m} \Rightarrow 20 + b = \dfrac{60}{2}\text{ m} = 30\text{ m}$

$\therefore \quad b = 30\text{ m} - 20\text{ m}$

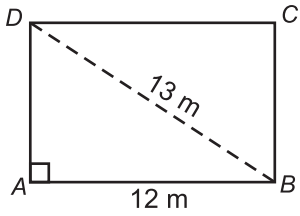
$\Rightarrow \quad b = 10\text{ m}$

Now, Area of rectangular field $= l \times b = 20\text{ m} \times 10\text{ m} = 200\text{ m}^2$

Hence, **the area of rectangular field is 200 m^2.** **Ans.**

(c) Let $ABCD$ be the required rectangular field with BD as diagonal.

In ΔABD by Pythagoras theorem,



$AD^2 + AB^2 = BD^2$ or $AD^2 + (12\text{ m})^2 = (13\text{ m})^2$

or $AD^2 + 144\,\text{m}^2 = 169\,\text{m}^2$ or $AD^2 = 169\,\text{m}^2 - 144\,\text{m}^2 = 25\,\text{m}^2$

or $AD = \sqrt{25\,\text{m}^2} = 5\text{ m}$

$\therefore l = 12\text{ m}$ and $b = AD = 5\text{ m}$

Now, area of rectangular field $= l \times b = 12\text{ m} \times 5\text{ m} = 60\,\text{m}^2$

Hence, **the area of rectangular field is 60 m^2.** **Ans.**

3. Let the height of triangular field is x m, then

base $= 3 \times x = 3x$ m

$\because$ The cost of cultivating the field at ₹ 46.72 per m^2 is ₹ 2522.88

$\therefore$ Area of triangular field $= \dfrac{2522.88}{46.72}\,\text{m}^2 = 54\,\text{m}^2$

$\because$ Area of triangular field $= \dfrac{1}{2} \times \text{base} \times \text{height}$

or $54\,\text{m}^2 = \dfrac{1}{2} \times x \times 3x$ or $54\,\text{m}^2 = \dfrac{1}{2} \times x \times 3x$ or $54\,\text{m}^2 = \dfrac{3x^2}{2}$

or $3x^2 = 54 \times 2\,\text{m}^2 \quad \Rightarrow x^2 = \dfrac{54 \times 2}{3}\,\text{m}^2$

or $x^2 = 36\,\text{m}^2 \Rightarrow x = \sqrt{36}\text{ m} = 6\text{ m}$

$\therefore$ Base $= 3x = 3 \times 6\text{ m} = 18\text{ m}$

and height $= x\text{ m} = 6\text{ m}$

Hence, **the base and height of the triangular field are 18 m and 6 m.** **Ans.**

4. Let the length and breadth of a room be $6x$ and $5x$.

$\because$ The cost of decorating the room wall at ₹ 57 per sq m is ₹ 5643.

$\therefore$ Area of the room wall $= \dfrac{5643}{57}\,\text{m}^2 = 99\,\text{m}^2$.

Now, area of the room $= 2(l + b) \times h$

$\Rightarrow \quad 2(6x+5x)\times 4.5 = 99\ \text{m}^2$

$\Rightarrow \quad 11x \times 4.5 = \frac{99}{2}\ \text{m}^2 = 49.5\ \text{m}^2$

$\Rightarrow \quad 49.5x = 49.5\ \text{m}$

$\Rightarrow \quad x = \frac{49.5}{49.5}\ \text{m} \Rightarrow x = 1\ \text{m}$

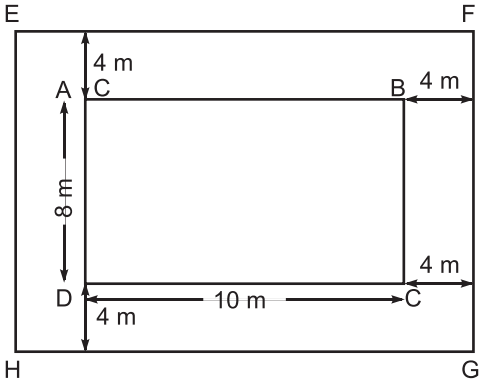
$\therefore$ Length of the room $= 5 \times 1\ \text{m} = 5\ \text{m}$

And breadth of the room $= 6 \times 1\ \text{m} = 6\ \text{m}$

Hence, **the length and breadth of the room are 5 m and 6 m.**

Ans.

5. Let $ABCD$ be a rectangular field of length 10 m and breadth 8 m. It is clear from the figure that a road 4 m wide runs around the rectangular field.



Area of the rectangular field $(ABCD) = l \times b$

$= 10\ \text{m} \times 8\ \text{m} = 80\ \text{m}^2$

Now, length of rectangular field with road $= (10+4+4)\ \text{m} = 18\ \text{m}$

Breadth of rectangular field with road $(8+4+4)\ \text{m} = 16\ \text{m}$

Area of the rectangular field with road $(EFGH) = 18\ \text{m} \times 16\ \text{m} = 288\ \text{m}^2$

$\therefore$ Area of road = Area of (outer $-$ inner) rectangular field

$= (288-80)\ \text{m}^2 = 208\ \text{m}^2$

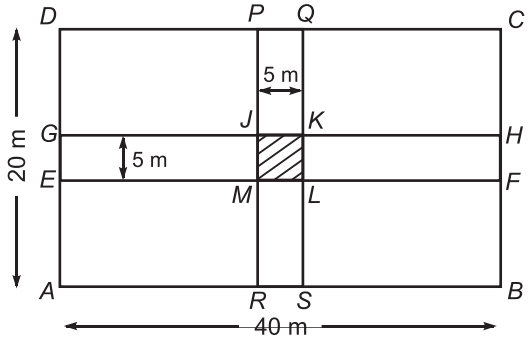
Thus, area of road $= 208\ \text{m}^2$

$\therefore$ Cost of levelling 1 m^2 = ₹ 125

$\therefore$ Cost of levelling road = ₹ 125×208 = ₹ 26000

Hence, **the cost of levelling the road is ₹ 26000.** **Ans.**

6. Let $ABCD$ be a rectangular lawn of length 40 m and breadth 20 m. It is clear from the figure that the two road are rectangular 40 m by 5 m and 20 m by 5 m with a square portion $JKLM$ common of both roads.



Now, Area of road $EFGH = 5\,\text{m} \times 40\,\text{m} = 200\,\text{m}^2$

Area of road $PQRS = 5\,\text{m} \times 20\,\text{m} = 100\,\text{m}^2$

Area of common square $= 5\,\text{m} \times 5\,\text{m} = 25\,\text{m}^2$

Area of roads to be gravelled $= (200 + 100 - 25)\,\text{m}^2$

$= (300 - 25)\,\text{m}^2 = 275\,\text{m}^2$

$\because$ Cost of gravelling 1 sq m is ₹ 40.

$\therefore$ Total cost = ₹ 275×40 = **₹ 11000.** **Ans.**

7. Let the base of parallelogram be x, then altitude $= 2 \times x = 2x$

Area of parallelogram = Base × altitude

$\therefore x \times 2x = 338$

$2x^2 = 338$ or $x^2 = \dfrac{338}{2} = 169$

or $x = \sqrt{169}$ m $\Rightarrow x = 13$ m

$\therefore$ Base $= x = 13$ m and altitude $= 2x = 2 \times 13\,\text{m} = 26\,\text{m}$

Hence, **the base and altitude of the parallelogram are 13 m and 26 m.** **Ans.**

8. $\because$ Area of the square field $= (\text{side})^2$

$\therefore (\text{Side})^2 = 100\,\text{m}^2$

Side $= \sqrt{100\,\text{m}^2} = 10\,\text{m}$

Hence, **the side of the square field is 10 m.** **Ans.**

9. Let the breadth of the rectangular field be x m.

$\because$ The cost of fencing a rectangular field at ₹ 2.50 per meter is ₹ 795.

$\therefore$ Area of rectangular field $= \frac{795}{2.50}\ \text{m}^2 = 318\ \text{m}^2$

$\therefore 40\ \text{m} \times x = 318$

$x = \frac{318\ \text{m}^2}{40\ \text{m}} = 7.95\ \text{m}$

Hence, **the breadth of rectangular field is 7.95 m.** **Ans.**

10. Let the breadth of rectangular field be x, then

length $= 2 \times x = 2x$

$\because$ Perimeter of the rectangular field = (length + breadth)

$2(x + 2x) = 1.2\ \text{km} = 1.2 \times 1000\ \text{m} = 1200\ \text{m}$

$\Rightarrow 2 \times 3x = 1200\ \text{m}$ **[$\because$ 1 km = 1000 m]**

$\Rightarrow 6x = 1200\ \text{m}$ or $x = \frac{1200}{6}\ \text{m}$ $x = 200\ \text{m}$

$\therefore$ breadth $= x = 200\ \text{m}$ and length $= 2x = 2 \times 200\ \text{m} = 400\ \text{m}$

$\therefore$ Area of the rectangular field = length $\times$ breadth

$= 400\ \text{m} \times 200\ \text{m} = 80000\ \text{m}^2$

Hence, **the area of the rectangular field is 80000 m^2.** **Ans.**

11. $\because$ Base length of tent $= 2.5$ m and height $= 4$ m.

$\therefore$ Area of the triangle = metarial required cover the front of the tent.

$= \frac{1}{2} \times b \times h = \frac{1}{2} \times 2.5\ \text{m} \times 4\ \text{m}$

$= 2.5\ \text{m} \times 2\ \text{m} = 5\ \text{m}^2$

Hence, **5 m^2 metarial required to cover the front of the tent.** **Ans.**

12. $\because$ Breadth of the room $= 8$ m and height $= 6$ m

Let the length of the room be x m.

$\therefore$ Area of four walls room $= 2(l + b) \times h$

or $2 \times (x + 8) \times 6 = 192\ \text{m}^2$

or $(x + 8) \times 6 = \frac{192}{2}\ \text{m} = 96\ \text{m}$

or $6x + 48\ \text{m} = 96\ \text{m}$ or $6x = 96\ \text{m} - 48\ \text{m} = 48\ \text{m}$

or $x = \frac{48}{6}\ \text{m} = 8\ \text{m}$

Hence, **the length of the room is 8 m.** **Ans.**

13. Let length = $5x$

Breadth $= 4x$

Area Arectangle = 3380 m^2

$4x \times 5x = 3380$

$x^2 = 169$

$x = 13$

length = $13 \times 5 = 65$m

Breadth $= 13 \times 4 = 52$m

Perimeter of rectangle = 2(l+b)

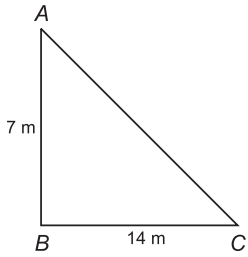
2(65+32) = 234m

Total Cost of fencing

$= 234 \times 75 = ₹17550$

Hence, **the cost of fencing the park is ₹ 17550.** **Ans.**

14. Area of the triangle $= \frac{1}{2} \times b \times h$



$= \frac{1}{2} \times 14\text{ m} \times 7\text{ m} = 7\text{ m} \times 7\text{ m} = 49\text{ m}^2$

Hence, **the area of the triangle is 49 m^2.** **Ans.**

15. (a) Area of figure $ABEF$ = Area of rectangle $ABEF$

$= l \times b = 10\text{ m} \times 4\text{ m} = 40\text{ m}^2$

Area of figure $BCDE$ = Area of parallelogram $BCDE$

$=$ Base $\times$ height $= 10\text{ m} \times 7\text{ m} = 70\text{ m}^2$

$\therefore$ Total area of the figure = Area of figure $ABEF$ + Area of figure $BCDE$.

$= (40 + 70)\text{ m}^2 =$ **110 m^2** **Ans.**

(b) Area of figure $ABDF$ = Area of square $ABDF$

$= (\text{side})^2 = (6\text{ cm})^2 = 36\text{ cm}^2$

Area of figure BCD = Area of triangle BCD

$= \frac{1}{2} \times \text{base} \times \text{altitude}$

$= \frac{1}{2} \times 6\text{ cm} \times 5\text{ cm} = 3\text{ cm} \times 5\text{ cm} = 15\text{ cm}^2$

Area of figure $DEF = \frac{1}{2} \times 6\text{ cm} \times 4\text{ cm} = 6\text{ cm} \times 2\text{ cm} = 12\text{ cm}^2$

Total area of the figure = Area of figure $ABDF$ + Area of figure BCD + Area of figure DEF

$= (36 + 15 + 12)\text{ cm}^2 =$ **63 cm²** **Ans.**

16. Area of shaded portion = Area of $PQRS$ – Area of TPQ

$= 6\text{ cm} \times 4\text{ cm} - \frac{1}{2} \times 6\text{ cm} \times 4\text{ cm}$

$= 24\text{ cm}^2 - 12\text{ cm}^2 = 12\text{ cm}^2$

Hence, **area of shaded portion is 12 cm².** **Ans.**

17. Area of rectangle $= 2 \times$ Area of $\Delta\, NOP$

$= 2 \times \frac{1}{2} \times NP \times OQ$

$= NP \times PQ$

$= 10\text{ m} \times 5.2\text{ m} = 52\text{ m}^2$

Hence, **area of rectangle = 52 m²** **Ans.**

Exercise 16.2

1. Volume of wall $= 35\text{ m} \times 40\text{ cm} \times 6\text{ m}$

$= 3500\text{ cm} \times 40\text{ cm} \times 600\text{ cm}$

$\therefore$ Volume of wall $= (3500 \times 40 \times 600)\text{ cm}^3$

and Volume of one brick $= 30\text{ cm} \times 14\text{ cm} \times 10\text{ cm}$

$= (30 \times 14 \times 10)\text{ cm}^3$

$\therefore$ Number of bricks required $= \frac{\text{Volume of wall}}{\text{Volume of one brick}}$

$= \frac{3500 \times 40 \times 600}{30 \times 14 \times 10} = 20000\text{ bricks}$

Hence, **the number of bricks required = 20000** **Ans.**

2. Area of field $= 50\text{ m} \times 40\text{ m} = 2000\text{ m}^2$

Area of water = Area of field $\times 13$ cm $= 2000\,\text{m}^2 \times \frac{13}{100}$ m

$= 2000 \times \frac{13}{100}\,\text{m}^3 = 20 \times 13\,\text{m}^3 =$ **260 m^3** **Ans.**

3. Total paper required to cover the box is equal to the surface area of the box $(S) = 2[lb + bh + hl]$

$= 2[30 \times 15 + 15 \times 4 + 4 \times 30]\,\text{cm}^2 = 2[450 + 60 + 120]\,\text{cm}^2$

$= 2 \times 630\,\text{cm}^2 = 1260\,\text{cm}^2$

The sheet of paper is 12 cm wide.

$\therefore$ The length of paper required $= \frac{1260}{12}$ cm $=$ **105 cm** **Ans.**

$\because$ The cost of 20 cm paper = ₹ 4

$\therefore$ Total cost = ₹ $\frac{4}{20} \times 105 =$ ₹ 21

Hence, **the cost of paper is ₹ 21.** **Ans.**

4. Volume of cuboid $= 60\,\text{m} \times 25\,\text{m} \times 15$ cm

$= 60\,\text{m} \times 25\,\text{m} \times \frac{15}{100}\,\text{m} = 225\,\text{m}^3$

Hence, **the volume of cuboid is 225 m^3.** **Ans.**

5. Total paper required to cover the inner surface of box is equal to the surface area of the box

$S = 2[lb + bh + hl] = 2[34 \times 24 + 24 \times 20 + 20 \times 34]\,\text{cm}^2$

$= 2[816 + 480 + 680]\,\text{cm}^2 = 2[1976]\,\text{cm}^2 = 2 \times 1976\,\text{cm}^2$

$= 3952\,\text{cm}^2$

Hence, **the paper required is 3952 cm^2.** **Ans.**

6. Volume of cube $= (20 \times 20 \times 20)\,\text{cm}^3$

Volume of cuboid $= (4 \times 4 \times 10)\,\text{cm}^3$

$\therefore$ Number of cuboids $= \frac{\text{Volume of cube}}{\text{Volume of cuboid}}$

$= \frac{(20 \times 20 \times 20)\,\text{cm}^3}{(4 \times 4 \times 10)\,\text{cm}^3} = 50$ cuboids

Hence, **number of cuboid = 50** **Ans.**

7. $\because$ Volume of oil $= 1500$ litres

$= 1500 \times 1000\ \text{cm}^3 = 1500000\ \text{cm}^3$

Height of the tank $= \dfrac{1500000\text{cm}^3}{125\text{cm} \times 125\text{cm}} =$ **96 cm** **Ans.**

8. Volume of cuboid $= 8\ \text{cm} \times 4\ \text{cm} \times 3\ \text{cm}$

$= (8 \times 4 \times 3)\ \text{cm}^3 = 96\ \text{cm}^3$

$\because$ Weighs of $1\ \text{cm}^3 = 6\ \text{g}$

$\therefore$ Weighs of $96\ \text{cm}^3 = 6 \times 96\ \text{g} = 576\ \text{g}$

Hence, **the weighs of cuboid 576 g.** **Ans.**

9. $\because$ Edge $= 40\ \text{cm}$

$\therefore$ Volume of cube $= l^3 = (40\ \text{cm})^3$

$= 40\ \text{cm} \times 40\ \text{cm} \times 40\ \text{cm} = (40 \times 40 \times 40)\ \text{cm}^3 = 64000\ \text{cm}^3$

Surface area $= 6l^2$

$= 6 \times (40)^2\ \text{cm}^2$

$= 6 \times 1600\ \text{cm}^2 = 9600\ \text{cm}^2$

Hence, **volume of cube = 64000 cm^3 and surface area = 9600 cm^2** **Ans.**

10. $\because$ Surface area of cube $= 6l^2$

$\therefore 384\ \text{m}^2 = 6l^2$ or $l^2 = \dfrac{384}{6}\ \text{m}^2 = 64\ \text{m}^2$

$l = \sqrt{64\ \text{m}^2}$ or $l = 8\ \text{m}$

Now, volume of cube $= l^3 = (8\ \text{m})^2 = 8\ \text{m} \times 8\ \text{m} \times 8\ \text{m}$

$= (8 \times 8 \times 8)\ \text{m}^3 = 512\ \text{m}^3$

Hence, **the volume of cube = 512 m^3.** **Ans.**

11. Volume of iron cube $= 175\ \text{cm} \times 175\ \text{cm} \times 175\ \text{cm}$

$= (175 \times 175 \times 175)\ \text{cm}^2$

Let the height of cuboid be h cm.

Volume of cuboid $= l \times b \times h = 225\ \text{m} \times 85\ \text{cm} \times h$

$= 225\ \text{cm} \times 85\ \text{cm} \times h$

Now, volume of iron cube = Volume of cuboid

$(175 \times 175 \times 175)\ \text{cm}^2 = 225\ \text{cm} \times 85\ \text{cm} \times h$

$\therefore h = \dfrac{175 \times 175 \times 175}{225 \times 85} = 280.23\ \text{cm} =$ **2.80 m**

Hence, **the height of cuboid is 2.80 m.** **Ans.**

12. Total cement required in equal to the surface area of the tank.

$= 2(l + b) \times h + l \times b$

$= 2(80 + 75) \times 120\ \text{cm}^2 + 80 \times 75\ \text{cm}^2$

$= 2 \times 155 \times 120\ \text{cm}^2 + 6000\ \text{cm}^2$

$= 37200\ \text{cm}^2 + 6000\ \text{cm}^2 = 43200\ \text{cm}^2$

$\therefore \text{Weight of cement} = \dfrac{43200 \times 300}{15}\ \text{g}$

$= 864000\ \text{g} = 864\ \text{kg}$

Hence, **weight of cement = 864 kg** **Ans.**

13. Area of hall $= 2(l + b) \times h = 2(4.5\ \text{m} + 3\ \text{m}) \times 2\ \text{m}$

$= 2(4.5 + 3) \times 2\ \text{m}^2 = 2 \times 7.5 \times 2\ \text{m}^2 = 30\ \text{m}^2$

Now, Area of 1 door $= 60\ \text{cm} \times 40\ \text{cm}$

$= 0.60\ \text{m} \times 0.40\ \text{m} = 0.24\ \text{m}^2$

Area of 2 doors $= 2 \times 0.24\ \text{m}^2 = 0.48\ \text{m}^2$

and area of 1 window $= 15\ \text{cm} \times 105\ \text{cm} = 0.15\ \text{m} \times 1.05\ \text{m} = 0.1575\ \text{m}^2$

Area of 8 windows $= 8 \times 0.1575\ \text{m}^2 = 1.2600\ \text{m}^2 = 1.26\ \text{m}^2$

Remain area of the hall $= 30\ \text{m}^2 - (0.48 + 1.26)\ \text{m}^2$

$= (30 - 1.74)\ \text{m}^2 = 28.26\ \text{m}^2$

$\because$ The cost of per sq m = ₹ 10

$\therefore$ Total cost = ₹ 28.26×10 = ₹ **282.6** **Ans.**

14. Volume of swimming pool $= 20\ \text{m} \times 16\ \text{m} \times 9\ \text{m}$

$= (20 \times 16 \times 9)\ \text{m}^2$

Volume of swimming pool after dugin it $= l \times b \times h = 40 \times 20 \times h$

or $20 \times 16 \times 9 = 40 \times 20 \times h$ or $h = \dfrac{20 \times 16 \times 9}{40 \times 20}\ \text{m} = 3.6\ \text{m}$

Hence, **the height of level of field increased = 3.6 m** **Ans.**

15. Surface area of cube $= 6l^2 = 6 \times (3\ \text{m})^2 = 6 \times 3\ \text{m} \times 3\ \text{m} = 54\ \text{m}^2$

Surface area of cuboid $= 2[6 \times 2 + 2 \times 5 + 5 \times 6]\ \text{m}^2$

$= 2[12 + 10 + 30]\ \text{m}^2 = 2 \times 52\ \text{m}^2 = 104\ \text{m}^2$

$\therefore$ Surface area of cuboid > surface area of the cube

Hence, **the cuboid need more of the colour than cube.** **Ans.**

16. (a) 1 m^3 = **1000** litres.

(b) A cuboid has **8** vertices.

(c) The area of all the **faces** of a cube is equal.

(d) A cuboid has **6** faces.

(e) A cube has all the edges **equal**.

(f) 1 m^3 = **1000000** ml

(g) The standard unit of volume is $\mathbf{m^3}$.

17. (a) The three edges of a cube meet at a point called a vertex. **True**

(b) A cuboid has all faces of equal area. **False**

(c) 1 cm^3 is the volume of a cube of edge 1 cm. **True**

(d) A cube of edge 10 cm can hold 10 litres of water. **False**

(e) 1 m^3 is equal to 105 cm^3. **False**

(f) The volume is the amount of space occupied by an object. **True**

(g) The surface area of a cube of edge x cm is $6x^2$ sq cm. **True**

(h) 1 litre is equal to 1000 m^3. **False**

(i) The S.I. unit of volume is m^3. **True**

(j) A cube has six edges. **False**

Multiple Choice Questions

1. (i) Perimeter of square $= 4 \times \text{side} = 4 \times 12 \text{ cm} = 48 \text{ cm}$

Hence, the answer **(a)** is correct. **Ans.**

(ii) The area of equilateral triangle $= \frac{\sqrt{3}}{4} \times (\text{side})^2$

$= \frac{\sqrt{3}}{4} \times (6 \text{ cm})^2 \text{ sq cm sq cm} = 9\sqrt{3} \text{ sq cm}$

Hence, the answer **(a)** is correct. **Ans.**

(iii) Area of rectangle $= l \times b = 6 \text{ cm} \times 3 \text{ cm} = 18 \text{ sq cm}$.

Hence, the answer **(d)** is correct. **Ans.**

(iv) Area of parallelogram $= \text{base} \times \text{altitude}$

$= 8 \text{ cm} \times 6 \text{ cm} = 48 \text{ sq cm}$

Hence, the answer **(c)** is correct. **Ans.**

(v) In ΔABC, $BD = \frac{1}{2} \times BC = \frac{1}{2} \times 12$ cm

$= 6$ cm

Area of $\Delta ABD = \frac{1}{2} \times BD \times AD = \frac{1}{2} \times 6 \times 5$ sq cm

$= 3 \times 5$ sq cm $= 15$ sq cm

Hence, the answer **(a)** is correct. **Ans.**

(vi) Area of the parallelogram = Base × altitude

or 420 sq cm $= 30 \times$ altitude

altitude $= \frac{420}{30}$ cm $= 14$ cm

Hence, the answer **(a)** is correct. **Ans.**

(vii) $\therefore$ Altitude $= 2x$,

$\therefore$ Base $= 2 \times 2x = 4x$

Area of triangle $= \frac{1}{2}$ Base × altitude $= \frac{1}{2} \times 2x \times 4x = 4x^2$

Hence, the answer **(c)** is correct. **Ans.**

17. Data Handing

Exercise 17.1

1. (a) The numerical figure or entry in the data is called **observation**.

(b) The number of times a particular observation occurs is called **frequency**.

(c) Arranging the data in ascending or descending order is called **array**.

(d) The difference between the highest and lowest observation in a given set of data is called the **range** of data.

(e) The table showing the observation and their frequency is called **frequency distribution table**.

2. Let us arrange the data in ascending order :

20, 20, 20, 20, 20, 24, 24, 24, 25, 25, 25, 25, 27, 27, 27, 27, 28, 28, 28, 28, 32, 32, 32, 34, 34

Frequency Table

Weights of children (in kg)	Tally Bars	Number of students
20	𝍸	5
24	𝍸	3
25	𝍸	4
27	𝍸	4
28	𝍸	4
32	𝍸	3
34	𝍸	2
Total		25

3. Let us arrange the data in ascending order :

34, 34, 34, 35, 35, 35, 35, 35, 35, 35, 35, 36, 36, 36, 36, 36, 36, 36, 37, 37, 37, 38, 40, 40, 40, 40, 40, 40, 42

Frequency Table

Number of students	Tally Bars	Frequency number of classes
34	𝍸	3
35	𝍸 𝍸	9
36	𝍸 𝍸	7
37	𝍸	3
38	𝍸	1
40	𝍸 𝍸	6
42	𝍸	1
Total		30

4. Let us arrange the data in ascending order :

6, 6, 6, 6, 6, 7, 7, 7, 7, 7, 8, 8, 8, 8, 8, 8, 8, 9, 9, 9, 9, 9, 10, 10, 10

Frequency Table

Number of working hours	Tally Bars	Frequency number of workers
6	𝍸	5
7	𝍸	5
8	𝍸 ||	7
9	𝍸	5
10	|||	3
Total		25

Exercise 17.2

1. First ten natural numbers are : 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

$$\text{Mean} = \frac{\text{Sum of all the observation}}{\text{Total number of observation}}$$

$$= \frac{1+2+3+4+5+6+7+8+9+10}{10} = \frac{55}{10} = 5.5$$

Hence, **the mean of first ten natural number is 5.5.** **Ans.**

2. First five even natural numbers are : 2, 4, 6, 8, 10

$$\text{Mean} = \frac{\text{Sum of all the observation}}{\text{Total number of observation}}$$

$$= \frac{2+4+6+8+10}{5} = \frac{30}{5} = 6$$

Hence, **the mean of first five even natural number is 6.** **Ans.**

3. First 10 multiples of 3 are : 3, 6, 9, 12, 15, 18, 21, 24, 27, 30

$$\text{Mean} = \frac{\text{Sum of all the observations}}{\text{Total number of observation}}$$

$$= \frac{3+6+9+12+15+18+21+24+27+30}{10} = \frac{165}{10} = 16.5$$

Hence, **the mean of first 10 multiples of 3 is 16.5.** **Ans.**

4. $\text{Mean} = \dfrac{\text{Sum of all the observations}}{\text{Total number of observation}}$

$$= \frac{2+3+5+7+9}{5} = \frac{26}{5} = 5.2$$

Hence, **the mean is 5.2.** **Ans.**

5. $\text{Mean} = \dfrac{\text{Sum of all the observations}}{\text{Total number of observation}}$

Here, **mean = 20, total number of observations = 5**

Let the unknow observation be x.

$20 = \dfrac{30+40+15+5+x}{5}$ or $20 = \dfrac{90+x}{5}$

or $90 + x = 20 \times 5 = 100$ or $x = 100 - 90 \Rightarrow x = 10$

Hence, **the fifth observation is 10.** **Ans.**

6. The scores of a batsman in four innings are : 50, 70, 68, 85.

$\text{Mean} = \dfrac{\text{Sum of the runs}}{\text{Number of inning}}$

Here mean score = 60, total number of innings = 5

Let batsman make x score in fifth inning.

$\therefore \quad 60 = \dfrac{50+70+68+85+x}{5}$

or $60 = \dfrac{273+x}{5}$

or $273 + x = 60 \times 5 = 300$

$x = 300 - 273 \Rightarrow x = 27$

Hence, **batsman make 27 score in fifth inning.** **Ans.**

7. Mean marks, $\bar{x} = \dfrac{\text{Sum of marks of students}}{\text{Total number of students}}$

$$= \frac{5+7+9+3+2+10+11+12+13+10}{10}$$

$$= \frac{82}{10} = 8.2$$

Hence, **the mean of the given marks is 8.2 marks.** **Ans.**

8. **Frequency table**

Age in years	Tally Bars	Frequency
10	||	2
11	𝍸	5
12	𝍸	5
13	||||	4
14	|||	3
15	|	1
Total		20

Now, to find the mean age, we prepare following table.

Age in years (x)	Frequency (f)	(fx)
10	2	20
11	5	55
12	5	60
13	4	52
14	3	42
15	1	15
	$\sum f = 20$	$\sum fx = 244$

$$\text{Mean } \bar{x} = \frac{\sum fx}{\sum f} = \frac{224}{20} \text{ years} = 12.2 \text{ years}$$

Hence, **the mean age of students is 12.2 years.** **Ans.**

9. $$\text{Mean} = \frac{\text{Sum of all the observations}}{\text{Total number of observation}}$$

$$= \frac{3+2+1+2+1+2+3}{7} = \frac{14}{7} = 2$$

Hence, **the mean of observation is 2.** **Ans.**

10. $$\text{Mean} = \frac{\text{Sum of all the observations}}{\text{Total number of observation}}$$

$$= \frac{34+32+36+28+28+30+32+34+30+34}{10} = \frac{318}{10} = 31.8$$

Hence, **the mean trouser sizes of 10 boys is 31.8.** **Ans.**

11. To find the mean study time, we prepare the following table :

Number of hours (x)	Number of students (f)	(fx)
5	3	15
7	7	49
9	6	54
11	2	22
13	2	26
	$\sum f = 20$	$\sum fx = 166$

$$\text{Mean } \bar{x} = \frac{\sum fx}{\sum f} = \frac{166}{20} = \frac{83}{10} = 8.3 \text{ hours}$$

Hence, **the mean study time of 20 students is 8.3 hours. Ans.**

12. To find the mean contribution, we prepare the following table.

Amount (in ₹)	Number of persons (f)	(fx)
100	6	600
200	4	800
300	8	2400
400	5	2000
500	2	1000
	$\sum f = 25$	$\sum fx = 6800$

$$\text{Mean } \bar{x} = \frac{\sum fx}{\sum f} = ₹\ \frac{6800}{25} = ₹\ 272$$

Hence, **the mean contribution of 25 persons is ₹ 272. Ans.**

13. Here, we are given the mean $= 50$, but the frequency again the variate 30 is missing. To find the missing frequency p, we prepare the following table :

x	f	fx
10	17	170
30	p	30p
50	32	1600
70	24	1680
90	19	1710
	$\sum f = 92 + p$	$\sum fx = 5160 + 30p$

Mean $\bar{x} = \dfrac{\sum fx}{\sum f}$

$50 = \dfrac{5160 + 30p}{92 + p}$ **[$\because \bar{x} = 50$]**

$50(92 + p) = 5160 + 30p$ [By cross-multiplying]

or $4600 + 50P = 5160 + 30p$ or $50p - 30p = 5160 - 4600$

or $20p = 560$ or $p = \dfrac{560}{20} = 28$

Hence, **the missing frequency is 28.** **Ans.**

14. Here, we are given the mean = 6. To find the value of a, we prepare the following table :

x	f	fx
2	4	8
4	4	16
6	7	42
10	3	30
$a + 5$	2	$2a + 10$
	$\sum f = 20$	$\sum fx = 106 + 2a$

Mean $\bar{x} = \dfrac{\sum fx}{\sum f}$

$6 = \dfrac{106 + 2a}{20}$ **[$\because \bar{x} = 6$]**

or $106 + 2a = 120$ [By cross-multiplying]

or $2a = 120 - 106 = 14$ or $a = \frac{14}{2} = 7$

Hence, **the value of *a* is 7.** **Ans.**

Exercise 17.3

1. (a) Let us first arrange the data ascending order :

12, 13, 14, 15, 16, 17, 18, 19, 20

Here, $x = 9$, which is odd.

$$\therefore \text{Median} = \left(\frac{x+1}{2}\right)^{\text{th}} \text{ observation} = \left(\frac{9+1}{2}\right)^{\text{th}} \text{ observation}$$

$$= \left(\frac{10}{2}\right)^{\text{th}} \text{ observation} = 5^{\text{th}} \text{ observation} = 16$$

Hence, **the median of the data is 16.** **Ans.**

(b) **Let us first arrange the data ascending order :**

45, 50, 55, 60, 65, 70, 75

Here, $n = 7$, which is odd.

$$\therefore \text{Median} = \left(\frac{n+1}{2}\right)^{\text{th}} \text{ observation} = \left(\frac{7+1}{2}\right)^{\text{th}} \text{ observation}$$

$$= \left(\frac{8}{2}\right)^{\text{th}} \text{ observation} = 4^{\text{th}} \text{ observation} = 60$$

Hence, **the median of the data is 60.** **Ans.**

(c) Let us first arrange the data in ascending order :

12, 13, 14, 15, 16, 17, 18, 20

Here, $n = 8$, which is even.

$$\therefore \text{Median} = \frac{\left(\frac{n}{2}\right)^{\text{th}} \text{ observation} + \left(\frac{n}{2}+1\right)^{\text{th}} \text{ observation}}{2}$$

$$= \frac{\left(\frac{8}{2}\right)^{\text{th}} \text{ observation} + \left(\frac{8}{2}+1\right)^{\text{th}} \text{ observation}}{2}$$

$$= \frac{4^{\text{th}} \text{ observation} + 5^{\text{th}} \text{ observation}}{2} = \frac{15+16}{2} = \frac{31}{2} = 15.5$$

Hence, **the median of the data is 15.5.** **Ans.**

(d) Let us first arrange the data in ascending order :

25, 28, 29, 40, 42, 48, 50, 55

Here, $n = 8$, which is even.

$$\therefore \text{Median} = \frac{\left(\frac{n}{2}\right)^{\text{th}} \text{ observation} + \left(\frac{n}{2}+1\right)^{\text{th}} \text{ observation}}{2}$$

$$= \frac{\left(\frac{8}{2}\right)^{\text{th}} \text{ observation} + \left(\frac{8}{2}+1\right)^{\text{th}} \text{ observation}}{2}$$

$$= \frac{4^{\text{th}} \text{ observation} + 5^{\text{th}} \text{ observation}}{2} = \frac{40+42}{2} = \frac{82}{2} = 41$$

Hence, **the median of the data is 41.** **Ans.**

2. The data given here is already arranged in ascending order and it is odd in number $(n = 11)$

$$\therefore \text{Median} = \left(\frac{n+1}{2}\right)^{\text{th}} \text{ observation} = \left(\frac{11+1}{2}\right)^{\text{th}} \text{ observation}$$

$$= \left(\frac{12}{2}\right)^{\text{th}} \text{ observation} = 6^{\text{th}} \text{ observation} = x$$

But median $= 20$

Hence, **the value of x is 20.** **Ans.**

3. The data given here is already arranged in ascending order and it is even in number $(n = 10)$

$$\therefore \text{Median} = \frac{\left(\frac{n}{2}\right)^{\text{th}} \text{ observation} + \left(\frac{n}{2}+1\right)^{\text{th}} \text{ observation}}{2}$$

$$= \frac{\left(\frac{10}{2}\right)^{\text{th}} \text{ observation} + \left(\frac{10}{2}+1\right)^{\text{th}} \text{ observation}}{2}$$

$$= \frac{5^{\text{th}} \text{ observation} + 6^{\text{th}} \text{ observation}}{2} = \frac{x+x+2}{2}$$

But it is given that median is 14.

$$\therefore \frac{x+x+2}{2} = 14 \text{ or } 2x+2 = 28$$

or $2x = 28 - 2 = 26$

or $x = \frac{26}{2} \Rightarrow x = 13$

Hence, **the value of x is 13.** **Ans.**

Exercise 17.4

1. We observe that 3 occurs maximum number of times and the mode of data is 3.

Hence, **the value of x is 3.** **Ans.**

2. (a) **Let us first arrange the data in ascending order :**

22, 22, 22, 23, 23, 24, 25, 27, 29

Here, we observe that 22 occurs maximum number of times.

Hence, **the mode of data is 22.** **Ans.**

(b) **Let us first arrange the data in ascending order :**

12, 13, 14, 15, 17, 17, 17, 18, 19

Here, we observe that 17 occurs maximum number of times.

Hence, **the mode of data is 17.** **Ans.**

(c) **Let us first arrange the data in ascending order :**

32, 32, 32, 32, 32, 33, 33, 33, 33, 33

Here, we observe the observations 32 and 33 have maximum number of frequency i.e., 5 each.

Hence, **mode of the data is 32 and 33.** **Ans.**

(d) **Let us first arrange the data in ascending order :**

31, 32, 35, 37, 37, 39

Here, we observe that 37 occurs maximum number of times.

Hence, **the mode of data is 37.** **Ans.**

(e) **Let us first arrange the data in ascending order :**

21, 21, 21, 21, 22, 23, 24, 24, 25, 28

Here, we observe that 21 occurs maximum number of times.

Hence, **the mode of data is 21.** **Ans.**

(f) **Let us first arrange the data in ascending order :**

40, 41, 42, 42, 42, 42, 44

Here, we observe that 42 occurs maximum number of times.

Hence, **the mode of data is 42.** **Ans.**

3. To find the mean height, we prepare the following table :

Height (in m) (x)	**Number of trees** (f)	fx
70	2	140
75	4	300
80	5	400
85	4	340
	$\sum f = 15$	$\sum fx = 1180$

$$\text{Mean } \bar{x} = \frac{\sum fx}{\sum f} = \frac{1180}{15} \text{ m} = 78.67 \text{ m}$$

Hence, **the mean height of the trees is 78.67 m.** **Ans.**

Now, we observe that in the table the maximum frequency is 5.

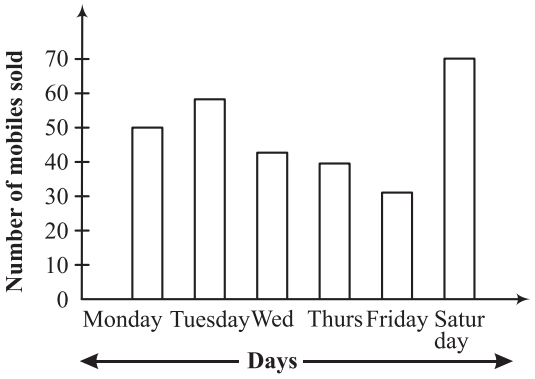
Hence, **the mode of height is 80 cm.** **Ans.**

4. We observe that the maximum frequency is 9.

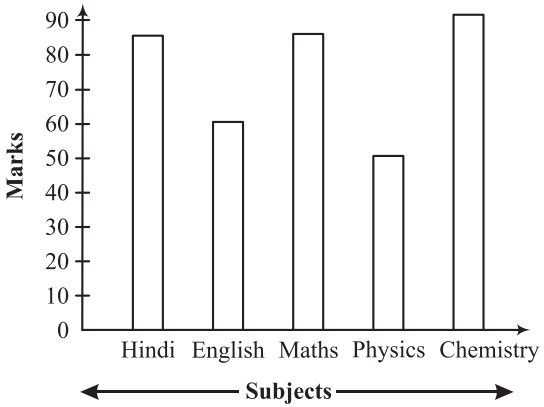
Hence, **the mode of height is 60 cm.** **Ans.**

Exercise 17.5

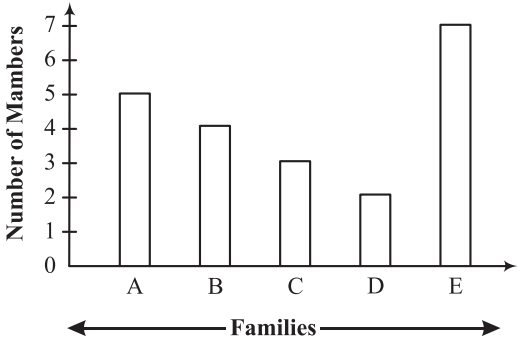
1.



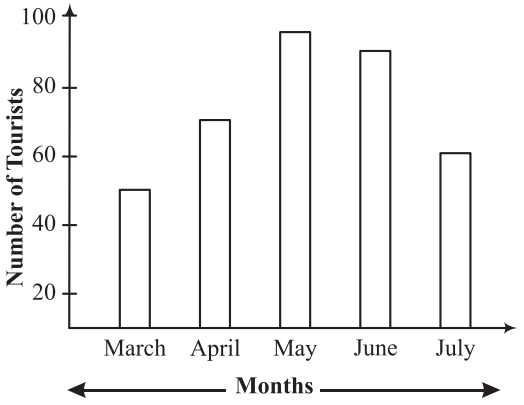
2.


Marks
90
80
70
60
50
40
30
20
10
0
Hindi
English
Maths
Physics
Chemistry
Subjects

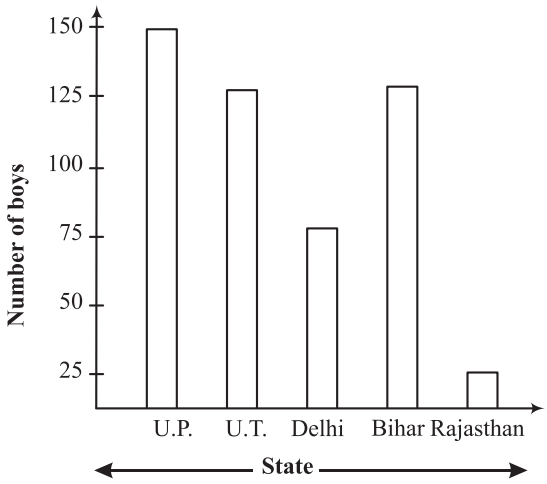
3.


Number of Mambers
7
6
5
4
3
2
1
0
A
B
C
D
E
Families

4.


Number of Tourists
100
80
60
40
20
March
April
May
June
July
Months

5.



6. (a) The bar graph represents number of centuries scored by a batsman agains different countries. **Ans.**

(b) The total number of centuries scored by the batsman is $= 20 + 40 + 30 + 10 + 50 = 150$. **Ans.**

(c) Pakistan **Ans.** (d) Australia **Ans.**

7. (a) The bar graph represents favourite fruits of student. **Ans.**

(b) Over $= 60 + 100 + 80 + 40 + 120 = 400$ children the survey way conducted. **Ans.**

(c) We can say the grapes is the favourite fruits because its frequency is maximum i.e. **120**. **Ans.**

(d) Banana fruit do the children like least because its frequence is least i.e. **40**. **Ans.**

8. (a) The bar graph represents the different courses taken UP by the students after class XII. **Ans.**

(b) IT course attract most of the students after class XII. **Ans.**

(c) There are $= 25 + 30 + 40 + 35 + 30 = 160$ students surveyed.

(d) The ratio between the student opting engineering and medical $= \dfrac{\text{Number of engineering students}}{\text{Number of medical students}} = \dfrac{25}{30} = \dfrac{5}{6} = \mathbf{5 : 6}$ **Ans.**

9. (a) The bar graphs represent number of teachers per subject in a school. **Ans.**

(b) For mathematics subject are more teachers than any other subject. **Ans.**

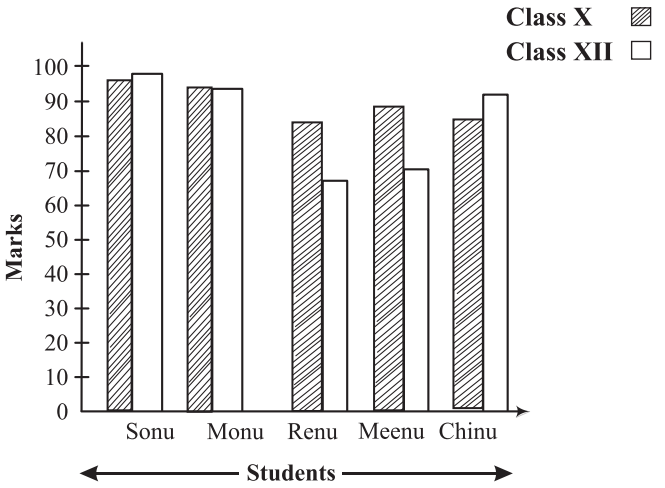
(c) Total number of the teachers are $= 25 + 30 + 40 + 35 + 30 =$ 160. **Ans.**

(d) Teacher-students ratio $= \dfrac{\text{Number of teachers}}{\text{Number of students}}$

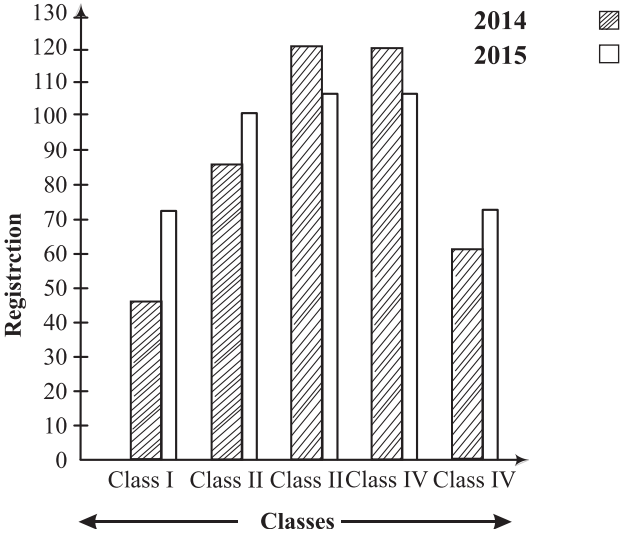
$= \dfrac{160}{1280} = \dfrac{16}{128} = \dfrac{1}{8} =$ **1 : 8** **Ans.**

Exercise 17.6

1.



2.



3. (a) DVD players **Ans.**

(b) 10 **Ans.**

(c) 70 **Ans.**

(d) calculators (90) **Ans.**

4. (a) **Milk** drink is liked equally by girls and boys. **Ans.**

(b) There are **600** more boys like coffee than girls. **Ans.**

(c) **Juice** drink is liked more by girls than boys. **Ans.**

(d) There are **200** less girls like tea than boys. **Ans.**

Multiple Choice Questions

1. (i) $\text{Mean} = \dfrac{2+3+4+5+6+7}{6}$

$= \dfrac{27}{6} = \dfrac{9}{2} = \mathbf{4.5}$

Hence, the answer **(d)** is correct. **Ans.**

(ii) $\text{Mean} = \dfrac{10+12+14+16+18}{5}$

$= \dfrac{70}{5} = 14$

Hence, the answer **(c)** is correct. **Ans.**

(iii) $\text{Mean} = \dfrac{5+10+15+20+25}{5}$

$= \dfrac{75}{5} = 15$

Hence, the answer **(b)** is correct. **Ans.**

(iv) $\text{Mean} = \dfrac{6+18+44+20+34}{5}$

$= \dfrac{122}{5} = 24.4$

Hence, the answer **(c)** is correct. **Ans.**

(v) Here, $n = 5$, which is odd.

$\therefore \text{Median} = \left(\dfrac{n+1}{2}\right)^{\text{th}} \text{ observation} = \left(\dfrac{5+1}{2}\right)^{\text{th}} \text{ observation}$

$= 3^{th}$ observation $= 16$

Hence, the answer **(c)** is correct. **Ans.**

(vi) Here, $n = 6$, which is even.

$$\therefore \text{Median} = \frac{\left(\frac{n}{2}\right)^{th} \text{observation} + \left(\frac{n}{2}+1\right)^{th} \text{observation}}{2}$$

$$= \frac{\left(\frac{6}{2}\right)^{th} \text{observation} + \left(\frac{6}{2}+1\right)^{th} \text{observation}}{2}$$

$$= \frac{3^{th} \text{ observation} + 4^{th} \text{ observation}}{2} = \frac{15+20}{2} = \frac{35}{2} = 17.5$$

Hence, the answer **(d)** is correct. **Ans.**

(vii) Let us first arrange the data is ascending order :

2, 2, 2, 2, 3, 3, 4, 4, 5, 6

We observe that 2 occurs maximum number of time.

$\therefore$ Mode $= 2$

Hence, the answer **(a)** is correct. **Ans.**

(viii) Let us first arrange the data in ascending order :

12, 12, 14, 15, 16, 20

We observe that 12 occurs maximum number of time.

$\therefore$ Mode $= 12$

Hence, the answer **(a)** is correct. **Ans.**

18. Probability

Exercise 18

1. (a) When we throw coin and left it fall freely on the ground, resting on one of its faces. On the upper face it will show either a head or a tail.

Thus, in throwing a coin, all possible outcomes are Head, Tail i.e., [H, T] **Ans.**

(b) In throwing two coins, all possible outcomes are two heads, two Tails, Head on the first coin and tail on the second, tail on the first coin, and Head on the second i.e., [HH, TT, HT, TH] **Ans.**

(c) The possible outcomes, when dice is rolled are 1, 2, 3, 4, 5 and 6. **Ans.**

2. (a) If a coin is tossed, the total number of outcome is 2 (H and T).

If the probability of getting will be $P(H) = \frac{1}{2}$

Hence, the probability of getting head will be $P(H) = \frac{1}{2}$. **Ans.**

(b) If a coin is tossed, the total number of outcome is 2(H and T)

If the probability of getting will be $P(T) = \frac{1}{2}$

Hence, **the probability of getting tail will be $P(T) = \frac{1}{2}$** **Ans.**

3. Sample space for toss of two coins is (H, H), (H, T), (T, H), (T, T)

(a) The probability of getting head will be $P(H) = \frac{2}{4} = \frac{1}{2}$ **Ans.**

(b) The probability of getting tail will be $P(T) = \frac{2}{4} = \frac{1}{2}$ **Ans.**

(c) The probability of no head will be $P(noH) = \frac{1}{4}$ **Ans.**

(d) The probability of no Tail will be $P(noT) = \frac{1}{4}$ **Ans.**

4. The possible outcomes, when dice is rolled are 1, 2, 3, 4, 5 and 6.

(a) Probability of $5 = P(5)$

$$= \frac{\text{Number of outcome favourable to } 5}{\text{Total number of possible out comes}} = \frac{1}{6}$$ **Ans.**

(b) Probability of $7 = P(7)$

$$= \frac{\text{Number of outcome favourable to 7}}{\text{Total number of possible out comes}} = \frac{\mathbf{0}}{\mathbf{6}} = \mathbf{0}$$

Ans.

(c) Probability of $3 = P(3)$

$$= \frac{\text{Number of outcome favourable to 3}}{\text{Total number of possible out comes}} = \frac{\mathbf{1}}{\mathbf{6}}$$

Ans.

(d) Number from 1 to $6 = P(6)$

$$= \frac{\text{Number of outcome favourable to 4}}{\text{Total number of possible out comes}} = \frac{\mathbf{6}}{\mathbf{6}} = \mathbf{1}$$

Ans.

5. Total number of trials $= 500$

(a) Number of heads $= 267$

$\therefore$ Probability of getting a head,

$$P(H) = \frac{\text{Number of heads}}{\text{Total number of trials}}$$

$$= \frac{\mathbf{267}}{\mathbf{500}}$$

Ans.

(b) Number of tails $= 233$

$\therefore$ Probability of getting tail, $P(T) = \dfrac{\text{Number of tails}}{\text{Total number of trials}}$

$$= \frac{233}{500}$$

Ans.