Chapter 3
Algebra

Ex 3.1

Question 1.
Complete the table.

×	$2x^2$	$-2xy$	x^4y^3	$2xyz$	$(\_\_)xz^2$
x^4					
$(\_\_)$			$4x^5y^4$		
$-x^2y$					
$2y^2z$					$-10xy^2z^3$
$-3xyz$					
$(\_\_)$				$-14xyz^2$	

Answer:

×	$2x^2$	$-2xy$	x^4y^3	$2xyz$	$(-5)xz^2$
x^4	$2x^6$	$-2x^5y$	x^8y^3	$2x^5yz$	$-5x^5z^2$
$4xy$	$8x^3y$	$-8x^2y^2$	$4x^5y^4$	$8x^2y^2z$	$-20x^2yz^2$
$-x^2y$	$-2x^4y$	$2x^3y^2$	$-x^6y^4$	$-2x^3y^2z$	$5x^3yz^2$
$2y^2z$	$4x^2y^2z$	$-4xy^3z$	$2x^4y^5z$	$4xy^3z^2$	$-10xy^2z^3$
$-3xyz$	$-6x^3yz$	$6x^2y^2z$	$-3x^5y^4z$	$-6x^2y^2z^2$	$15x^2yz^3$
$-7z$	$-14x^2z$	$14xyz$	$-7x^4y^3z$	$-14xyz^2$	$35xz^3$

Question 2.
Find the product of the terms.
(i) -2mn, $(2m)^2$, -3mn
(ii) $3x^2y$, $-3xy^3$, x^2y^2
Answer:
(i) $(-2mn) \times (2m)^2 \times (-3mn) = (-2mn) \times 2^2m^2 \times (-3mn) = (-2mn) \times 4m^2 \times (-3mn)$
$= (-)(+)(-)(2 \times 4 \times 3)(m \times m^2 \times m)(n \times n)$
$= +24\ m^4\ 4n^2$

(ii) $(3x^2y) \times (-3xy^3) \times (x^2y^2) = (+) \times (-) \times (+) \times (3 \times 3 \times 1)(x^2 \times x \times x^2) \times (y \times y^3 \times y^2)$
$= -9x^5 y^6$

Question 3.
If $l = 4pq^2$, $b = -3p^2q$ $h = 2p^3q^3$ then, find the value of $l \times b \times h$.
Answer:
Given $l = 4pq^2$
$b = -3p^2q$
$h = 2p^3q^3$
$l \times b \times h = (4pq^2) \times -3p^2q \times 2p^3q^3$
$= (+) (-) (+) (4 \times 3 \times 2) (p \times p^2 \times p^3) (q \times q^2 \times q^3)$
$= -24p^6q^6$

Question 4.
Expand
(i) $5x(2y - 3)$
(ii) $-2p(5p^2 - 3p + 7)$
(iii) $3mn(m^3n^3 - 5m^2n + 7mn^2)$
(iv) $x^2(x + y + z) + y^2(x + y + z) + z^2(x - y - z)$
Answer:
(i) $5x(2y - 3)$
$5x(2y - .3) = (5x)(2y) - (5x)(3)$
$= (5 \times 2) (x \times y) - (5 \times 3)x$
$= 10xy - 15x$

(ii) $-2p(5p^2 - 3p + 7)$
$-2p (5p^2 - 3p + 7) = (-2p) (5p^2) + (-2p) (-3p) + (-2p) (7)$
$= [(-) (+) (2 \times 5) (p \times p^2)] + [(-) (-) (2 \times 3) (p \times p)] + (-)(+)(2 \times 7)p$
$= -10p^3 + 6p^2 - 14p$

(iii) $3mn(m^3n^3 - 5m^2n + 7mn^2)$
$3mn(m^3n^3 - 5m^2n + 7\ mn^2) = (3mn) (m^3n^3) + (3mn) (-5m^3n) + (3mn)(7mn^3)$
$= (3)(m \times m^3) (n \times n^3) + (+)(-)(3 \times 5)(m \times m^2)(n \times n) + (3 \times 7) (m \times m)(n \times n^2)$
$= 3m^4n^4 - 15m^3n^2 + 21m^2n^3$

(iv) $x^2(x + y + z) + y^2(x + y + z) + z^2(x - y - z)$
$x^2(x + y + z) + y^2(x + y + z) + z^2(x - y - z) = (x^2 \times x) + (x^2 \times y) + (x^2 \times z) + (y^2 \times x) +$
$(y^2 \times y) + (y^2 \times z) + (z^2 \times x) + z^2 (-y) + z^2 (-z)$
$= x^3 + x^2y + x^2z + xy^2 + y^3 + y^2z + xz^2 - yz^2 - z^3$
$= x^3 + y^3 - z^3 + x^2y + x^2z + xy^2 + zy^2 + xz^2 - yz^2$

Question 5.
Find the product of
(i) $(2x + 3)(2x - 4)$
(ii) $(y^2 - 4)(2y^2 + 3y)$
(iii) $(m^2 - n)(5m^2n^2 - n^2)$

(iv) $3(x - 5) \times 2(x - 1)$

Answer:

(i) $(2x + 3)(2x - 4)$

$(2x + 3)(2x - 4) = (2x)(2x - 4) + 3(2x - 4)$

$= (2x \times 2x) - 4(2x) - 3(2x) - 3(4)$

$= 4x^2 - 8x + 6x - 12$

$= 4x^2 + (- 8 + 6)x - 12$

$= 4x^2 - 2x - 12$

(ii) $(y^2 - 4)(2y^2 + 3y)$

$(y^2 - 4)(2y^2 + 3y) = y^2(2y^2 + 3y) - 4(2y^2) - 4(3y)$

$= y^2(2y^2) + y^2 (3y) - 4(2y^2) - 4 (3y)$

$= 2y^4 + 3y^3 - 8y^2 - 12y$

(iii) $(m^2 - n)(5m^2n^2 - n^2)$

$(m^2 - n)(5m^2 n^2 - n^2) = m^2 (5m^2n^2 - n^2) - n (5m^2n^2 - n^2)$

$= m^2 (5m^2n^2) + m^2 (-n^2) - n (5m^2n^2) + (-) (-) n (n^2)$

$= 5m^4n^2 - m^2n^2 - 5m^2n^3 + n^3$

(iv) $3(x - 5) \times 2(x - 1)$

$3(x - 5) \times 2(x - 1) = (3 \times 2) (x - 5) (x - 1)$

$= 6 \times [x (x - 1) - 5 (x - 1)]$

6 [x.x – x.1 – 5x + (-1)(-)5 1]

$= 6[x^2 - x - 5x + 5] = 6[x^2 + (-1 - 5)x + 5]$

$= 6[x^2 - 6x + 5] = 6x^2 - 36 x + 30$

Question 6.

Find the missing term.

(i) $6xy \times$ _____ $= -12x^3y$

Answer:

$6xy \times (-2x^2) = -12x^3y$

(ii) _____ $\times (-15m^2n^3p) = 45m^3n^3p^2$

Answer:

$-3mp \times (-15m^2n^3p) = 45m^3n^3p^2$

(iii) $2y(5x^2y -$ ___ $+ 3$___ $) = 10x^2y^2 - 2xy + 6y^3$

Answer:

$2y(5x^2y - x + 3y^2) = 10x^2y^2 - 2xy + 6y^3$

Question 7.

Match the following

a)	$4y^2 \times -3y$	(i)	$20x^2y - 20x$
b)	$-2xy(5x^2 - 3)$	(ii)	$5x^3 - 5xy^2 + 5x^2y$
c)	$5x(x^2 - y^2 + xy)$	(iii)	$4x^2 - 9$
d)	$(2x + 3)(2x - 3)$	(iv)	$-12y^3$
e)	$5x(4xy - 4)$	(v)	$-10x^3y + 6xy$

(A) iv, v, ii, i, iii
(B) v, iv, iii, ii, i
(C) iv, v, ii, iii, i
(D) iv, v, iii, ii, i
Answer:
(C) iv, v, ii, iii, i
a) – iv
b) – v
c) – ii
d) – iii
e) – i

Question 8.
A car moves at a uniform speed of (x + 30) km/hr. Find the distance covered by the car in (y + 2)hours. (Hint: distance = speed × time).
Answer:
Speed of the car = (x + 30) km/hr.
Time = (y + 2) hours
Distance = Speed × time
= (x + 30) (y + 2) = x(y + 2) + 30(y + 2)
= (x) (y) + (x) (2) + (30) (y) + (30) (2)
= xy + 2x + 30y + 60
Distance covered = (xy + 2x + 30y + 60) km

Objective Type Questions

Question 9.
The product of $7p^3$ and $(2p^2)^2$ is
(A) $14p^{12}$
(B) $28p^7$
(C) $9p^7$
(D) $11p^{12}$
Answer:
(B) $28p^7$

Question 10.
The missing terms in the product $-3m^3n \times 9(\_) = \_\_\_\_\_ m^4n^3$ are
(A) mn^2, 27
(B) m^2n, 27
(C) m^2n^2, – 27
(D) mn^2, – 27
Answer:
(A) mn^2, 27

Question 11.
If the area of a square is $36x^4y^2$ then, its side is _____ .
(A) $6x^4y^2$
(B) $8x^2y^2$
(C) $6x^2y$
(D) $-6x^2y$
Answer:
(C) $6x^2y$

Question 12.
If the area of a rectangle is $48m^2n^3$ and whose length is $8mn^2$ then, its breadth is _____ .
(A) 6 mn
(B) $8m^2n$
(C) $7m^2n^2$
(D) $6m^2n^2$
Answer:
(A) 6 mn

Question 13.
If the area of a rectangular land is $(a^2 – b^2)$ sq.units whose breadth is$(a – b)$ then, its length is_____
(A) a – b
(B) a + b
(C) $a^2 – b$
(D) $(a + b)^2$
Answer:
(B) a + b

Ex 3.2

Question 1.
Fill in the blanks
(i)

$$\frac{18m^4(\_\_\_)}{2m^3n^3} = \_\_\_\_\_ mn^5.$$

Answer:

$$\frac{18m^4(n^8)}{2m^{(3)}n^3} = 9\ mn^5$$

(ii)

$$\frac{l^4m^5n^{(\ )}}{2lm^{(\ )}n^6} = \frac{l^3m^3n}{2}.$$

Answer:

$$\frac{l^4m^5n^{(7)}}{2lm^{(3)}n^6} = \frac{l^3m^2n}{2}$$

(iii)

$$\frac{42a^2b^5(\_\_)}{6a^4b^2} = (\_\_\_\_)b^3c^2.$$

Answer:

$$\frac{42a^4b^5(c^2)}{6(a)^4(b)^2} = (7)b^3c^2$$

Question 2.
Say True or False
(i) $8x^3y \div 4x^2 = 2xy$
Answer:
True

(ii) $7ab^3 \div 14\ ab = 2b^2$
Answer:
False

Question 3.
Divide
(i) 27 y^3 by 3y
(ii) $x^3\ y^2$ by x^2y
(iii) $45x^3\ y^2\ z^4$ by (-15 xyz)

(iv) $(3xy)^2$ by 9xy

Answer:

(i) 27 y^3 by 3y

$\frac{27y^3}{3y} = \frac{27}{3}y^{3-1} = 9y^2$

(ii) x^3 y^2 by x^2y

$\frac{x^3y^2}{x^2y} = x^{3-2}\ y^{2-1} = x^1\ y^1 = xy$

(iii) $45x^3\ y^2\ z^4$ by (-15 xyz)

$\frac{45x^3y^2z^4}{-15xyz} = \frac{45}{-15}\ x^{3-2}\ y^{2-1}\ y^{4-1}\ z^{4-1} = -3x^2\ yz^3$

(iv) $(3xy)^2$ by 9xy

$\frac{(3xy)^2}{3\times(3xy)} = \frac{(3xy)^2}{3\times(3xy)} = \frac{1}{3}\ (3xy)^{2-1} = \frac{1}{3}\ 3xy = xy$

Question 4.

Simplify

(i) $\frac{3m^2}{m} + \frac{2m^4}{m^3}$

(ii) $\frac{14p^5q^3}{2p^2q}\ \frac{12p^3q^4}{3q^2}$

Answer:

(i) $\frac{3m^2}{m} + \frac{2m^4}{m^3}$

$\frac{3m^2}{m} + \frac{2m^4}{m^3} = 3m^{2-1} + 2m^{4-3}$

$= 3m + 2m$

$= (3 + 2)\ m$

$= 5m$

(ii) $\frac{14p^5q^3}{2p^2q}\ \frac{12p^3q^4}{3q^2}$

$\frac{14p^5q^3}{2p^2q}\ \frac{12p^3q^4}{3q^2} = \frac{14}{2}\ p^{5-2}q^{3-1} - \frac{12}{3}\ p^3q^{4-3}$

$= 7p^3q^2 - 4p^3q$

Question 5.

Divide:

(i) $32y^2 - 8yz$ by 2y

(ii) $(4m^2n^3 + 16m^4\ n^2 - mn)$ by 2mn

(iii) $5xy^2 - 18x^2y^3 + 6xy$ by 6xy

(iv) $81(p^4 q^2 r^3 + 2p^3q^3 r^2 - 5p^2q^2r^2)$ by $(3pqr)^2$

Answer:

(i) $32y^2 - 8yz$ by $2y$

$$\frac{32y^2 - 8yz}{2y} = \frac{32y^2}{2y} - \frac{8yz}{2y} = \frac{32}{2}y^{2-1} - \frac{8}{2}y^{1-1}z = 16y - 4z$$

(ii) $(4m^2n^3 + 16m^4 n^2 - mn)$ by $2mn$

$$\frac{4m^2n^3 + 16m^4n^2 - mn}{2mn} = \frac{4m^2n^3}{2mn} + \frac{16m^4n^2}{2mn} - \frac{mn}{2mn}$$

$$= \frac{4}{2}m^{2-1}n^{3-1} + \frac{16}{2}m^{4-1}n^{2-1} - \frac{1}{2}m^{1-1}n^{1-1}$$

$$= 2m^1 n^2 + 8\, m^3 n^1 - \frac{1}{2}m^0 n^0$$

$$= 2mn^2 + 8\, m^3 n - \frac{1}{2}$$

(iii) $5xy^2 - 18x^2y^3 + 6xy$ by $6xy$

$$\frac{5xy^2 - 18x^2y^3 + 6xy}{6xy} = \frac{xy(5y - 18xy^2 + 6)}{6xy}$$

$$= \frac{5y - 18xy^2 + 6}{6}$$

(iv) $81(p^4 q^2 r^3 + 2p^3q^3 r^2 - 5p^2q^2r^2)$ by $(3pqr)^2$

$$\frac{81(p^4q^2r^3 + 2p^3q^3r^2 - 5p^2q^2r^2)}{(3pqr)^2}$$

$$= \frac{81(p^2q^2r^2)(p^2r + 2pq - 5)}{9(p^2q^2r^2)}$$

$= 819(p^2q^2r^2)^{1-1}(p^2r + 2pq - 5)$

$= 9(p^2r + 2pq - 5) = 9\, p^2r + 18pq - 45$

Question 6.

Identify the errors and correct them.

(i) $7y^2 - y^2 + 3y^2 = 10y^2$

Answer:

$7y^2 - y^2 + 3y^2 = 10y^2 = (7 - 1 + 3)y^2$

$= (6 + 3)y^2$

$= 9y^2$

(ii) $6xy + 3xy = 9x^2y^2$
Answer:
$6xy + 3xy = (6 + 3)\ xy$
$= 9\ xy$

(iii) $m(4m - 3) = 4m^2 - 3$
Answer:
$m(4m - 3) = m(4m) + m(-3)$
$= 4m^2 - 3m$

(iv) $(4n)^2 - 2n + 3 = 4n^2 - 2n + 3$
Answer:
$(4n)^2 - 2n + 3 = 16n^2 - 2n + 3$

(v) $(x - 2)(x + 3) = x^2 - 6$
Answer:
$(x - 2)(x + 3) = x(x + 3) - 2\ (x + 3)$
$= x(x) + (x) \times 3 + (-2)\ (x) + (-2)\ (3)$
$= x^2 + 3x - 2x - 6$
$= x^2 + x - 6$

(vi) $-3p^2 + 4p - 7 = -(3p^2 + 4p - 7)$
Answer:
$-3p^2 + 4p - 7 = -(3p^2 - 4p + 7)$

Question 7.
Statement A: If $24p^2q$ is divided by $3pq$, then the quotient is $8p$.
Statement B: Simplification of $\frac{(5x+5)}{5}$ is $5x$.
(i) Both A and B are true
(ii) A is true but B is false
(iii) A is false but B is true
(iv) Both A and B are false
Answer:
(ii) A is true but B is false
Hint:

$$\frac{\overset{8}{\cancel{24}}\ p^2\ \cancel{q}}{\cancel{3}\ p\ \cancel{q}} = \frac{8p^2}{p} = 8p^{2-1} = 8p$$

$$\left(\frac{5x+5}{5}\right) = \frac{\cancel{5}\,(x+1)}{\cancel{5}} = x + 1$$

Question 8.
Statement A: $4x^2 + 3x - 2 = 2(2x^2 + \frac{3x}{2} - 1)$

Statement B: $(2m - 5) - (5 - 2m) = (2m - 5) + (2m - 5)$
(i) Both A and B are true
(ii) A is true but B is false
(iii) A is false but B is true
(iv) Both A and B are false
Answer:
(i) Both A and B are true
Hint:
$(2m - 5) - (5 - 2m) = 2m - 5 - 5 + 2m = 4m - 10$
$(2m - 5) + (2m - 5) = 4m - 10$

Ex 3.3

Question 1.
Expand
(i) $(3m + 5)^2$
(ii) $(5p - 1)^2$
(iii) $(2n - 1)(2n + 3)$
(iv) $4p^2 - 25q^2$
Answer:
(i) $(3m + 5)^2$
Comparing $(3m + 5)^2$ with $(a + b)^2$ we have $a = 3m$ and $b = 5$
$(a + b)^2 = a^2 + 2ab + b^2$
$(3m + 5)^2 = (3m)^2 + 2(3m)(5) + 5^2$
$= 3^2 m^2 + 30 m + 25$
$= 9m^2 + 30 m + 25$

(ii) $(5p - 1)^2$
Comparing $(5p - 1)^2$ with $(a - b)^2$ we have $a = 5p$ and $b = 1$
$(a - b)^2 = a^2 - 2ab + b^2$
$(5p - 1)^2 = (5p)^2 - 2(5p)(1) + 1^2$
$= 5^2p^2 - 10 p + 1$
$= 25p^2 - 10p + 1$

(iii) $(2n - 1)(2n + 3)$
Comparing $(2n - 1)(2n + 3)$ with $(x + a)(x + b)$ we have $a = -1$; $b = 3$
$(x + a)(x + b) = x^2 + (a + b)x + ab$
$(2n + (-1))(2n + 3) = (2n)^2 + (-1 + 3)2n + (-1)(3)$
$= 2^2 n^2 + 2(2n) - 3 = 4n^2 + 4n - 3$

(iv) $4p^2 - 25q^2 = (2p)^2 - (5q)^2$
Comparing $(2p)^2 - (5q)^2$ with $a^2 - b^2$ we have $a = 2p$ and $b = 5q$
$(a^2 - b^2) = (a + b)(a - b)$
$= (2p + 5q)(2p - 5q)$

Question 2.
Expand
(i) $(3 + m)^3$
(ii) $(2a + 5)^3$
(iii) $(3p + 4q)^3$
(iv) $(52)^3$
(v) $(104)^3$
Answer:
(i) $(3 + m)^3$
Cornparing $(3 + m)^3$ with $(a + b)^3$ we have $a = 3$; $b = m$
$(a + b)^3 = a^2 + 3a^2b + 3ab^2 + b^3$

$(3 + m)^3 = 3^3 + 3(3)^2 (m) + 3(3)m^2 + m^3$
$= 27 + 27m + 9m^2 + m^3$
$= m^3 + 9m^2 + 27m + 27$

(ii) $(2a + 5)^3 =$
Comparing $(2a + 5)^3$ with $(a + b)^3$ we have $a = 2a, b = 5$
$(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$
$= (2a)^3 + 3(2a)^2 5 + 3 (2a) 5^2 + 5^3$
$= 2^3a^3 + 3(2^2a^2)5 + 6a(25) + 125$
$= 8a^3 + 60a^2 + 150a + 125$

(iii) $(3p + 4q)^3$
Comparing $(3p + 4q)^3$ with $(a + b)^3$ we have $a = 3p$ and $b = 4q$
$(a + b) = a^3 + 3a^2b + 3ab^2 + b^2$
$(3p + 4q)^3 = (3p)^3 + 3(3p)^2 (4q) + 3(3p)(4q)^2 + (4q)^3$
$= 3^3p^3 + 3(9p^2)(4q) + 9p(16q^2) – 4^3q^3$
$= 27p^3 + 108p^2q + 144pq^3 + 64q^3$

(iv) $(52)^3$
$(52)^3 = (50 + 2)^3$
Comparing $(50 + 2)^3$ with $(a + b)^3$ we have $a = 50$ and $b = 2$
$(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$
$(50 + 2)^3 = 50^3 + 3 (50)^2 2 + 3 (50)(2)^2 + 2^3$
$52^3 = 125000 + 6(2,500) + 150(4) + 8$
$= 1,25,000 + 15,000 + 600 + 8$
$52^3 = 1,40,608$

(v) $(104)^3$
$(104)^3 = (100 + 4)^3$
Comparing $(100 + 4)^3$ with $(a + b)^3$ we have $a = 100$ and $b = 4$
$(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$
$(100 + 4)^3 = (100)^3 + 3 (100)^2 (4) + 3 (100) (4)^2 + 4^3$
$= 10,00,000 + 3(10000)4 + 300(16) + 64$
$= 10,00,000 + 1,20,000 + 4,800 + 64 = 11,24,864$

Question 3.
Expand
(i) $(5- x)^3$
(ii) $(2x – 4y)^3$
(iii) $(ab – c)^3$
(iv) $(48)^3$
(v) $(97xy)^3$
Answer:
(i) $(5- x)^3$
Comparing $(5 – x)^3$ with $(a – b)^3$ we have $a = 5$ and $b = x$
$(a – b)^3 = a^3 – 3a^2b + 3ab^2 – b^3$

$(5 - x)^3 = 5^3 - 3(5)^2(x) + 3(5)(x^2) - x^3$
$= 125 - 3(25)(x) + 15x^2 - x^3$
$= 125 - 75x + 15\,x^2 - x^3$

(ii) $(2x - 4y)^3$
Comparing $(2x - 4y)^3$ with $(a - b)^3$ we have $a = 2x$ and $b = 4y$
$(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$
$(2x - 4y)^3 = (2x)^3 - 3(2x)^2\,(4y) + 3(2x)\,(4y)^2 - (4y)^3$
$= 2^3x^3 - 3(2^2x^2)(4y) + 3(2x)\,(4^2y^2) - (4^3y^3)$
$= 8x^3 - 48x^2y + 96xy^2 - 64y^3$

(iii) $(ab - c)^3$
Comparing $(ab - c)^3$ with $(a - b)^3$ we have $a = ab$ and $b = c$
$(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$
$(ab - c)^3 = (ab)^3 - 3(ab)^2\,c + 3ab\,(c)^2 - c^3$
$= a^3b^3 - 3(a^2b^2)\,c + 3abc^2 - c^3$
$= a^3b^3 - 3a^2b^2c + 3abc^2 - c^3$

(iv) $(48)^3$
$(48)^3 = (50 - 2)^3$
Comparing $(50- 2)^3$ with $(a - b)^3$ we have $a = 50$ and $b = 2$
$(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$
$(50 - 2)^3 = (50)^3 - 3(50)^2\,(2) + 3\,(50)(2)^2 - 2^3$
$= 1{,}25{,}000 - 15000 + 600 - 8$
$= 1{,}10{,}000 + 592$
$= 1{,}10{,}592$

(v) $(97xy)^3$
$(97xy)^3 = 97^3\,x^3\,y^3 = (100 - 3)\,x^3y^3$ … (1)
Comparing$(100 - 3)^3$ with $(a - b)^3$ we have $a = 100$, $b = 3$
$(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$
$(100 - 3)^3 = (100)^3 - 3(100)^2\,(3) + 3\,(100)(3)^2 - 3^3$
$97^3 = 10{,}00{,}000 - 90000 + 2700 - 27$
$97^3 = 910000 + 2673$
$97^3 = 912673$
$97x^3y^3 = 912673x^3y^3$

Question 4.
Simplify $(p - 2)(p + 1)(p - 4)$
Answer:
$(p - 2)(p + 1)(p - 4) = (p + (-2))\,(p + 1)\,(p + (-4))$
Comparing $(p - 2)\,(p + 1)\,(p - 4)$ with $(x + a)\,(x + b)\,(x + c)$ we have $x = p$; $a = -2$; $b = 1$; $c = -4$.
$(x + a)(x + b)(x + c) = x^2 + (a + b + c)\,x^2 + (ab + bc + ca)x + abc$
$= p^3 + (-2 + 1 + (-4))\,p^2 + (-2)(\,1) + (1)(-4) + (-4)\,(-2))p + (-2)\,(1)\,(-4)$

$= p^3 + (-5)p^2 + (-2 + (-4) + 8)p + 8$
$= p^2 - 5p^2 + 2p + 8$

Question 5.
Find the volume of the cube whose side is (x + 1) cm
Answer:
Given side of the cube = (x + 1) cm
Volume of the cube = $(side)^3$ cubic units = $(x + 1)^3$ cm^3
We have $(a + b)^3 = (a3^3 + 3a^2b + 3ab^2 + b^3)$ cm^3
$(x + 1)^3 = (x^3 + 3x^2(1) + 3x(1)^2 + 1^3)cm^3$
Volume = $(x^3 + 3x^2 + 3x + 1)$ cm^3

Question 6.
Find the volume of the cuboid whose dimensions are (x + 2),(x – 1) and (x – 3)
Answer:
Given the dimensions of the cuboid as (x + 2), (x – 1) and (x – 3)
∴ Volume of the cuboid = $(l \times b \times h)$ $units^3$
= (x + 2) (x – 1) (x – 3) $units^3$
We have $(x + a)(x + b)(x+c) = x^3 + (a + b + c)x^2 + (ab + bc + ca)x + abc$
∴ $(x+2)(x- 1)(x-3) = x^3 + (2 - 1 - 3)x^2 + (2(-1) + (-1)(-3) + (-3)(2))x + (2)(-1)(-3)$
$= x^3 - 2x^2 + (-2 + 3 - 6)x + 6$
Volume = $x^3 - 2x^3 - 5x + 6$ $units^3$

Objective Type Questions

Question 7.
If $x^2 - y^2 = 16$ and (x + y) = 8 then (x – y) is _____
(A) 8
(B) 3
(C) 2
(D) 1
Answer:
(C) 2
Hint:
$x^2 - y^2 = 16$
(x + y) (x – y) = 16
8 (x – y) = 16
$(x - y) = \frac{16}{8} = 2$

Question 8.
$\frac{(a+b)(a^3-b^3)}{(a^2-b^2)}$ = _____
(A) $a^2 - ab + b^2$
(B) $a^2 + ab + b^2$

(C) $a^2 + 2ab + b^2$
(D) $a2^2 - 2ab + b^2$
Answer:
(B) $a^2 + ab + b^2$
Hint:

$$\frac{(a+b)(a^3-b^3)}{(a^2-b^2)} = \frac{\cancel{(a+b)}\,\cancel{(a-b)}\,(a^2+ab+b^2)}{\cancel{(a+b)}\,\cancel{(a-b)}}$$

$= a^2 + ab + b^2$

Question 9.
$(p + q)(p^2 - pq + q^2)$ is equal to _____
(A) $p^3 + q^3$
(B) $(p + q)^3$
(C) $p^3 - q^3$
(D) $(p - q)^3$
Answer:
(A) $p^3 + q^3$
Hint:
$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

Question 10.
$(a - b) = 3$ and $ab = 5$ then $a^3 - b^3$ = _____
(A) 15
(B) 18
(C) 62
(D) 72
Answer:
(D) 72
Hint:
$(a - b) = 3$
$(a - b)^2 = 3^2$
$a^2 + b^2 - 2ab = 9$
$a^2 + b^2 - 2(5) = 9$
$a^2 + b^2 = 9 + 10$
$a^2 + b^2 = 19$
$a^3 - b^3 = (a - b)(a^2 + ab + b^2) = 3(19 + 5)$
$= 3(24) = 72$

Question 11.
$a^3 + b^3 = (a + b)^3$ _____
(A) $3a(a + b)$
(B) $3ab(a - b)$
(C) $-3ab(a + b)$
(D) $3ab(a + b)$

Answer:
(D) $3ab(a + b)$
Hint:
$(a + b)^3 = a^3 + b^3 + 3a^2b + 3ab^2$
$(a + b)^3 - 3a^2b - 3ab^3 = a^3 + b^3$
$(a + b)^3 - 3ab(a + b) = a^3 + b^3$

Ex 3.4

Question 1.
Factorise the following by taking out the common factor
(i) $18xy - 12yz$
Answer:
$18xy - 12yz = (2 \times 3 \times 3 \times y \times x) - (2 \times 2 \times 3 \times y \times z)$
Taking out the common factors 2, 3, y, we get
$= 2 \times 3 \times y(3x - 2z) = 6y(3x - 2z)$

(ii) $9x^5y^3 + 6x^3y^2 - 18x^2y$
Answer:
$9x^5 + 6x^3y^2 - 18x^2y = (3 \times 3 \times x^2 \times x^3 \times y \times y) + (2 \times 3 \times x^2 \times x \times y \times y) - (2 \times 3 \times 3 \times x^2 \times y)$
Taking out the common factors 3, x^2, y, we get
$= 3 \times x^2 \times y\ (3x^3y^2 + 2xy - 6)$
$= 3x^2y\ (3x^3y^2 + 2xy - 6)$

(iii) $x(b - 2c) + y(b - 2c)$
Answer:
Taking out the binomial factor $(b - 2c)$ from each term, we have
$= (b - 2c)(x + y)$

(iv)$(ax + ay) + (bx + by)$
Answer:
Taking at 'a' from the first term and 'b' from the second term we have
$(ax + ay) + (bx + by) = a(x + y) + b(x + y)$
Now taking out the binomial factor $(x + y)$ from each term
$= (x + y)\ (a + b)$

(v) $2x^2(4x - 1) - 4x + 1$
Answer:
Taking out -1 from last two terms
$2x^2\ (4x - 1) - 4x + 1 = 2x^2\ (4x - 1) - 1\ (4x - 1)$
Taking out the binomial factor $4x - 1$, we get
$= (4x - 1)\ (2x^2 - 1)$

(vi) $3y(x - 2)^2 - 2(2 - x)$
Answer:
$3y(x - 2)^2 - 2(2 - x) = 3y(x - 2)(x - 2) - 2(-1)(x - 2)$
[$\because$ Taking out -1 from $2 - x$]
$= 3y(x - 2)(x - 2) + 2(x - 2)$
Taking out the binomial factor $x - 2$ from each term, we get
$= (x - 2)\ [3y(x - 2) + 2]$

(vii) $6xy - 4y^2 + 12xy - 2yzx$

Answer:

$= 6xy + 12xy - 4y^2 - 2yzx$ [∵ Addition is commutative]

$= (6 \times x \times y) + (2 \times 6 \times x \times y) + (-1)\ (2)\ (2)\ y + y) + ((-1)\ (2)\ (y)\ (z)\ (x))$

Taking out 6 x x x y from first two terms and $(-1) \times 2 \times y$ from last two terms we get

$= 6 \times x \times y(1 + 2) + (-1)\ (2)\ y\ [2y + zx]$

$= 6 \times y(3) - 2y(2y + zx)$

$= (2 \times 3 \times 3 \times x \times y) - 2xy(2y + zx)$

Taking out 2y from two terms

$= 2y(9x - (2y + zx))$

$= 2y\ (9x - 2y - xz)$

(viii) $a^3 - 3a^2 + a - 3$

Answer:

$a^2 - 3a^2 + a - 3 = a^2(a - 3) + 1(a - 3)$ [:Groupingthetermssuitably]

$= (a - 3)\ (a^2 + 1)$

(ix) $3y^3 - 48y$

Answer:

$3y^2 - 48y = 3 \times y \times y^2 - 3 \times l6 \times y$

Taking out $3 \times y$

$= 3y(y^2 - 16) = 3y(y^2 - 4^2)$

Comparing $y^2 - 4^2$ with $a^2 - b^2$

$a = y, b = 4$

$a^2 - b^2 = (a + b)\ (a - b)$

$y^2 - 4^2 = (y + 4)\ (y - 4)$

$\therefore 3y(y^2 - 16) = 3y(y + 4)(y - 4)$

(x) $ab^2 - bc^2 - ab + c^2$

Answer:

$ab^2 - bc^2 - ab + c^2$

Grouping suitably

$ab^2 - bc^2 - ab + c^2 = b\ (ab - c^2) - 1\ (ab - c^2)$

Taking out the binomial factor $ab - c^2 = (ab - c^2)\ (b - 1)$

Question 2.

Factorise the following expressions

(i) $x^2 + 14x + 49$

Answer:

$x^2 + 14x + 49 = x^2 + 14x + 72$

Comparing with $a^2 + 2ab + b^2 = (a + b)^2$ we have $a = x$ and $b = 7$

$\Rightarrow x^2 + 2(x)(7) + 7^2 = (x + 7)^2$

$\therefore x^2 + 14x + 49 = (x + 7)^2$

(ii) $y^2 - 10y + 25$

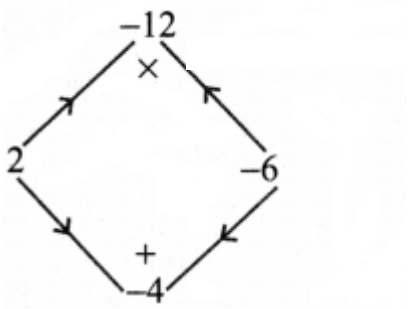
Answer:

$y^2 - 10y + 25 = y^2 - 10y + 5^2$
Comparing with $a^2 - 2ab + b^2 = (a - b)^2$ we get $a = y$; $b = 5$
$\Rightarrow y^2 - 2(y)(5) + 5^2 = (y - 5)^2$
$\therefore y^2 - 10y + 25 = (y - 5)^2$

(iii) $c^2 - 4c - 12$
Answer:
This is of the form $ax^2 + bx + c$
Where $a = 1$, $b = -4$ $c = -12$, $x = c$
Now the product $ac = 1 \times -12 = -12$ and the sum $b = -4$

Product = – 72	Sum = 1
$1 \times (-12) = -12$	$1 + (-12) = -11$
$2 \times (-6) = -12$	$2 + (-6) = -4$

$\therefore$ The middle term $-4c$ can be written as $2c - 6c$
$\therefore c^2 - 4c - 12 = c^2 + 2c - 6c - 12$
$= c(c + 2) - 6(c + 2)$



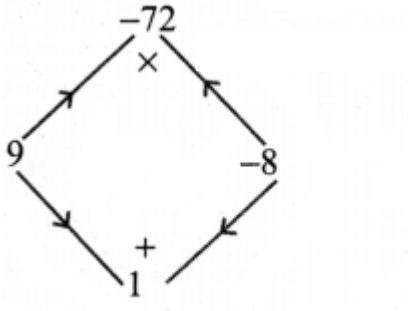
Taking out $(c + 2)$
$\Rightarrow (c + 2)(c - 6)$
$\therefore c^2 - 4c - 12 = (c + 2)(c - 6)$

(iv) $m^2 + m - 72$
Answer:
$m^2 + m - 72$
This is of the form $ax + bx + c$
where $a = 1$, $b = 1$, $c = -72$

Product = – 72	Sum = 1
$1 \times -72 = -72$	$1 + (-72) = -71$
$2 \times -36 = -72$	$2 + (-36) = -34$
$3 \times (-24) = -72$	$3 + (-24) = -21$
$4 \times (-18) = -72$	$4 + (-18) = -14$
$6 \times (-12) = -72$	$6 + (-12) = -6$

$8 \times (-9) = -72$	$8 + (-9) = -1$
$9 \times (-8) = -72$	$9 + (-8) = 1$

Product $a \times c = 1 \times -72 = -72$
Sum $b = 1$
The middle term m can be written as $9m - 8m$
$m^2 + m - 72 = m^2 + 9m - 8m - 72$
$= m(m + 9) - 8(m + 9)$

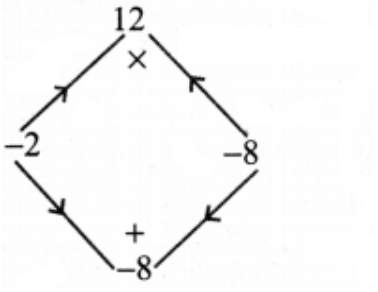


Taking out $(m + 9)$
$= (m + 9)(m - 8)$
$\therefore m^2 + m - 72 = (m + 9)(m - 8)$

(v) $4x^2 - 8x + 3$
Answer:
$4x^2 - 8x + 3$
This is of the form $ax^2 + bx + c$ with $a = 4$ $b = -8$ $c = 3$
Product $ac = 4 \times 3 = 12$
sum $b = -8$

Product = 12	Sum = -8
$(-1) \times (-12) = 12$	$(-1) + (-12) = -13$
$(-2) \times (-6) = 12$	$(-2) + (-6) = -8$

The middle term can be written as $-8x = -2x - 6x$
$4x^2 - 8x + 3 = 4x^2 - 2x - 6x + 3$
$= 2x(2x - 1) - 3(2x - 1)$
$= (2x - 1)(2x - 3)$
$4x^2 - 8x + 3 = (2x - 1)(2x - 3)$



Question 3.
Factorise the following expressions using $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$ identity
(i) $64x^3 + 144x^2 + 108x + 27$
(ii) $27p^3 + 54p^3q + 36pq^2 + 8q^3$
Answer:
(i) $64x^3 + 144x^2 + 108x + 27$
$= (4x)^3 + 3(4x)^2 (3) + 3(4) (3)^2 + 3^3$
$= (4x + 3)^3$

(ii) $27p^3 + 54p^3q + 36pq^2 + 8q^3$
$= (3p)^3 + 3(3p)^2 (2q) + 3(3p) (2q)^2 + (2q)^3$
$= (3p + 2q)^3$

Question 4.
Factorise the following expressions using $(a – b)^3 = a^3 – 3a^2b + 3ab^2 – b^3$ identity
(i) $y^3 – 18y^2 + 108y – 216$
(ii) $8m^3 – 60m^2n + 150mn^2 – 125n^3$
Answer:
(i) $y^3 – 18y^2 + 108y – 216$
$= y^3 – 3y^2(6) + 3(6)^2y – 6^3$
$= (y – 6)^3$

(ii) $8m^3 – 60m^2n + 150mn^2 – 125n^3$
$= (2m)^3 – 3(2m)^2 (5) + 3(2m)(5n)^2 – (5n)^3$
$= (2m – 5n)^3$

Ex 3.5

Question 1.
Subtract: $-2(xy)^2 (y^3 + 7x^2y + 5)$ from $5y^2 (x^2y^3 - 2x^4y + 10x^2)$
Answer:

$5y^2 (x^2 y^3 - 2x^4y + 10x^2) - [(-2) (xy)^2 (y^3 + 7x^2y + 5)]$

$= [5y^2 (x^2 y^3) - 5y^2 (2x^4 y) + 5y^2 (10x^2)] - [(-2) x^2y^2 (y^3 + 7x^2 y + 5)]$

$= (5y^5x^2 - 10 x^4y^3 + 50 x^2y^2) - [(-2x^2y^2) (y^3) + (-2x^2y^2) (7x^2y) + (-2x^2y^2) (5)]$

$= 5x^2y^5 - 10x^4y^3 + 50x^2y^2 - [-2x^2 y^5 - 14x^4y^3 - 10x^2y^2]$

$= 5x^2y^5 - 10x^4y^3 + 50x^2y^2 + 2x^2 y^5 + 14x^4y^3 + 10x^2y^2$

$= (5 + 2) x^2 y^5 + (-10 + 14) x^4y^3 + (+50 +10)x^2y^2$

$= 7x^2y^5 + 4x^4y^3 + 60x^2y^2$

Question 2.
Multiply $(4x^2 + 9)$ and $(3x - 2)$.
Answer:
$(4x^2 + 9)(3x - 2) = 4x^2(3x - 2) + 9(3x - 2)$
$= (4x^2)(3x) - (4x^2) (2) + 9(3x) - 9(2)$
$= (4 \times 3 \times x \times x^2) - (4 \times 2 \times x^2) + (9 \times 3 \times x) - 18$
$= 12x^3 - 8x^2 + 27x - 18(4x^3 + 9)(3x - 2)$
$= 12x^3 - 8x^2 + 27x - 18$

Question 3.
Find the simple interest on Rs. $5a^2b^2$ for 4ab years at 7b% per annum.
Answer:

$$\text{Simple interest} = \frac{\text{Principal} \times \text{years} \times \text{rate of interest}}{100}$$

$$= \frac{5a^2b^2 \times 4ab \times 7b}{100} = \frac{(5 \times 4 \times 7)(a^2 \times b^2 \times a \times b \times b)}{100}$$

$$= \frac{140}{100} (a^2 b^4) = \frac{14}{10} a^3 b^4$$

$$\text{Simple Interest} = \frac{7}{5} a^3 b^4$$

Question 4.
The cost of a note book is Rs. 10ab. If Babu has Rs. $(5a^2b + 20ab^2 + 40ab)$. Then how many note books can he buy?
Answer:

For ₹ 10 ab the number of note books can buy = 1.

For ₹$(5a^2b + 20ab^2 + 40\ ab)$ the number of note books can buy = $\frac{\text{Total amount}}{\text{cost of 1 note book}}$

$$= \frac{5a^2b + 20ab^2 + 40ab}{10ab} = \frac{5a^2b}{10ab} + \frac{20ab^2}{10ab} + \frac{40ab}{10ab}$$

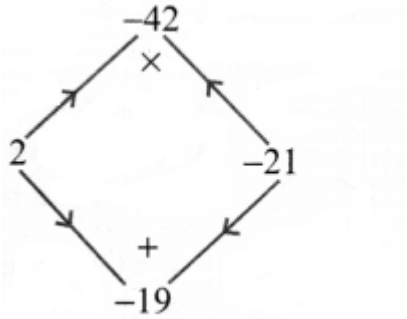
$$= \frac{1}{2} a^{2-1} b^{1-1} + 2\, a^{1-1} b^{2-1} + 4\, a^{1-1} b^{1-1} = \frac{1}{2} a^1 b^0 + 2\, a^0 b^1 + 4\, a^0 b^0$$

Number of note book he can buy = $\frac{1}{2}$a + 2b + 4

Question 5.
Factorise: ($7y^2 - 19y - 6$)
Answer:
$7y^2 - 19y - 6$ is of the form $ax^2 + bx + c$ where a = 7; b = – 19; c = – 6

Product = – 42	Sum = -19
1 × – 42 = -42	1 + (-42) = – 41
2 × – 21 = – 42	2 + (-21) = – 19

The product a × c = 7 × – 6 = – 42
sum b = – 19



The middle term – 19 y can be written as – 21y + 2y
$7y^2 - 19y - 6 = 7y^2 - 21y + 2y - 6$
$= 7y(y - 3) + 2(y - 3)$
$= (y - 3)(7y + 2)$
$7y^2 - 19y - 6 = (y - 3)(7y + 2)$

Question 6.
A contractor uses the expression $4x^2 + 11x + 6$ to determine the amount of wire to order when wiring a house. If the expression comes from multiplying the number of rooms times the number of outlets and he knows the number of rooms to be (x + 2), find the number of outlets in terms of 'x'. [Hint : factorise $4x^2 + 11x + 6$]
Answer:
Given Number of rooms = x + 2

Number of rooms × Number of outlets = amount of wire.
(x + 2) × Number of outlets = $4x^2 + 11x + 6$

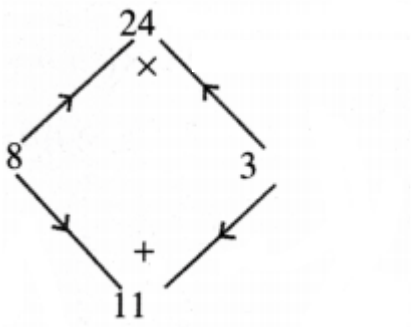
Number of outlets = $\frac{4x^2+11x+6}{x+2}$ ... (1)

Now factorising $4x^2 + 11x + 6$ which is of the form $ax^2 + bx + c$ with a = 4 b = 11 c = 6.

The product a × c = 4 × 6 = 24

sum b = 11

Product = 24	Sum = 11
1 × 24 = 24	1 + 24 = 25
2 × 12 = 24	2 + 12 = 14
3 × 8 = 24	3 + 18 = 11



The middle term 11x can be written as 8x + 3x
∴ $4x^2 + 11x + 6 = 4x^2 + 8x + 3x + 6$
$= 4x(x + 2) + 3(x + 2)$
$4x^2 + 11x + 6 = (x + 2)(4x + 3)$
Now from (1) the number of outlets

$$= \frac{4x^2+11x+6}{x+2} = \frac{(x+2)(4x+3)}{(x+2)} = 4x+3$$

∴ Number of outlets = 4x + 3

Question 7.
A mason uses the expression $x^2 + 6x + 8$ to represent the area of the floor of a room. If the decides that the length of the room will be represented by (x + 4), what will the width of the room be in terms of x?
Answer:
Given length of the room = x + 4 .
Area of the room = $x^2 + 6x + 8$
Length × breadth = $x^2 + 6x + 8$

breadth = $\frac{x^2+6x+8}{x+4}$ ..... (1)

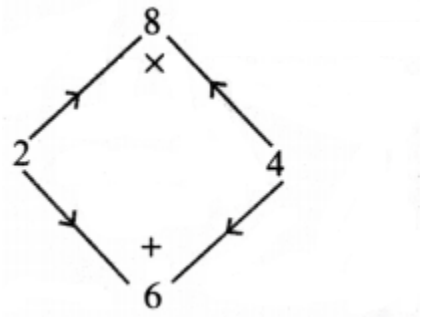
Factorizing $x^2 + 6x + 8$, it is in the form of $ax^2 + bx + c$

Where a =1 b = 6 c = 8.

The product a × c = 1 × 8 = 8

sum = b = 6

Product = 8	Sum = 6
1 × 8 = 8	1 + 8 = 9
2 × 4 = 8	2 + 4 = 6



The middle term 6x can be written as 2x + 4x

$\therefore x^2 + 6x + 8 = x^2 + 2x + 4x + 8$

$= x(x + 2) + 4(x + 2)$

$x^2 + 6x + 8 = (x + 2)(x + 4)$

Now from (1)

$$\text{breadth} = \frac{x^2+6x+8}{x+4} = \frac{(x+2)(\cancel{x+4})}{(\cancel{x+4})} = x+2$$

∴ Width of the room = x + 2

Question 8.

Find the missing term: $y^2 + (-)x + 56 = (y + 7)(y + -)$

Answer:

We have $(x + a)(x + b) = x^2 + (a + b)x + ab$

$56 = 7 \times 8$

$\therefore y^2 + (7 + 8)x + 56 = (y + 7)\ (y + 8)$

Question 9.

Factorise : $16p^4 - 1$

Answer:

$16p^4 - 1 = 2^4p^4 - 1 = (2^2)^2\ (p^2)^2 - 1^2$

$= (2^2p^2)^2 - 1^2$

Comparing with $a^2 - b^2\ (a + b)(a - b)$ where $a = 2^2p^2$ and b= 1

$\therefore (2^2p^2)^2 - 1^2 = (2^2p^2 + 1)(2^2p^2 - 1)$
$= (4p^2 + 1)(4p^2 - 1)$
$\therefore 16p^4 - 1 = (4p^2 + 1)(4p^2 - 1) = (4p^2 + 1)(2^2p^2 - 1^2)$
$= (4p^2 + 1)\,[(2p)^2 - 1^2] = (4p^2 + 1)\,(2p + 1)(2p - 1)$ [$\because$ using $a^2 - b^2 = (a + b)(a - b)$]
$\therefore 16p^4 - 1 = (4p^2 + 1)(2p + 1)(2p - 1)$

Question 10.
Factorise : $3x^3 - 45x^2y + 225xy^2 - 375y^3$
Answer:
$= 3x^3 - 45x^2y + 225xy^2 - 375y^3$
$= 3(x^3 - 15x^2y + 75xy^2 - 125y^3)$
$= 3(x^3 - 3x^2(5y) + 3x(5y)^2 - (5y)^3)$
$= 3(x - 5y)^3$

Ex 3.6

To find the value of x, bring the variable to the left side and bring all the remaining values to the right side. Simplify the values to find the result.

Question 1.
Fill in the blanks:
(i) The value of x in the equation $x + 5 = 12$ is _____ .
Answer:
7
Hint:
Given, $x + 5 = 12$
$x = 12 - 5 = 7$ (by transposition method)
Value of x is 7

(ii) The value of y in the equation $y - 9 = (-5) + 7$ is _____ .
Answer:
11
Hint:
Given, $y - 9 = (-5) + 7$
$y - 9 = 7 - 5$ (re-arranging)
$y - 9 = 2$
$\therefore y = 2 + 9 = 11$ (by transposition method)

(iii) The value of m in the equation $8m = 56$ is _____ .
Answer:
7
Hint:
Given, $8m = 56$
Divided by 8 on both sides
$\frac{8 \times m}{8} = \frac{56}{8}$
$\therefore m = 7$

(iv) The value of p in the equation $\frac{2p}{3} = 10$ is _____ .
Answer:
15
Hint:
Given, $\frac{2p}{3} = 10$
Multiplying by 3 on both sides
$\frac{2p}{\cancel{3}} \times \cancel{3} = 10 \times 3$
Dividing by 2 on both sides

$$\frac{2p}{2} = \frac{30}{2}$$

$\therefore$ p = 15

(v) The linear equation in one variable has _____ solution.

Answer:

one

Question 2.

Say True or False.

(i) The shifting of a number from one side of an equation to other is called transposition.

Answer:

True

(ii) Linear equation in one variable has only one variable with power 2.

Answer:

False

[Linear equation in one variable has only one variable with power one – correct statement]

Question 3.

Match the following

a.	$\frac{x}{2} = 10$	i.	$x = 4$
b.	$20 = 6x - 4$	ii.	$x = 1$
c.	$2x - 5 = 3 - x$	iii.	$x = 20$
d.	$7x - 4 - 8x = 20$	iv.	$x = \frac{8}{3}$
e.	$\frac{4}{11} - x = \frac{-7}{11}$	v.	$x = -24$

(A) (i),(ii), (iv) ,(iii),(v)

(B) (iii), (iv), (i) ,(ii), (v)

(C) (iii),(i) ,(iv), (v), (ii)

(D) (iii) , (i) , (v) ,(iv) ,(ii)

Answer:

(C) (iii),(i) ,(iv), (v), (ii)

a. $\frac{x}{2} = 10$, multiplying by 2 on both sides, we get

$\frac{x}{2} \times 2 = 10 \times 2 \Rightarrow$ x = 20

b. 20 = 6x – 4 by transposition ⇒ 20 + 4 =6x
6x = 24 dividing by 6 on both sides,
$\frac{6x}{6}=\frac{24}{6}$ ⇒ x = 4

c. 2x – 5 = 3 – x
By transposing the variable 'x', we get
2x – 5 + x = 3
by transposing – 5 to other side,
2x + x = 3 + 5

$$\therefore 3x = 8, \frac{\cancel{3}x}{\cancel{3}} = \frac{8}{3}$$

∴ x = 83

d. 7x – 4 – 8x = 20
by transposing – 4 to other side,
7x – 8x = 20 + 4
– x = 24
∴ x = – 24

e. $\frac{4}{11} - x = \frac{-7}{11}$
Transposing $\frac{4}{11}$ to other side,
$-x = \frac{-7}{11} \frac{-4}{11} = \frac{-7-4}{11} = \frac{-11}{11} = -1$
∴ – x = – 1 ⇒ x = 1

Question 4.
Find x:
(i) $\frac{2x}{3}-4=\frac{10}{3}$
Answer:
Transposing – 4 to other side, it becomes + 4

$$\therefore \frac{2x}{3} = \frac{10}{3}+4 \text{ Taking LCM \& adding,}$$

$$\frac{2x}{3} = \frac{10}{3}+\frac{4}{1} = \frac{10+12}{3} = \frac{22}{3}$$

$$\frac{2x}{3} = \frac{22}{3} \text{ Multiplying by 3 on both sides}$$

$$\frac{2x}{\cancel{3}} \times \cancel{3} = \frac{22}{\cancel{3}} \times \cancel{3} \Rightarrow 2x = 22, \text{ dividing by 2 on both sides,}$$

We get $\frac{2x}{2} = \frac{22}{2}$

$\therefore x = 11$

(ii) $y+\frac{1}{6}-3y=\frac{2}{3}$

Answer:

Transposing to the other side,

$$y - 3y = \frac{2}{3} - \frac{1}{6}$$

Taking LCM,

$$-2y = \frac{2}{3} - \frac{1}{6} = \frac{2\times 2-1}{6} = \frac{3}{6} = \frac{1}{2}$$

$$\therefore -2y = \frac{1}{2} \Rightarrow 2y = -\frac{1}{2}, \text{ dividing by 2 or both sides.}$$

$$\frac{2y}{2} = -\frac{1}{2}\times\frac{1}{2} \Rightarrow y = -\frac{1}{4}$$

(iii) $\frac{1}{3} - \frac{x}{3} = \frac{7x}{12} + \frac{5}{4}$

Answer:

Transposing $\frac{-x}{3}$ to the other side, it becomes + $\frac{x}{3}$

$\therefore \frac{1}{3} = \frac{7x}{12} + \frac{5}{4} + \frac{x}{3}$

Transposing $\frac{5}{4}$ to the other side, it becomes $\frac{-5}{4}$

$\frac{1}{3} - \frac{5}{4} = \frac{7x}{12} + \frac{x}{3}$

Multiply by 12 throughout [we look at the denominators 3, 4, 12, 3 and take the LCM, which is 12]

$$\frac{1}{3}\times 12^{4} - \frac{5}{4}\times 12^{3} = \frac{7x}{12}\times 12 + \frac{x}{3}\times 12^{4}$$

$4 - 15 = 7x + x \times 4$

$-11 = 7x + 4x$

$11x = -11$

$x = -1$

Question 5.

Find x

(i) $-3(4x + 9) = 21$

Answer:

$-3(4x+9)=21$

Expanding the bracket,

$-3 \times 4 + (-3) \times 9 = 21$

$\therefore -12x + (-27) = 21$

$-12x - 27 = 21$

Transposing -27 to other side, it becomes $+27$

$-12x = 21 + 27 = 48$

$\therefore -12x = 48 \Rightarrow 12x = -48$

Dividing by 12 on both sides

$$\frac{12x}{12} = \frac{-48}{12} \Rightarrow x = -4$$

(ii) $20 - 2(5 - p) = 8$

Answer:

$20-2(5-p)=8$

Expanding the bracket,

$20 - 2 \times 5 - 2 \times (-p) = 8$

$20 - 10 + 2p = 8$

$(-2 \times -p = 2p)$

$10 + 2p = 8$ transposing lo to other side

$2p = 8 - 10 = -2$

$\therefore 2p = -2$

$\therefore p = -1$

(iii) $(7x - 5) - 4(2 + 5x) = 10(2 - x)$

Answer:

$(7x-5)-4(2+5x)=10(2-x)$

Expanding the brackets,

$7x - 5 - 4 \times 2 - 4 \times 5x = 10 \times 2 + 10 \times (-x)$

$7x - 5 - 8 - 20x = 20 - 10x$

$7x - 13 - 20x = 20 - 10x$

Transposing $10x$ & -13, we get

$7x - 13 - 20x + 10x = 20$

$7x - 20x + 10x = 20 + 13$, Simplifying,

$-3x = 33$

$3x = -33$

$x = \frac{-33}{3} = -11$

$x = -11$

Question 6.

Find x and m:

(i) $\frac{3x-2}{4}-\frac{(x-3)}{5}=-1$

Answer:

Taking LCM on LHS, [LCM of 4 & 5 is 20]

$$\frac{(3x-2)\times 5-(x-3)\times 4}{20} = -1$$

$$\frac{(3x-2)\times 5-(x-3)}{20}$$

Expanding brackets,

$$\frac{3x\times 5-2\times 5-x\times 4-(-3)\times 4}{20} = -1$$

$$\frac{15x-10-4x-(-12)}{20} = -1$$

$$\frac{15x-10-4x+12}{20} = -1 \Rightarrow \frac{11x+2}{20}=-1$$

Multiplying both sides by 20

$$\frac{11x+2}{20}\times 20 = -1\times 20$$

$$\therefore 11x+2 = -20$$

$$\therefore 11x = -20-2=-22$$

$$x = \frac{-22}{11}=-2 \quad \therefore \text{ Ans}: x=-2$$

(ii) $\frac{m+9}{3m+15}=\frac{5}{3}$

Answer:

Cross multiplying, we get

$$\frac{m+9}{3m+15} \quad \frac{5}{3} \qquad \frac{m+9}{3m+15} \quad \frac{5}{3}$$

$\therefore (m + 9) \times 3 = 5 \times (3m + 15)$

$m \times 3 + 9 \times 3 = 5 \times 3m + 5 \times 15$

$3m + 27 = 15m + 75$ Transposing 3m & 75, we get

$27 - 75 = 15m - 3m$

$-48 = 12m$

$$\frac{\cancel{12}m}{\cancel{12}} = \frac{-48}{12}$$

$\Rightarrow m = -4$

Ex 3.7

Question 1.
Fill in the blanks:
(i) The solution of the equation $ax + b = 0$ is _____ .
Answer:
$-\frac{b}{a}$
Hint:
$ax + b = 0$
$ax = -b$
$\therefore x = -\frac{b}{a}$

(ii) If a and b are positive integers then the solution of the equation $ax = b$ has to be always _____ .
Answer:
Positive
Hint:
Since a & b are positive integers, b
The solution to the equation $ax = b$ is $x = \frac{b}{a}$ is also positive.

(iii) One-sixth of a number when subtracted from the number itself gives 25. The number is _____ .
Answer:
30
Hint:
Let the number be x.
As per **Question**, when one sixth of number is subtracted from itself it gives 25

$$x - \frac{x}{6} = 25$$
$$\therefore \frac{6x - x}{6} = 25$$
$$\therefore \frac{5x}{6} = 25$$
$$\therefore x = \frac{25 \times 6}{5} = 5 \times 6 = 30$$

(iv) If the angles of a triangle are in the ratio 2:3:4 then the difference between the greatest and the smallest angle is _____ .
Answer:
40°
Hint:

Given angles are in the ratio 2:3:4

Let the angles be 2x, 3x & 4x

Since sum of the angles of a triangle is 180°,

We get 2x + 3x + 4x = 180

∴ 9x = 180

∴ $x = \frac{180}{9} = 20°$

∴ The angles are 2x = 2 × 20 = 40°

3x = 3 × 20 = 60°

4x = 4 × 20 = 80°

∴ Difference between greatest & smallest angle is

80° – 40° = 40°

(v) In an equation a + b = 23. The value of a is 14 then the value of b is _____ .

Answer:

b = 9

Hint:

Given equation is a + b = 23, a = 14

14 + b = 23

∴ b = 23 – 14 = 9

b = 9

Question 2.

Say True or False

(i) "Sum of a number and two times that number is 48" can be written as y + 2y = 48

Answer:

True

Hint:

Let the number be 'y'

∴ Sum of number & two times that number is 48

Can be written as y + 2y = 48 – True

(ii) 5(3x + 2) = 3(5x – 7) is a linear equation in one variable.

Answer:

True

Hint:

5 (3x + 2) = 3 (5x – 7) is a linear equation in one variable – 'x' – True

(iii) x = 25 is the solution of one third of a number is less than 10 the original number.

Answer:

False

Hint:

One third of number is 10 less than original number.
Let number be 'x'. Therefore let us frame the equation
$\frac{x}{3} = x - 10$
$\therefore x = 3x - 30$
$3x - x = 30$
$2x = 30$
$x = 15$ is the solution

Question 3.
One number is seven times another. If their difference is 18, find the numbers.
Answer:
Let the numbers be x & y
Given that one number is 7 times the other & that the difference is 18.
Let $x = 7y$
also, $x - y = 18$ (given)
Substituting for x in the above
We get $7y - y = 18$
$\therefore 6y = 18$
$y = \frac{18}{6} = 3$
$\therefore x = 7y = 7 \times 3 = 21$
The number are 3 & 21

Question 4.
The sum of three consecutive odd numbers is 75. Which is the largest among them?
Answer:
Given sum of three consecutive odd numbers is 75
Odd numbers are 1,3,5,7,9, 11, 13
$\therefore$ The difference between 2 consecutive odd numbers is always 2. or in other words, if one odd number is x, the next odd number would be $x + 2$ and the next number would be $x + 2 + 2x + 4$
i.e $x + 4$
Since sum of 3 consecutive odd nos is 75
$\therefore x + x + 2 + x + 4 = 75$
$\therefore 3x + 6 = 75 \Rightarrow 3x = 75 - 6$
$\therefore 3x = 69$
$x = \frac{69}{3} = 23$
$\therefore$ The odd numbers are $23, 23 + 2, 23 + 4$
i.e 23, 25, 27
$\therefore$ Largest number is 27.

Question 5.
The length of a rectangle is $\frac{1}{3}$ rd of its breadth. If its perimeter is 64 m, then find the length and breadth of the rectangle.

Answer:
Let length & breadth of rectangle be 'l' and 'b' respectively
Given that length is $\frac{1}{3}$ of breadth,
$\therefore l = \frac{1}{3} \times b \Rightarrow l = \frac{b}{3} \Rightarrow b = 3l$ ..... (1)

Also given that perimeter is 64 m
Perimeter $= 2 \times (l + b)$
$2 \times 1 + 2 \times b = 64$
Substituting for value of b from (1), we get
$2l + 2(3l) = 64$
$\therefore 2l + 6l = 64$
$8l = 64$
$\therefore l = \frac{64}{8} = 8m$
$b = 3l = 3 \times 8 = 24m$
Ienglh $l = 8$ m in & breadth $b = 24$ m

Question 6.
A total of 90 currency notes, consisting only of ₹ 5 and ₹ 10 denominations, amount to ₹ 500. Find the number of notes in each denomination.
Answer:
Let the number of ₹ 5 notes be 'x'
And number of ₹ 10 notes be 'y'
Total numbers of notes is $x + y = 90$ (given)
The total value of the notes is 500 rupees.
Value of one ₹ 5 rupee note is 5
Value of x ₹ 5 rupee notes is $5 \times x = 5x$
$\therefore$ Value of y ₹ 10 rupee flotes is $10 \times y = l0y$
$\therefore$ The total value is $5x + 10y$ which is 500
$\therefore$ we have 2 equations:
$x + y = 90$ ....(1)
$5x + 10y = 500$ ....(2)
Multiplying both sides of(1) by 5, we get
$5 \times x + 5 \times y = 90 \times 5$
$5x + 5y = 450$
Subtracting (3) from (2), we get

$$\begin{array}{rcl} 5x + 10y & = & 500 \\ (-) \quad (-) & & (-) \\ 5x + 5y & = & 450 \\ \hline 0 + 5y & = & 50 \\ \hline \end{array}$$

$\therefore y = \frac{50}{5} = 10$

Substitute y = 10 in equation (1)

x + y = 90 ⇒ x + 10 = 90 ⇒ x = 90 – 10 ⇒ x = 80

There are ₹5 denominations are 80 numbers and ₹10 denominations are 10 numbers

Question 7.

At present, Thenmozhi's age is 5 years more than that of Murali's age. Five years ago, the ratio of Then mozhi's age to Murali's age was 3 : 2. Find their present ages.

Answer:

Let present ages of Thenmozhi & Murali be 't' & 'm'

Given that at present

Then mozhi's age is 5 years more than Murali

$\therefore t = m + 5$ ..... (1)

5 years ago, Thenmozhi's age would be t – 5

& Murali's age would be m – 5

Ratio of their ages is given as 3 : 2

$\therefore \frac{t-5}{m-5} = \frac{3}{2}$ [$\therefore$ By cross multiplication] $\Rightarrow \therefore \frac{t-5}{m-5} \times \frac{3}{2}$

2(t – 5) = 3(m – 5)

2 × t – 2 × 5 = 3 × m – 3 × 5 ⇒ 2t – 10 = 3m – 15

Substituting for t from (1)

2(m + 5) – 10 = 3m – 15

$2m + 10 - 10 = 3m - 15$

2m = 3m – 15

3m – 2m = 15

m = 15

t = m + 5 = 15 + 5 = 20

$\therefore$ Present ages of Thenmozhi & Murali are 20 & 15

Question 8.

A number consists of two digits whose sum is 9. If 27 is subtracted from the original number, its djgit.s are interchanged. Find the original number.

Answer:

Let the units/digit of a number be 'u' & tens digit of the number be 't'

Given that sum of it's digits is 9

$\therefore t + u = 9$ ..... (1)

If 27 is subtracted from original number, the digits are interchanged

The number is written as 10t + u

[Understand: Suppose a 2 digit number is 21
it can be written as $2 \times 10 + 1$
$\therefore 32 = 3 \times 10 + 2$
$45 = 4 \times 10 + 5$
$tu = t \times 10 + u = 1ot + u$]
Given that when 27 is subtracted, digits interchange
$10t + u - 27 = 10u + t$ (number with interchanged digits)
$\therefore$ By transposition & bringing like variables together
$10t - t + u - 10u = 27$
$\therefore 9t - 9u = 27$
Dividing by '9' throughout , we get
$\frac{9t}{9} - \frac{9u}{9} = \frac{27}{9} \Rightarrow t - u = 3$ ..... (2)
Solving (1) & (2):

$$\begin{array}{rcl} t + u & = & 9 \\ t - u & = & 3 \\ \hline 2t & = & 12 \\ \hline t & = & \frac{12}{2} = 6 \therefore u = 3 \end{array}$$

$t = 6$ substitute in (1)
$t + u = 9 \Rightarrow 6 + u = 9 \Rightarrow u = 9 - 6 = 3$
Hence the number is 63.

Question 9.
The denominator of a fraction exceeds Its numerator by 8. If the numerator is increased by 17 and the denominator is decreased by 1, we get $\frac{3}{2}$. Find the original fraction.
Answer:
Let the numerator & denominator be 'n' & 'd'
Given that denominator exceeds numerator by 8
$\therefore d = n + 8$ ..... (1)
If numerator increased by 17 & denominator decreased by 1,
it becomes $(n + 17)$ & $(d - 1)$, fraction is $\frac{3}{2}$.

$$\text{i.e } \frac{n+17}{d-1} = \frac{3}{2} \text{ by cross multiplying, we get}$$
$$\frac{n+17}{d-1} = \frac{3}{2}$$

$2(n + 17) = 3(d - 1)$
$2n + 2 \times 17 = 3d - 3$
$2n + 34 = 3d - 3$

$\therefore 34 + 3 = 3d - 2n$
$\therefore 3d - 2n = 37$ …..... (2)
Substituting eqn. (1) in (2), we get,
$3 \times (n + 8) - 2n = 37$
$3n + 3 \times 8 - 2n = 37$

$\therefore 3n + 24 - 2n = 37$

$\therefore n = 37 - 24 = 13$
$d = n + 8 = 13 + 8 = 21$
The fraction is $\frac{n}{d} = \frac{13}{21}$

Question 10.
If a train runs at 60 km/hr it reaches its destination late by 15 minutes. But, if it runs at 85 kmph it is late by only 4 minutes. Find the distance to be covered by the train.
Answer:
Let the distance to be covered by train be 'd'

$$\text{Using the formula, time take } (t) = \frac{\text{Distance}}{\text{Speed}}$$

Case 1:
If speed = 60km/h
The time taken is 15 minutes more than usual $(t + \frac{15}{60})$
Let usual time taken be 't' hrs.
Caution: Since speed is given in km/hr, we should take care to maintain all units such as time should be in hour and distance should be in kin.
Given that in case 1, it takes 15 min. more
$15m = \frac{15}{60}$ hr $= \frac{1}{4}$hr.
$\therefore$ Substituting in formula,

$$\frac{\text{Distance}}{\text{Speed}} = \text{time}$$

$$\therefore \frac{d}{60} = t + \frac{1}{4}$$

Since usually it takes 't' hr, but when running at 60 k, it kes 15 min ($\frac{1}{4}$hr) extra.
Multiplying by 60 on both sides
$d = 60 \times t + 60 \times \frac{1}{4} = 6ot + 15$ …... (1)

Case 2:
Speed is given as 85 km/h
Time taken is only 4 min ($\frac{4}{60}$hr) more than usual time
$\therefore$ time taken = (t + 115) hr. ($\frac{4}{60} = \frac{1}{15}$)

Using the formula,

$$\frac{\text{Distance}}{\text{Speed}} = \text{time}$$

$$\therefore \frac{d}{85} = t + \frac{1}{15}$$

Multiplying by 85 on both sides

$\frac{d}{85} \times 85 = 85 \times t + 85 \times \frac{1}{15}$

$\therefore d = 85t + \frac{17}{3}$ ..... (2)

From (1) & (2), we will solve for 'r'

Equating & eliminating 'd' we get

$$60t + 15 = 85t + \frac{17}{3}$$

∴ By transposing, we get

$$15 - \frac{17}{3} = 85t - 60t$$

$$\frac{45-17}{3} = 25t$$

$$\therefore 25t = \frac{28}{3}$$

$$\therefore t = \frac{28}{3 \times 25} = \frac{28}{75} \text{ hr } \left(\frac{28}{75} \times 60 = 22.4 \text{ min} \right)$$

Substituting this value of 't' in eqn. (1), we get

$d = 60t + 15$

$= 60 \times \frac{28}{75} + 15 = \frac{1680}{75} + 15 = 22.4 + 15$

$= 37.4$ km

Question 11.

Sum of a number and its half is 30 then the number is _____

(a) 15

(b) 20

(c) 25

(d) 40

Answer:

(b) 20

Hint:

Let number be 'x'

∴ half of number is $\frac{x}{2}$

Sum of number and it's half is given by

$x + \frac{x}{2} = 30$ [Multiplying by 2 on both sides]

$2x + x = 30 \times 2$

$3x = 60$

$x = \frac{60}{3} = 20$

Question 12.

The exterior angle of a triangle is 1200 and one of its interior opposite angle 58°, then the other opposite interior angle is _____

(a) 62°

(b) 72°

(c) 78°

(d) 68°

Answer:

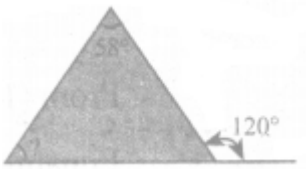
(a) 62°

As per property of A. exterior angle is equals to sum of interior opposite angles

Let the other interior angle to be found be 'x'

$\therefore x + 58 = 120°$

$\therefore x = 120 - 58 = 62°$



Question 13.

What sum of money will earn 500 as simple interest in 1 year at 5% per annum?

(a) 50000

(b) 30000

(c) 10000

(d) 5000

Answer:

(c) 10000

Hint:

Let sum of money be P'

Time period (n) is given as 1 yr.

Rate of simple interest (r) is given as 5% p.a

$\therefore$ As per formula for simple interest.

$S.I = \frac{P \times r \times n}{100} = \frac{P \times 5 \times 1}{100} = 500$

$\therefore P \times 5 \times n = 500 \times 100$

$\therefore p = \frac{500 \times 100}{5} = 100 \times 100 = 10{,}000$

Question 14.
The product of LCM and HCF of two numbers is 24. If one of the number is 6, then the other number is _____
(a) 6
(b) 2
(c) 4
(d) 8
Answer:
(C) 4
Hint:
Product of LCM & HCF of 2 numbers is always product of the numbers. [this is property]
Product of LCM & HCF is given as 24
∴ Product of the 2 nos. is 24
Given one number is 6. Let other number be 'x'
$\therefore 6 \times x = 24$
$x = \frac{24}{6} = 4$

Question 15.
The largest number of the three consecutie numbers is x+ 1, then the smallest number is _____ .
(A) x
(B) x + 1
(C) x + 2
(D) x – 1
Answer:
(D) x – 1
Hint:
The 3 consecutive numbers are: x – 1, x, x + 1

Ex 3.8

Question 1.
Fill in the blanks:
(i) X- axis and Y-axis intersect at _____ .
Answer:
Origin (0,0)

(ii) The coordinates of the point in third quadrant are always _____ .
Answer:
negative

(iii) (0, -5) point lies on _____ axis.
Answer:
Y-axis

(iv) The x- coordinate is always _____ on the y-axis.
Answer:
Zero

(v) _____ coordinates are the same for a line parallel to Y-axis.
Answer:
X

Question 2.
Say True or False:
(i) (-10,20) lies in the second quadrant.
Answer:
True
Hint:
(-10, 20)
$x = -10, y = 20$
$\therefore$ (-10, 20) lies in second quadrant – True

(ii) (-9, 0) lies on the x-axis.
Answer:
True
Hint:
(-9, 0) on x – axis. Y- coordinate is always zero.
$\therefore$ (-9, 0) lies on x axis – True

(iii) The coordinates of the origin are (1,1).
Answer:
False

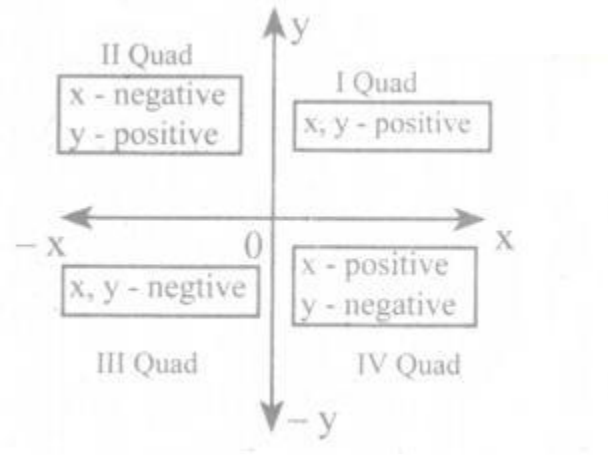
Hint:
Coordinate of origin is (0, 0), not (1, 1). Hence – False

Question 3.
Find the quadrants without plotting the points on a graph sheet.
(3, -4), (5, 7), (2, 0), (-3, -5), (4, -3), (-7, 2), (-8, 0), (0, 10), (-9, 50).

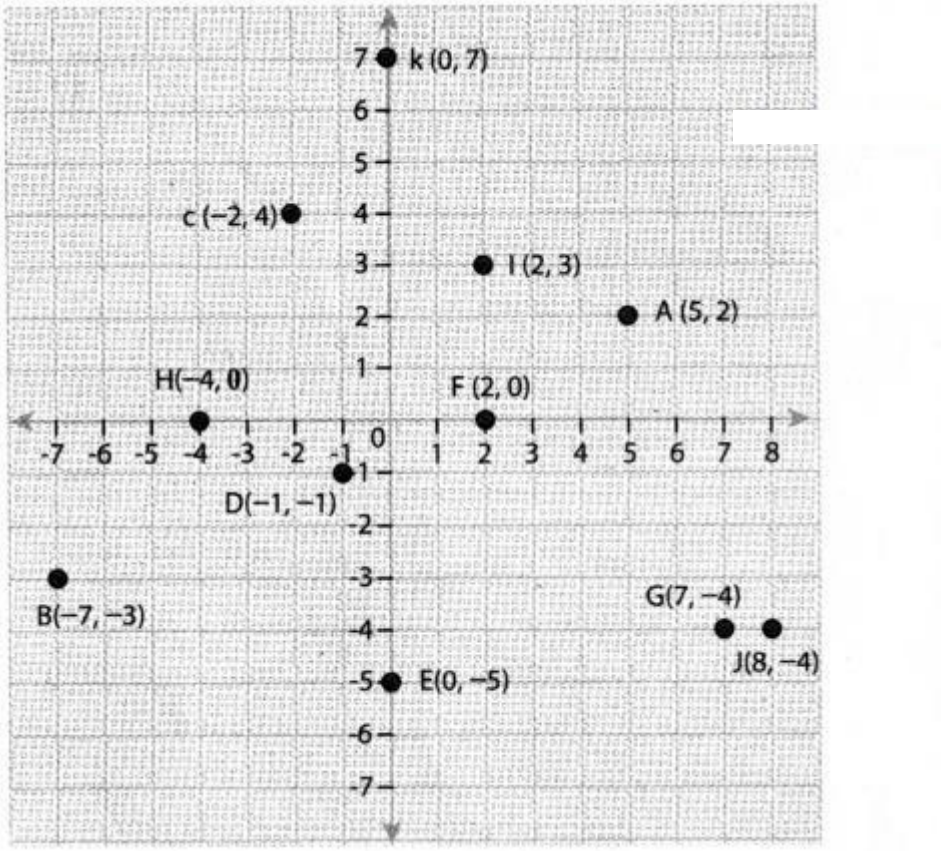
Answer:

(3, − 4)	(5, 7)	(2, 0)	(− 3, − 5)	(4, − 3)	(− 7, 2)	(− 8, 0)	(0, 10)	(− 9, 50)
↓	↓	↓	↓	↓	↓	↓	↓	↓
IV	I	X - axis	III	IV	II	X - axis	Y-axis	II

If X & y coordinate are positive – I quad
If x is positive,y is negative – IV quad
If x is negative, y is positive – II quad
If both are negative, then – III quad

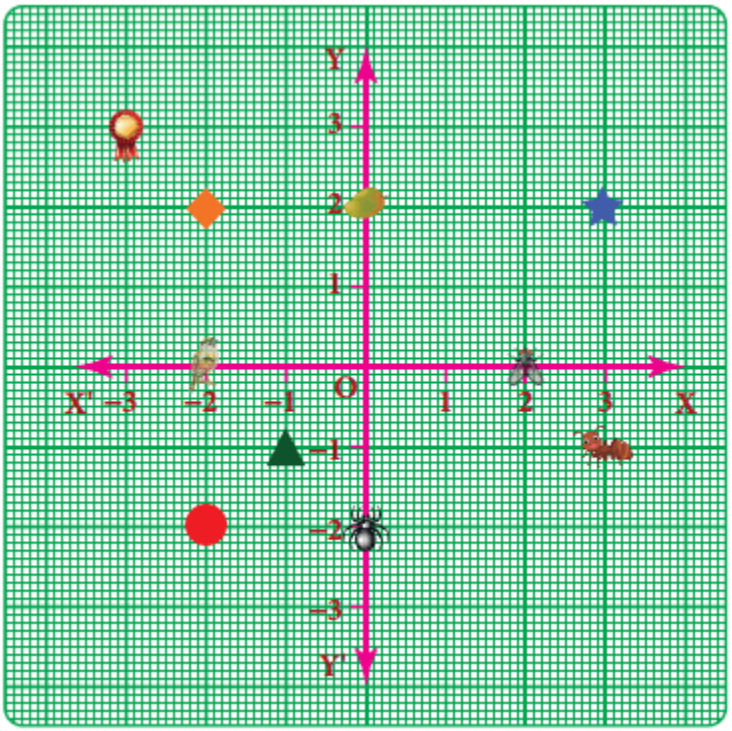


Question 4.
Plot the following points in a graph sheet.
A(5, 2), B(-7, -3), C(-2, 4), D(-1, -1), E(0, -5), F(2, 0), G(7, -4), H(-4, 0), I(2, 3), J(8, -4), K(0, 7).
Answer:



Question 5.

Use the graph to determine the coordinates where each figure is located.



a) Star	_____
b) Bird	_____
c) Red circle	_____
d) Diamond	_____
e) Triangle	_____
f) Ant	_____
g) Mango	_____
h) Housefly	_____
i) Medal	_____
j) Spider	_____

Answer:

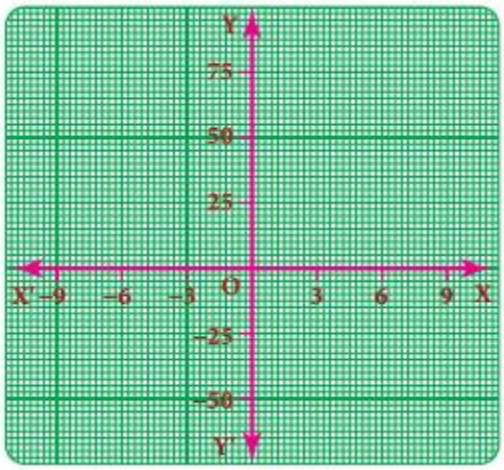
a) Star	(3, 2)
b) Bird	(-2, 0)
c) Red circle	(-2, -2)
d) Diamond	(-2, 2)
e) Triangle	(-1, 1)
f) Ant	(3, -1)
g) Mango	(0, 2)
h) Housefly	(2, 0)
i) Medal	(-3, 3)
j) Spider	(0, -2)

Ex 3.9

Question 1.
Fill in the blanks:
(i) y = p x where p ∈ Z always passes through the _____ .
Answer:
Origin (0,0)
Hint:
[When we substitute x = 0 in equation, y also becomes zero. (0,0) is a solution]

(ii) The intersecting point of the line x = 4 and y = -4 is _____ .
Answer:
4, -4
Hint:
x = 4 is a line parallel to the y – axis and
y = -4 is a line parallel to the x – axis. The point of intersection is a point that lies on both lines & which should satisfy both the equations. Therefore, that point is (4, -4)

(iii) Scale for the given graph,
On the x-axis 1 cm = _____ units
y-axis 1 cm = _____ units



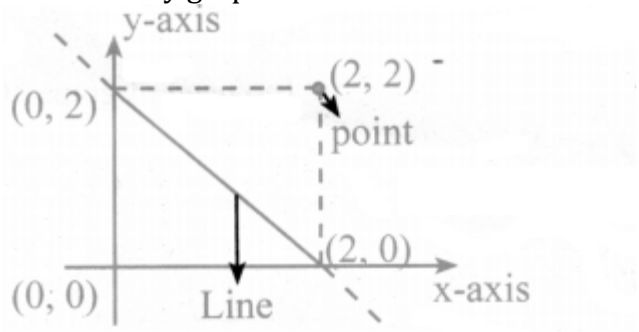
Answer:
3 units, 25 units
Hint:
With reference to given graph,
On the x – axis. 1 cm = 3 units
y axis, 1 cm = 25 units

Question 2.
Say True or False.
(i) The points (1,1) (2,2) (3,3) lie on a same straight line.
Answer:
True

Hint:
The points (1, 1), (2, 2), (3, 3) all satisfy the equation y = x which is straight line. Hence, it is true

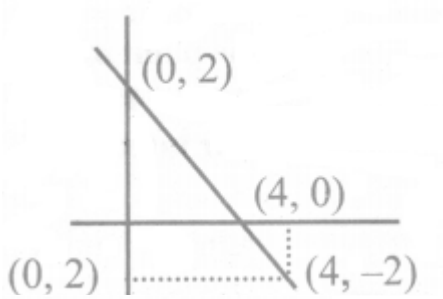
(ii) y = -9x not passes through the origin.
Answer:
False
Hint:
y = -9x substituting for x as zero, we get y = -9 × 0 = 0
∴ for x = 0, y = 0. Which means line passes through (0, 0), hence statement is false.

Question 3.
Will a line pass through (2, 2) if it intersects the axes at (2, 0) and (0, 2).
Answer:
Given a line intersects the axis at (2, 0) & (0, 2)
Let line intercept form be expressed as
ax + by = 1 Where a & b are the x & y intercept respectively.
Since the intercept points are (2. 0) & (0, 2)
a = 2, b = 2
∴ 2x + 2y = 1
When the point (2. 2) is considered & substituted in the equation
2x + 2y = 1, we get
2 × 2 + 2 × 2 = 4 ≠ 1
∴ the point (2. 2) does not satisfy the equation. Therefore the line does not pass through (2, 2)
Alternatively graphical method



as we can see the line doesn't pass through (2, 2)

Question 4.
A line passing through (4, – 2) and intersects the Y-axis at (0, 2). Find a point on the line in the second quadrant.
Answer:
Line passes through (4, – 2)
y – axis intercept point – (0, 2) using 2 point formula.



$$\frac{y-y_1}{x-x_1} = \frac{y_2-y_1}{x_2-x_1}$$

$$\frac{y-2}{x-0} = \frac{-2-2}{4-0}$$

$$\therefore \frac{y-2}{x} = \frac{-4}{4} = -1$$

$$y-2 = -1 \times x$$

$$\therefore y-2 = -x$$

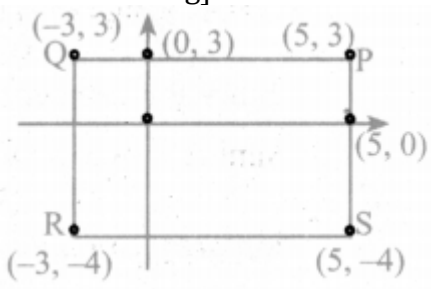
$$\therefore x+y = 2 \text{ is the equation of the line.}$$

Any point in II quadrant will have x as negative & y as positive.
So let us take x value as – 2
∴ -2 + y = 2
∴ y = 2 + 2 = 4
∴ Point in II Quadrant is (-2, 4)

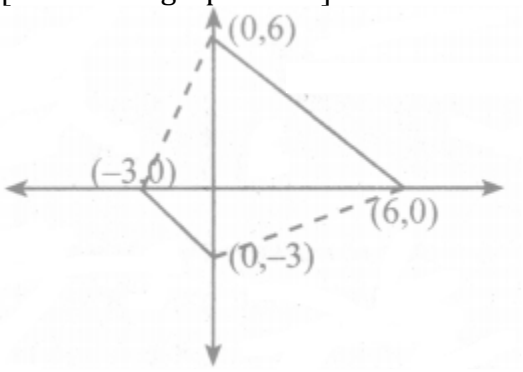
Question 5.
If the points P(5, 3) Q(-3, 3) R (-3, -4) and S form a rectangle then find the coordinate of S.
Answer:
Plotting the points on a graph (approximately)
Steps:

- Plot P, Q, R approximately on a graph.
- As it is a rectangle, RS should be parallel to PQ & QR should be paraHel to PS
- S should lie on the straight line from R parallel to x-axis & straight line from P parallel to y-axis
- Therefore, we get S to be (5, -4)

[Note: We don't need graph sheet for approximate plotting. This is just for graphical understanding]



Question 6.
A line passes through (6, 0) and (0, 6) and an another line passes through (-3, 0) and (0, -3). What are the points to be joined to get a trapezium?
Answer:
In a trapezium. there are 2 opposite sides that are parallel. The other opposite sides are non-parallel.
Now, let us approximately plot the points for our understanding
[no need of graph sheet]



- Plot the points (0, 6), (6, 0), (-3, 0) & (0, -3)
- Join (0, 6) & (6, 0)
- Join (-3,0) & (0, – 3)
- We find that the lines formed by joining the points are parallel lines.
- So, for forming a trapezium, we should join (0, 6), (-3, 0) & (0, -3), (6, 0)

Question 7.
Find the point of intersection of the line joining points (- 3, 7) (2, – 4) and (4, 6) (- 5, – 7).Also find the point of intersection of these lines and also their intersection with the axis.
Answer:

x_1 y_1 x_2 y_2

Line 1: Joining points $(-3, 7)$ & $(2, -4)$

Equation of line joining 2 points by 2 point formula is given by

$$\frac{y-y_1}{x-x_1} = \frac{y_2-y_1}{x_2-x_1}$$

$$\therefore \frac{y-7}{x-(-3)} = \frac{-4-7}{2-(-3)}$$

$$\frac{y-7}{x+3} = \frac{-11}{2+3}$$

$$\therefore \frac{y-7}{x+3} = \frac{-11}{5}$$

Cross multiplying, we get

$$\frac{y-7}{x+3} \quad \frac{-11}{5}$$

$$5(y-7) = -11(x+3)$$

$$5y-35 = -11x-33$$

Transposing the variables, we get

11 x + 5 y = 35 – 33 = 2

11 x + 5y = 2 – Line 1

Similarly, we should find out equation of second line

$x_1\ y_2 \qquad x_2\ \ y_2$

Joining the points (4, 6) & (–5, –7)

$$\frac{y-y_1}{x-x_1} = \frac{y_2-y_1}{x_2-x_1}$$

$$\therefore \frac{y-6}{x-4} = \frac{-7-6}{-5-4}$$

$$\therefore \frac{y-6}{x-4} = \frac{-13}{-9} = \frac{13}{9}$$

∴ 9y – 54 = 13x – 52

∴ 9y – 13x = 2 – Line 2

For finding point of intersection, we need to solve the 2 line equation to find a point that will satisfy both the line equations.

∴ Solving for x & y from line 1 & line 2 as below

11x + 5y = 2 ⇒ multiply both sides by 13,

11 × 13x + 5 × 13y = 26 …….. (3)

Line 2: 9y – 13x = 2 ⇒ multiply both sides by 11

9 × 11y – 13 × 11x = 22 ……. (4)

$$\begin{array}{lrcl} \text{i.e} & 65y + 143x & = & 26 \ldots.(3) \\ & +99y - 143x & = & 22 \ldots.(4) \\ \text{Adding (3) \& (4)} & 65y + 99y + 0 & = & 26 + 22 \end{array}$$

$\therefore 164\ y = 48$

$\therefore y = \frac{48}{164} = \frac{12}{41}$

Substituting this value ofy in line I we get

$11\ x + 5\ y = 2$

$11\ x + 5 \times \frac{12}{41} = 2$

$11\ x = 2 - \frac{60}{41} = \frac{82-60}{41} = \frac{22}{41}$

$\therefore x = \frac{2}{41}$

[$\therefore$ Point of intersection is $(\frac{2}{41}, \frac{12}{41})$]

To find point of intersection of the lines with the axis, we should substitute values & check

Line 1: $11\ x + 5\ y = 2$

Point of intersection of line with x – axis, i.e y coordinate is '0'

$\therefore$ put $y = 0$ in above equation

$\therefore 11\ x - 5 \times 0 = 2$

$\therefore 11x + 0 = 2$

$\therefore x = \frac{2}{11}$

$\therefore$ [Point is $(\frac{2}{11}, 0)$]

Similarly, Point of intersection of line with y – axis is when x-coordinate becomes '0'

$\therefore$ put $x = 0$ in above equation

$\therefore 11 \times 0 + 5y = 2$

$\therefore 0 + 5y = 2$

$y = \frac{2}{5}$

$\therefore$ [Point is $(0, \frac{2}{5})$]

Similarly for line 2,

$9y - 13x = 2$

For finding x intercept, i.e point where line meets x axis, we know that y coordinate becomes '0'

$\therefore$ Substituting $y = 0$ in above eqn. we get

$9 \times 0 - 13x = 2$

$\therefore 0 - 13x = 2$

$\therefore x = \frac{-2}{13}$

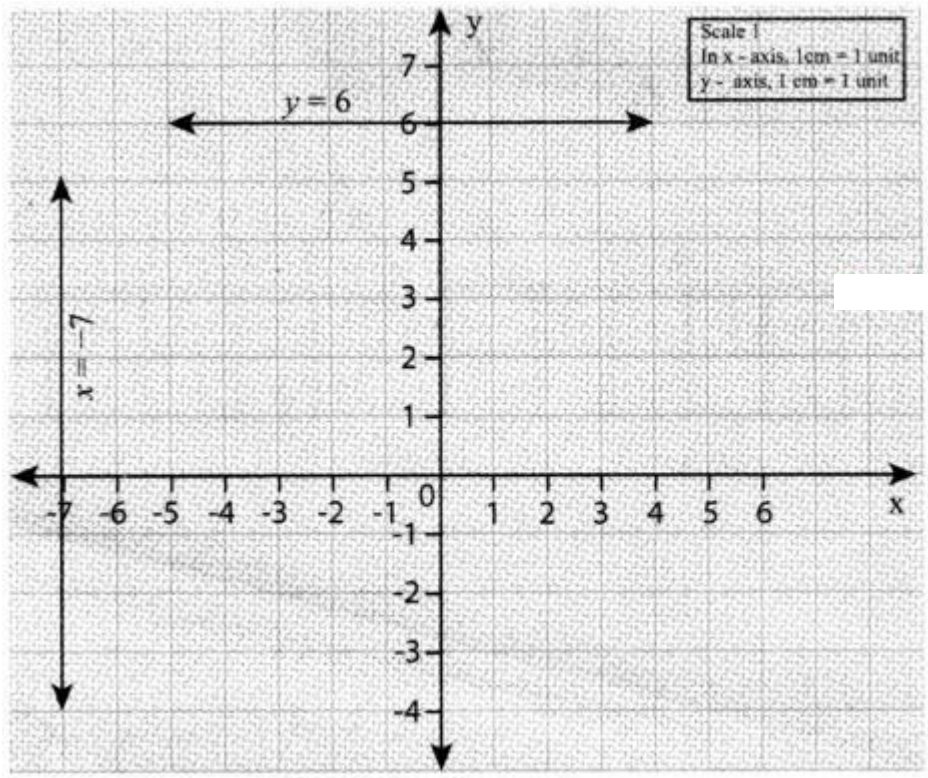
$\therefore$ [Point: $(\frac{-2}{13}, 0)$]

Similarly for y – intercept, x – coordinate becomes '0',

$\therefore$ Substituting for $x = 0$ in above equation, we get

$9y - 13 \times 0 = 2$
$9y - 0 = 2$
$9y = 2$
$y = \frac{2}{9}$
[Point $(0, \frac{2}{9})$]

Question 8.
Draw the graph of the following equations: (i) $x = -7$ (ii) $y = 6$
Answer:

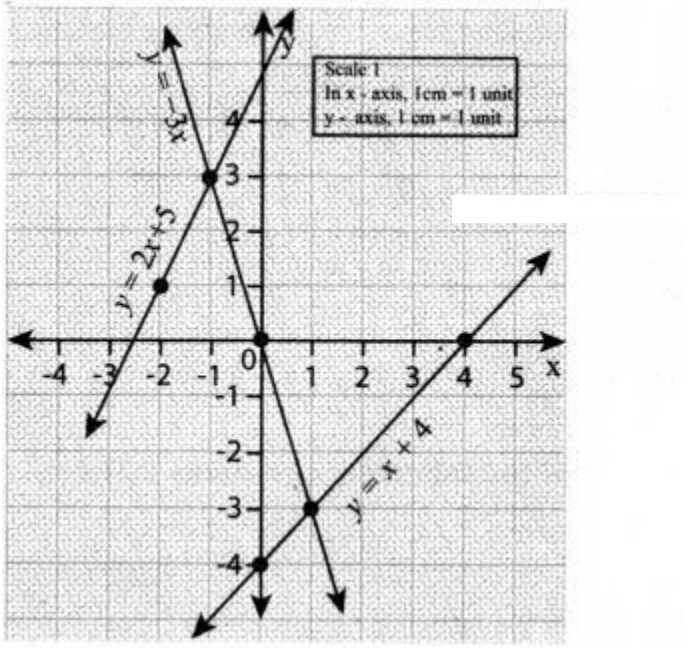


Question 9.
Draw the graph of
(i) $y = -3x$
(ii) $y = x - 4$
(ii) $y = 2x + 5$
Answer:
To draw graph, we need to find out some points.
(i) $y = -3x$
for $y = -3x$, let us first substituting values & check
put $x = 0$
$y = 3 \times 0 = 0$
$\therefore$ (0,0) is a point
put $x = 1$

$y = -3 \times 1 = -3$
$\therefore$ (1, – 3) is a point
If join these 2 points, we will get the line

(ii) $y = x - 4$
for $y = x - 4$
put $x = 0$
$y = 0 - 4 = -4$
$\therefore$ (0, – 4) is a point
$x = 4$
$y = 4 - 4 = 0$
$\therefore$ (4, 0) is a point

(iii) $y = 2x + 5$
for $y = 2x + 5$
put $x = -1$
$y = 2(-1) + 5 = -2 + 5 = 3$
$\therefore$ (-1, 3) is a point
put $x = -2$
$y = 2(-2) + 5 = -4 + 5 = 1$
$\therefore$ (-2, 1) is a point
Now let us plot the points & join them on graph



Question 10.
Find the values
(a) $y = x + 3$

x	0		–2	
y		0		–3

Answer:

Let $y = x+3$

(i) if $x = 0$, $y = 0 + 3 = 3$,

$\therefore y = 3$

(ii) $y = 0$, $0 = x + 3$,

$\therefore x = -3$

(iii) $x = -2$, $y = -2 + 3$,

$\therefore y = 1$

(iv) $y = -3$, $-3 = x + 3$,

$\therefore x = -6$

$y = x + 3$

x	0	–3	–2	–6
y	3	0	1	–3

(b) $2x + y - 6 = 0$

x	0		–1	
y		0		–2

Answer:

Let $2x + y - 6 = 0$

(i) $x = 0$ $2 \times 0 + y - 6 = 0$ $\therefore y = 6$

(ii) $y = 0$, $2x + 0 - 6 = 0$, $\therefore 2x = 6$

$x = 3$,

(iii) $x = -1$, $2 \times (-1) + y - 6 = 0$, $8 + y = 0$

$y = 8$

(iv) $y = -2$, $2x - 2 - 6 = 0$, $2x = 8$

$x = 4$

$2x + y - 6 = 0$

x	0	3	–1	4
y	6	0	8	–2

(c) $y = 3x + 1$

x	– 1	0	1	2
y				

Answer:

(i) $x = -1$, $y = 3(-1) + 1 = 0$

$\therefore y = -2$
(ii) $x = 0, y = 3(0) + 1 = 0$
$\therefore y = 1$
(iii) $x = 1, y = 3(1) + 1 = 0$
$\therefore y = 4$
(iv) $x = 2, y = 3(2) + 1 = 0$
$\therefore y = 7$

$y = 3x + 1$

x	-1	0	1	2
y	-2	1	4	7

Ex 3.10

Question 1.
The sum of three numbers is 58. The second number is three times of two-fifth of the first number and the third number is 6 less than the first number. Find the three numbers.
Answer:
Here what we know
$a + b + c = 58$ (sum of three numbers is 58)
Let the first number be b 'x'
$b = a + 3$ (the second number is three times of of the first $\frac{2}{5}$ number)
$b = 3 \times \frac{2}{5}x \frac{6}{5}x$
Third number $= x - 6$
Sum of the numbers is given as 58.
$\therefore x + \frac{6}{5}x + (x - 6) = 58$
Multiplying by 5 throughout, we get
$5 \times x + 6x + 5 \times (x - 6) = 58 \times 5$
$5x + 6x + 5x - 30 = 290$
$\therefore 16x = 290 + 30$
$\therefore 16x = 320$
$\therefore x = \frac{320}{16}$
$x = 20$
1st number $= 20$

$$2^{nd} \text{ number} = 3 \times \frac{2}{\cancel{5}} \times \cancel{20}^{4} = 24$$

3rd number $= 24 - 16 = 14$

Question 2.
In triangle ABC, the measure of ∠B is two-third of the measure of ∠A. The measure of ∠C is 200 more than the measure of ∠A. Find the measures of the three angles.
Answer:
Let angle ∠A be a°
Given that $\angle B = \frac{2}{3} \times \angle A = \frac{2}{3}a$
& given $\angle C = \angle A + 20 = a + 20$
Since A, B & C are angles of a triangle, they add up to 180° (Δ property)
$\therefore \angle A + \angle B + \angle C = 180°$
$\Rightarrow a + \frac{2}{3}a + a + 20 = 180°$
$\frac{3a+2a+3a}{3} + 20 = 180°$
$\frac{8a}{3} = 180 - 20 = 160$

$\therefore a = \frac{160 \times 3}{8} = 60°$

$\angle B = \frac{2}{3} \times \angle A = \frac{2}{\cancel{3}} \times \cancel{60}^{20} = 40°$

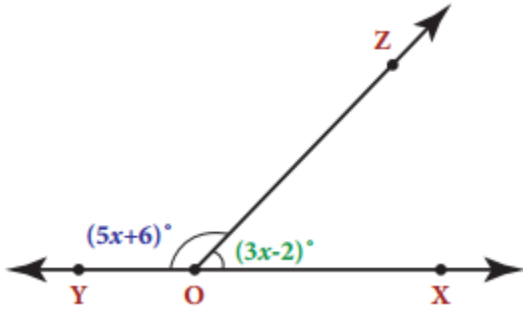
$\angle C = 80°$

Question 3.
Two equal sides of an isosceles triangle are 5y – 2 and 4y + 9 units. The third side is 2y + 5 units. Find 'y' and the perimeter of the triangle.
Answer:
Given that 5y – 2 & 4y + 9 are the equal sides of an isosceles triangle.
∴ The 2 sides are equal

$\Rightarrow \quad 5y - 2 = 4y + 9$

∴5y – 4y = 9 + 2 (by transposing)
∴ y = 11
∴ 1st side = 5y – 2 = 5 × 11 – 2 = 55 – 2 = 53
2ndside = 53 .
3rdside = 2y + 5 = 2 × 11 + 5 = 22 + 5 = 27
Perimeter is the sum of all 3 sides
∴ P = 53 + 53 + 27 = 133 units

Question 4.
In the given figure, angle XOZ and angle ZOY form a linear pair. Find the value of x.



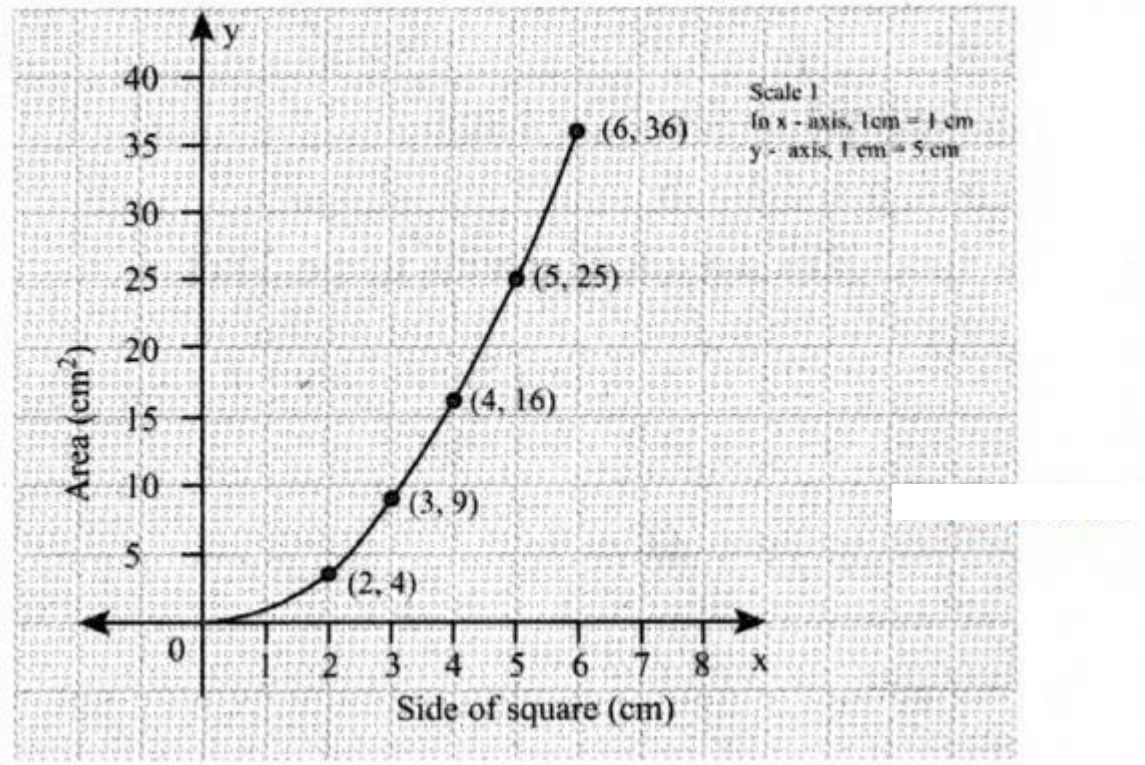
Answer:
Since ∠XOZ & ∠ZOY form a linear pair, by property, we have their sum to be 180°
∴ ∠XOZ + ∠ZOY 180°
∴ 3x – 2 + 5x + 6 = 180°
8x + 4 = 180 = 8x = 180 – 4
$\therefore 8x = 76 \Rightarrow x = \frac{176}{8} \Rightarrow x = 22°$
XOZ = 3x – 2 = 3 × 22 – 2 = 66 – 2 = 64°
YOZ = 5x + 6 = 5 × 22 + 6
= 110 + 6 = 116

Question 5.
Draw a graph for the following data:

Side of a square (cm)	2	3	4	5	6
Area (cm^2)	4	9	16	25	36

Answer:

Graph between side of square & area



When we plot the graph, we observe that it is not a linear relation.

Challenging problems

Question 6.

Three consecutive integers, when taken in increasing order and multiplied by 2, 3 and 4 respectIvely, total up to 74. Find the three numbers.

Answer:

Let the 3 consecutive integers be 'x', 'x + 1' & 'x + 2'

Given that when multiplied by 2, 3 & 4 respectively & added up, we get 74

i.e $2 \times x + 3 \times (x + 1) + 4 \times (x + 2) = 74$

Simplifying the equation, we get

$2x + 3x + 3 + 4x + 8 = 74$

$9x + 11 = 63$

$9x = 63 \Rightarrow x = \frac{63}{9} = 7$

First number = 7

Second numbers = $x + 1 \Rightarrow 7 + 1 = 8$

Third numbers = x + 2 ⇒ 7 + 2 = 9
∴ The numbers are 7, 8 & 9

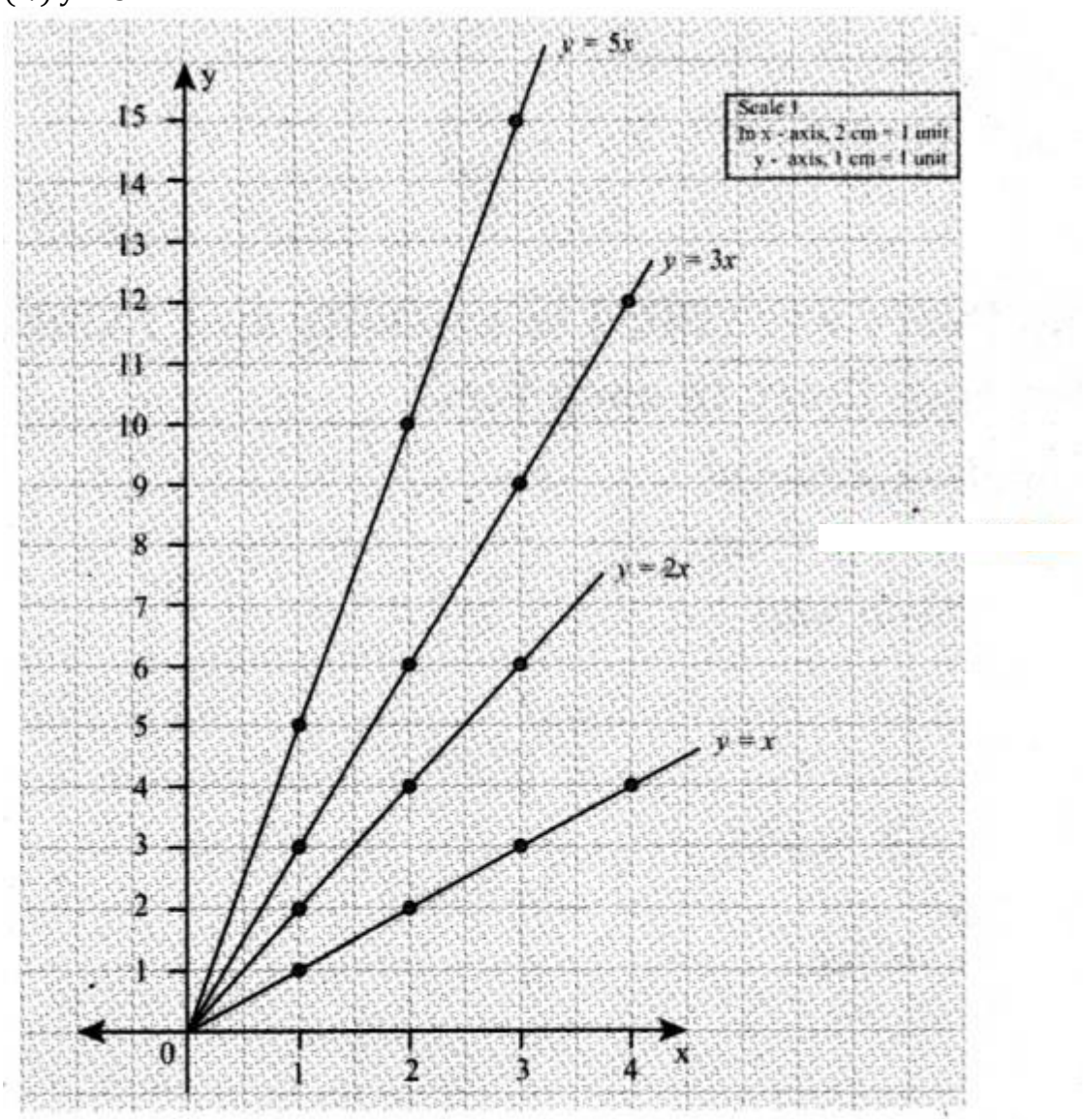
Question 7.
331 students went on a field trip. Six buses were filled to capacity and 7 students had to travel in a van. How many students were there in each bus?
Answer:
Let the number of students in each bus be 'x'
∴ number of students in 6 buses = 6 × x = 6x
A part from 6 buses, 7 students went in van
A total number of students is 331
∴ 6x + 7 = 331
∴ 6x = 331 – 7 = 324
∴ $x = \frac{324}{6} = 54$
∴ There are 54 students in each bus.

Question 8.
A mobile vendor has 22 items, some which are pencils and others are ball pens. On a particular day, he is able to sell the pencils and ball pens. Pencils are sold for ₹ 15 each and ball pens are sold at ₹ 20 each. If the total sale amount with the vendor is ₹ 380, how many pencils did he sell?
Answer:
Let vendor have 'p' number of pencils & 'b' number of ball pens
Given that total number of items is 22
∴ p + b = 22
Pencils are sold for ₹ 15 each & ball pens for ₹ 20 each
total sale amount = 15 × p + 20 × b
= 15p + 20b which is given to be 380.
∴ 15p + 20b = 380
Dividing by 5 throughout,
$\frac{15p}{5} + \frac{20b}{5} = \frac{380}{5}$ ⇒ – 3p + 4b = 76
Multiplying equation (1) by 3 we get
3 × p + 3 × b = 22 × 3
⇒ 3p + 3b = 66
Equation (2) – (3) gives

$$\begin{array}{rcl} 3p + 4b & = & 76 \\ (-)\quad (-) & & (-) \\ 3p + 3b & = & 66 \\ \hline 0 + b & = & 10 \end{array}$$

∴ b = 10
∴ p = 12
He sold 12 pencils

Question 9.
Draw the graph of the lines y = x, y = 2x, y = 3x and y = 5x on the same graph sheet. Is there anything special that you find in these graphs?
Answer:
(i) y = x
(ii) y = 2x,
(iii) y = 3x
(iv) y = 5x



(i) y = x
When x = 1, y = 1

x = 2, y = 2
x = 3, y = 2

(ii) y = 2x
When x = 1, y = 2
x = 2, y = 4
x = 3, y = 6

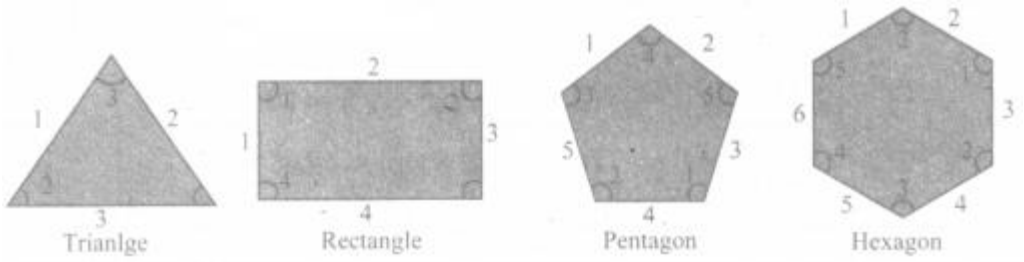
(iii) y = 3x
When x = 1, y = 3
x = 2, y = 6
x = 3, y = 9

(i) y = 5x
When x = 1, y = 5
x = 2, y = 10
x = 3, y = 15
When we plot the above points & join the points to form line, we notice that the lines become progressively steeper. In other words, the slope keeps increasing.

Question 10.
Consider the number of angles of a convex polygon and the number of sides of that polygon. Tabulate as follows:

Name of Polygon	*No. of angles*	*No. of sides*

Use this to draw a graph illustrating the relationship between the number of angles and the number of sides of a polygon.
Answer:
Angles



Name of Polygon	No of angles	No. of Sides
Triangle	3	3
Rectangle	4	4
Pentagon	5	5
Hexagon	6	6

Deptagon	7	7
Octagon	8	8