X-STANDARD

MATHEMATICS

X-STANDARD

MATHEMATICS

ஒரு மதிப்பெண் வினாக்கள்*(MATHEMATICS)*

*10-***ஆம் வகுப்பு கணித பாடப்புத்தகத்தில் உள்ள ஒரு மதிப்பெண் வினாக்கள்,** *GeoGebra* **மென்பொருளின் உதவியோடு, ஒரு வினாவிற்கு சரியான விடையை தேர்வு செய்ய, அதிகபட்சம் மூன்று வாய்ப்புகள் வழங்கி, மாணவர்களின் கற்றல், கற்பித்தல் திறன் அதிகரிக்கும் வகையில் வடிவமைக்கப்பட்டுள்ளது என்பதை தெரிவித்துக்கொள்கிறோம்.**

குறிப்பு : *Hi-Tech Lab-***ல்** *QR Code* **-ஐ** *Scan* **செய்து அல்லது** *Link* **-ஐ** *click* **செய்து மாணவர்கள் பயிற்சி செய்யும் விதமாக மென்பொருள் உருவாக்கப்பட்டுள்ளது.**

MATHEMATICS	*TAMIL MEDIUM*	*ENGLISH MEDIUM*
QR		
LINK	https://www.geogebra.org/m/q4wb3una	https://www.geogebra.org/m/utz8tarz

Dr. MURALI. B. J HM,
GHSS BARUR, KRISHNAGIRI.

KALIYAPPAN .N ,PG ASST
GHSS MORANAHALLI, KRISHNAGIRI

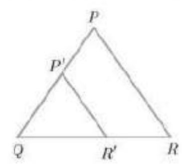
MATHS

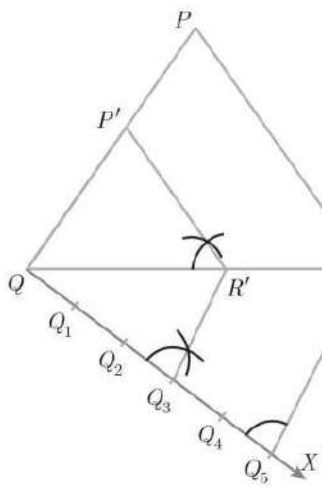
4 GEOMETRY

1. Construct a triangle similar to a given triangle PQR with its sides equal to $\frac{3}{5}$ of the corresponding sides of the triangle PQR (scale factor $\frac{3}{5} < 1$)

Solution:

Rough diagram

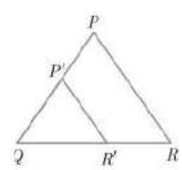


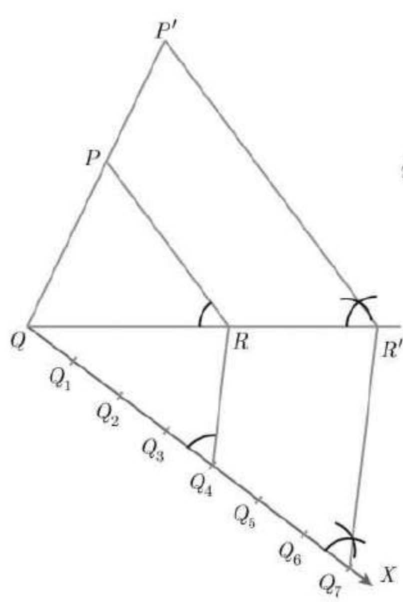


2. Cons Construct a triangle similar to a given triangle PQR with its sides equal to $\frac{7}{4}$ of the corresponding sides of the triangle PQR (scale factor $\frac{7}{4} > 1$)

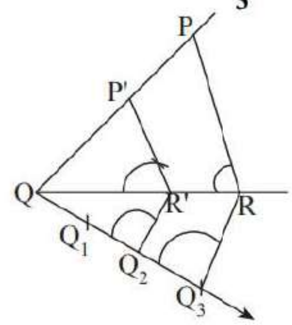
Solution:

Rough diagram

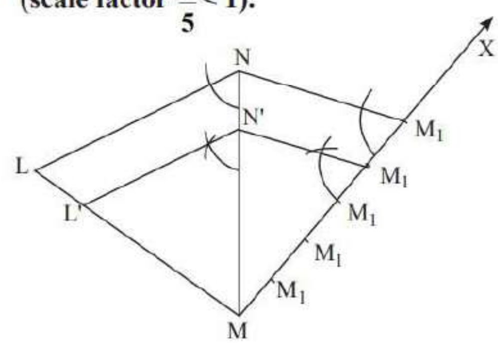




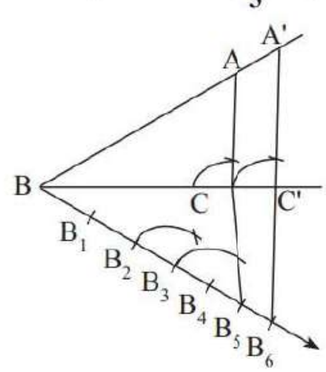
3. Construct a triangle similar to a given triangle PQR with its sides equal to $\frac{2}{3}$ of the corresponding sides of the triangle PQR (scale factor $\frac{2}{3} < 1$).



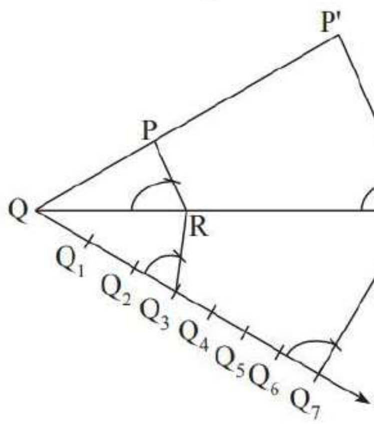
4. Construct a triangle similar to a given triangle LMN with its sides equal to $\frac{4}{5}$ of the corresponding sides of the triangle LMN (scale factor $\frac{4}{5} < 1$).



5. Construct a triangle similar to a given triangle ABC with its sides equal to $\frac{6}{5}$ of the corresponding sides of the triangle ABC (scale factor $\frac{6}{5} > 1$). SEP-20



6. Construct a triangle similar to a given triangle PQR with its sides equal to $\frac{7}{3}$ of the corresponding sides of the triangle PQR (scale factor $\frac{7}{3} > 1$).

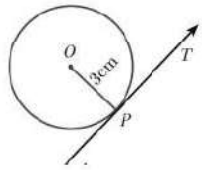


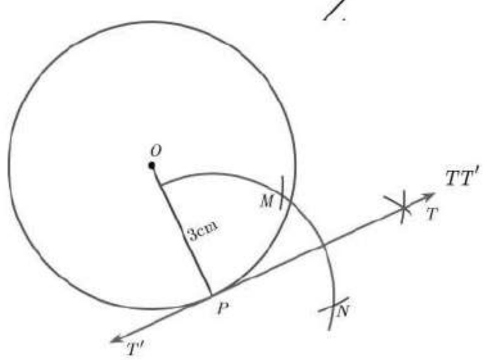
7. Draw a circle of radius 3 cm. Take a point P on this circle and draw a tangent at P.

Solution:

Given, radius r = 3 cm

Rough diagram

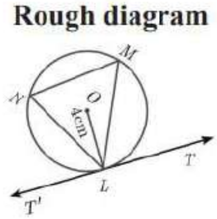


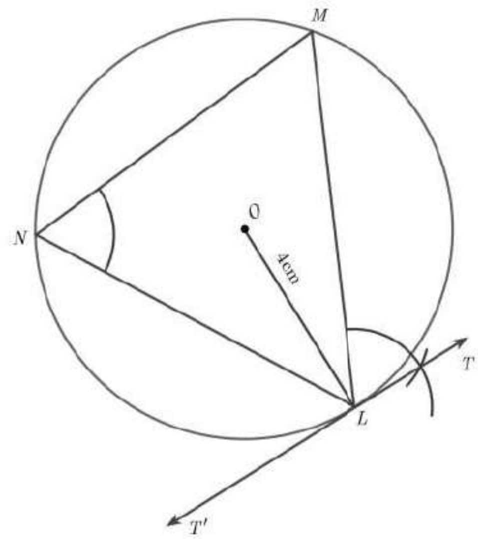


8. Draw a circle of radius 4 cm. At a point L on it draw a tangent to the circle using the alternate segment.

Solution:

Rough diagram





9. Draw a circle of diameter 6 cm from a point P, which is 8 cm away from its centre. Draw the two tangents PA and PB to the circle and measure their lengths.

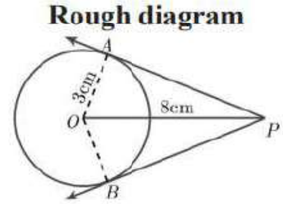
Verification: In the right angle triangle OAP.

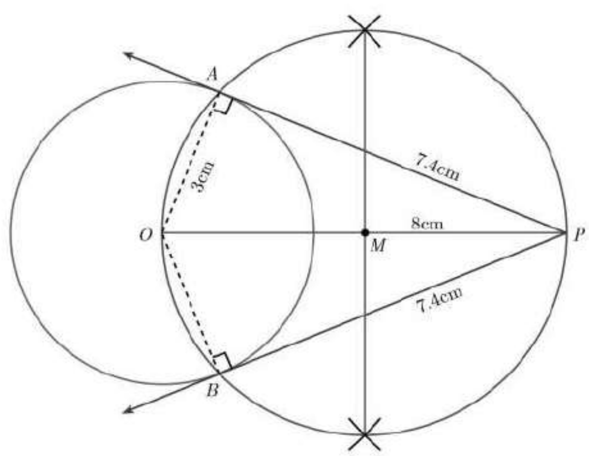
$PA^2 - OA^2 = 64 - 9 = 55$

$PA = \sqrt{55} = 7.4$ cm

Solution:

Rough diagram

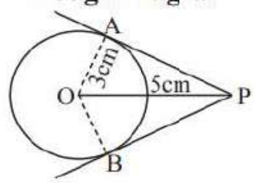


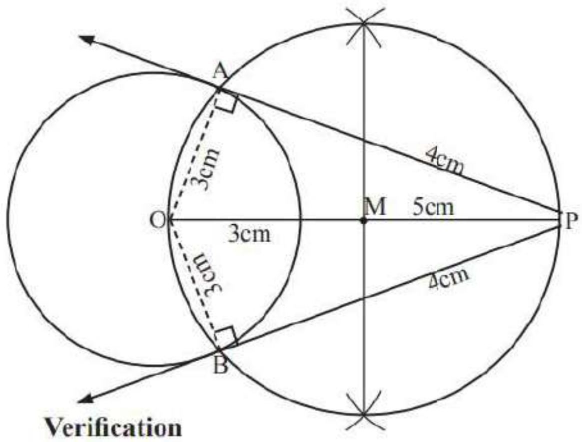


14. Draw the two tangents from a point which is 5 cm away from the centre of a circle of diameter 6 cm. Also, measure the lengths of the tangents. SEP-21

Solution:

Rough Diagram





Verification

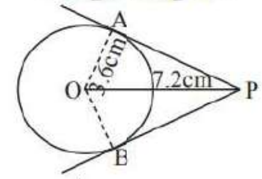
In ΔOPA $AP^2 = OP^2 - OA^2$

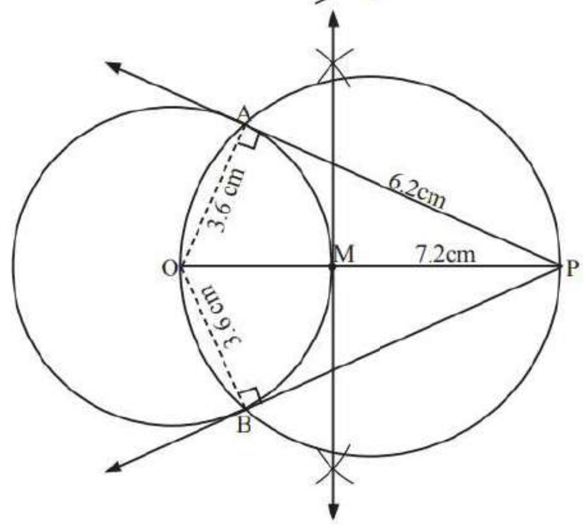
$= 5^2 - 3^2 = 25 - 9 = 16$

$AP = \sqrt{16} = 4$ cm

15. Draw a tangent to the circle from the point P having radius 3.6cm, and centre at O. Point P is at a distance 7.2 cm from the centre.

Solution: **Rough Diagram**





Verification:

In ΔOPA, $PA^2 = OP^2 - OA^2$

$= 7.2^2 - 3.6^2$

$= 51.84 - 12.96$

$= 38.88$

$PA = \sqrt{38.88} = 6.2$ cm (approx)

***

GRAPH

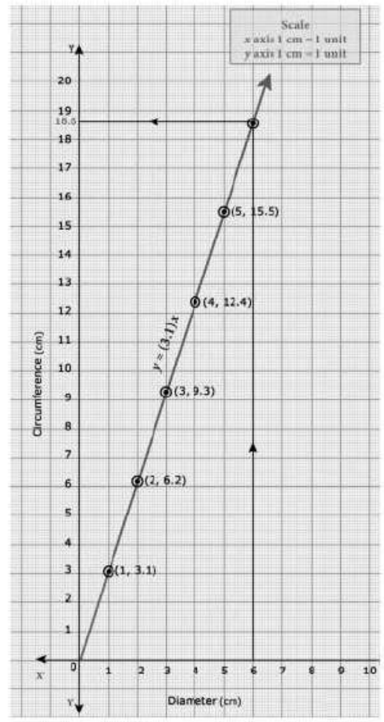
1. Varshika drew 6 circles with different sizes. Draw a graph for the relationship between the diameter and circumference of each circle as shown in the table and use it to find the circumference of a circle when its diameter is 6 cm.

Diameter (x) cm	1	2	3	4	5
Circumference (y) cm	3.1	6.2	9.3	12.4	15.5

Solution:

I. Table (Given)

Diameter(x) cm	1	2	3	4	5
Circumference (y) cm	3.1	6.2	9.3	12.4	15.5



II. Variation:

When 'x' increases, 'y' also increases. Thus, the variation is a direct variation.

Let y = kx, where k is a constant of proportionality.

From the given values, we have,

$$k = \frac{y}{x} = \frac{3.1}{1} = \frac{6.2}{2} = \frac{9.3}{3} = \frac{12.4}{4} = ... = 3.1$$

$\therefore y = 3.1x$

III. Points

(1, 3.1) (2, 6.2) (3, 9.3), (4, 12.4), (5, 15.5)

IV. Solution:

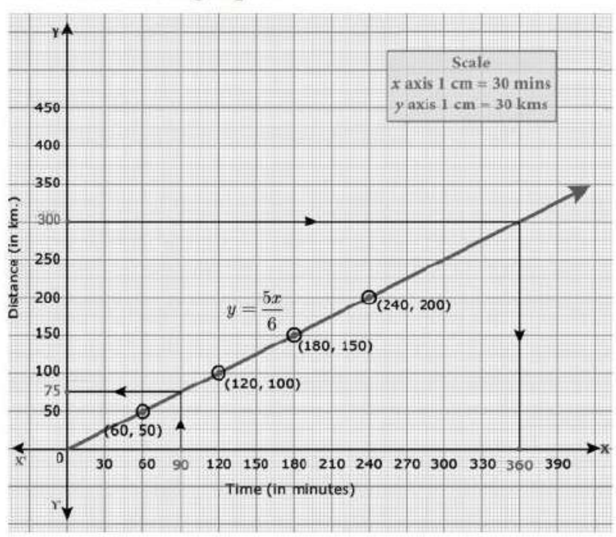
From the graph, when diameter is 6 cm, its circumference is 18.6 cm.

Verify: When $x = 6$, $y = (3.1) \times 6 = 18.6$

2. A bus is travelling at a uniform speed of 50 km/hr. Draw the distance-time graph and hence find (i) the constant of variation (ii) how far will it travel in 1½ hr (iii) the time required to cover a distance of 300 km from the graph.

Solution: I. Table

Time taken x (in minutes)	60	120	180	240	300	360
Distance y (in km)	50	100	150	200	250	300



II. Variation:

When 'x' increases, 'y' also increases. Thus, the variation is a direct variation.

$\frac{y}{x} = \frac{50}{60} = \frac{100}{120} = \frac{5}{6}$ $\therefore$ Equation $y = \frac{5}{6}x$

III. Points: (60, 50), (120, 100), (180, 150), (240, 200), (300, 250)

IV. Solution:

(i) the constant of variation $k = \frac{y}{x} = \frac{5}{6}$

(ii) the bus will travel 75 km in 90 mins

(verify : $y = \frac{5}{6} \times 90 = \frac{450}{6} = 75$)

(iii) from the graph, the time required to cover a distance of 300 km is 360 minutes.

3. A company initially started with 40 workers to complete the work by 150 days. Later, it decided to fasten up the work increasing the number of workers as shown below.

Number of workers (x)	40	50	60	75
Number of days (y)	150	120	100	80

(i) Graph the above data and identify the type of variation. (ii) From the graph, find the number of days required to complete the work if the company decides to opt for 120 workers? (iii) If the work has to be completed by 30 days, how many workers are required?

Solution: **I. Table (Given)**

Number of workers (x)	40	50	60	75
Number of days (y)	150	120	100	80

II. Variation:

When 'x' increases, 'y' also decreases. Hence, inverse variation. i.e. $xy = k$

$xy = 40 \times 150 = 50 \times 120 = \ldots.. 6000$ (k)

$\therefore$ Required Equation $xy = 6000$

III. Points: (40, 150) (50, 120) (60, 100), (75, 80)

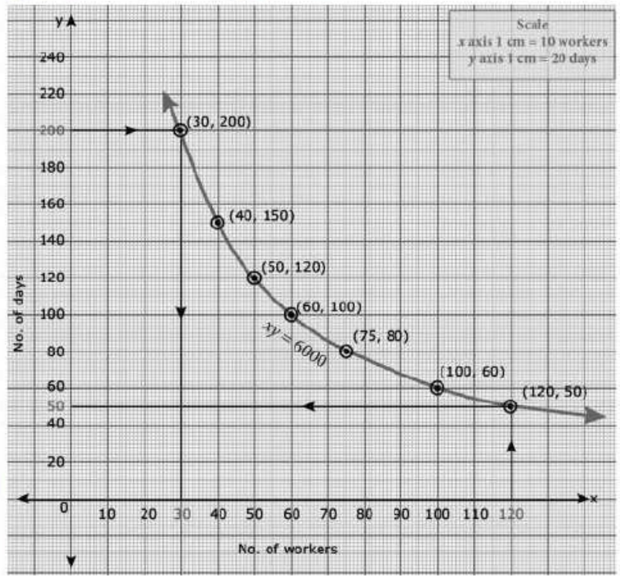
IV. Solution:

(i) Inverse Variation

(ii) When $x = 120 \Rightarrow 120 \times y = 6000$

$\Rightarrow y = \frac{6000}{120} = 50$. Also from the graph, the No. of days required to complete the work if the company decides to opt for 120 workers is 50 days.

(iii) When $y = 200 \Rightarrow x \times 200 = 6000 \Rightarrow x = \frac{6000}{200}$ $= 30$. Also from the graph, the No. of workers required to complete in 200 days is 30.



4. Nishanth is the winner in a Marathon race of 12 km distance. He ran at the uniform speed of 12 km/hr and reached the destination in 1 hour. He was followed by Aradhana, Ponmozhi, Jeyanth, Sathya and Swetha with their respective speed of 6 km/hr, 4 km/hr, 3 km/hr and 2 km/hr. And, they covered the distance in 2 hrs, 3 hrs, 4 hrs and 6 hours respectively. Draw the speed-time graph and use it to find the time taken to Kaushik with his speed of 2.4 km/hr.

Solution: **I. Table:**

Speed x(km / hr)	12	6	4	3	2
Time y (hours)	1	2	3	4	6

II. Variation:

From the table, we observe that as x decreases, y increases. Hence, the type is inverse variation.

Let y = – $\Rightarrow xy = k$, $k > 0$ is called the constant of variation.

$k = 12 \times 1 = 6 \times 2 = \ldots = 2 \times 6 = 12$ (k)

Therefore, $xy = 12$.

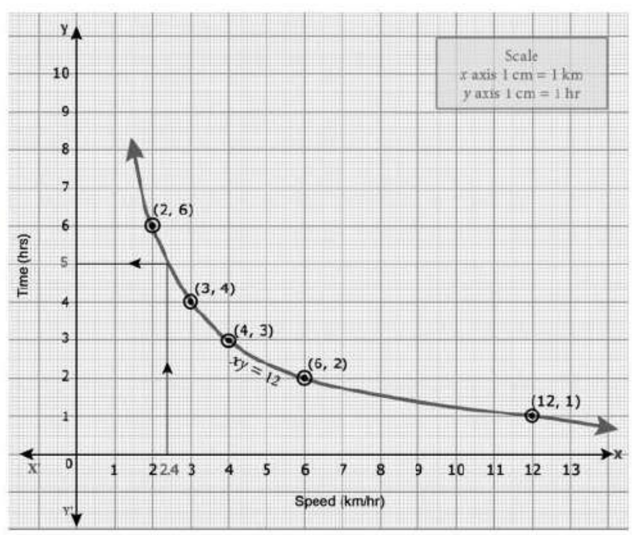
III. Points: (12, 1), (6, 2), (4, 3), (3, 4), (2, 6)

IV. Solution:

When $x = 2.4 \Rightarrow 2.4 \times y = 12$.

$y = \frac{12}{2.4} = 5$

Also, from the graph, the time taken to Kaushik with his speed of 2.4 km / hr is 5 hours .



5. A garment shop announces a flat 50% discount on every purchase of items for their customers. Draw the graph for the relation between the Marked Price and the Discount. Hence find
(i) the marked price when a customer gets a discount of ₹ 3250 (from graph)
(ii) the discount when the marked price is ₹ 2500

Solution: **I. Table (Given)**

Marked Price ₹ (x)	1000	2000	3000	4000	5000	6000
Discounted Price ₹ (y)	500	1000	1500	2000	2500	3000

II. Variation:

When 'x' increases, 'y' also increases. Thus, the variation is a direct variation.

Let y = kx, where k is a constant of proportionality.
From the given values, we have,

$$k = \frac{y}{x} = \frac{500}{1000} = \frac{1000}{2000} = \ldots = \frac{1}{2}$$

$\therefore$ Required Equation is $y = \frac{1}{2}x$

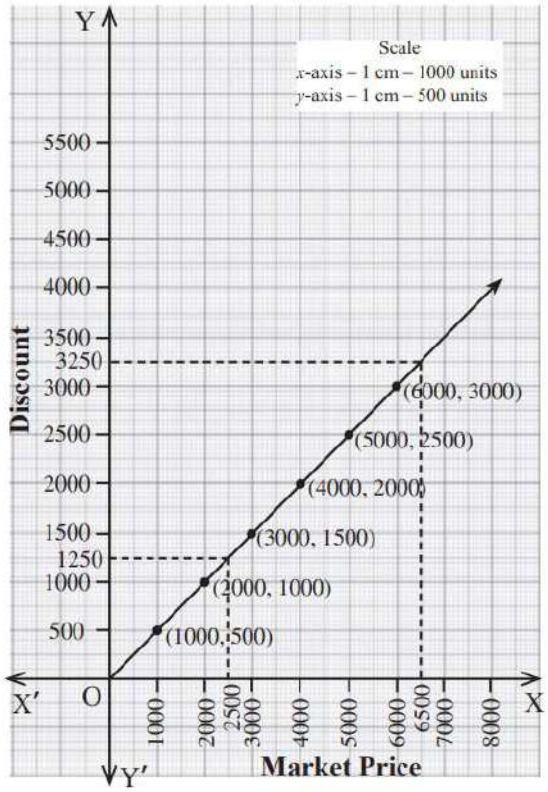
III. Points: (1000, 500), (2000, 1000), (3000, 1500), (4000, 2000), (5000, 2500), (6000, 3000)

IV. Solution:

(i) From the graph, when a discount price is ₹ 3250, the marked price is ₹ 6500

(ii) From the graph, when the marked price is ₹ 2500, the discounted price is ₹ 1250

Verify: When $x = 6$, $y = (3.1) \times 6 = 18.6$



6. Draw the graph of $xy = 24$, $x, y > 0$. Using the graph find,
(i) y when $x = 3$ and (ii) x when y = 6.

Solution:

I. Table: (Given)

x	1	2	3	4	6	12	24
y	24	12	8	6	4	2	1

II. Variation:

When 'x' increases, 'y' also decreases.

Hence, inverse variation.

i.e. $xy = k$

$xy = 1 \times 24 = 2 \times 12 = \ldots 12 \times 2 = 24$

$\therefore$ Required Equation $xy = 24$

III. Points:

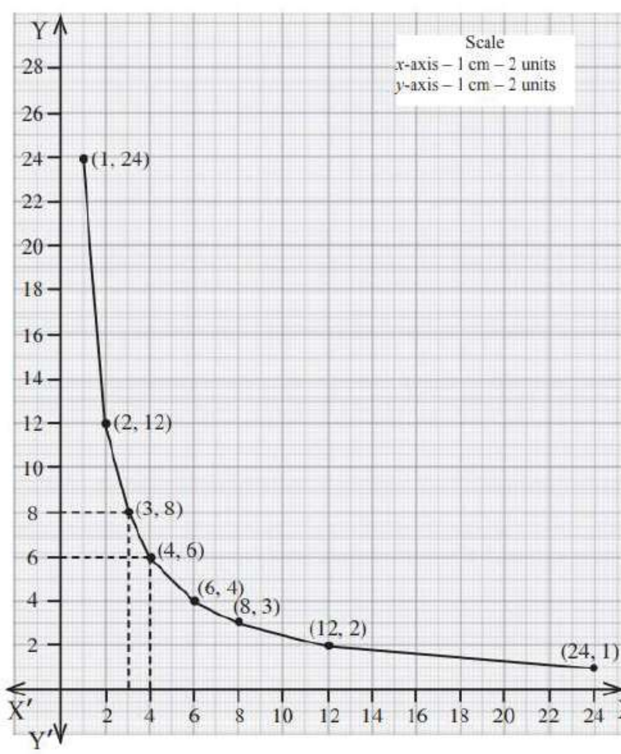
(1, 24), (2, 12), (3, 8), (4, 6), (6, 4), (12, 2)

IV. Solution:

(i) $x = 3 \Rightarrow 3 \times y = 24 \Rightarrow y = \frac{24}{3} = 8 \Rightarrow y = 8$

(ii) $y = 6 \Rightarrow x \times 6 = 24 \Rightarrow x = \frac{24}{6} = 4 \Rightarrow x = 4$

Also, Verified in the Graph.



MATHS

7. Graph the following linear function y =1/2 *x*. Identify the constant of variation and verify it with the graph. Also (i) find y when *x* = 9 (ii) find *x* when y = 7.5.

Solution: **I. Table: (Given)**

x	2	4	6	8	10
y	1	2	3	4	5

II. Variation:

When '*x*' increases, 'y' also increases. Thus, the variation is a direct variation.

Let y = kx, where k is a constant of proportionality. From the given values, we have,

$$k = \frac{y}{x} = \frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \ldots. = \frac{1}{2}$$

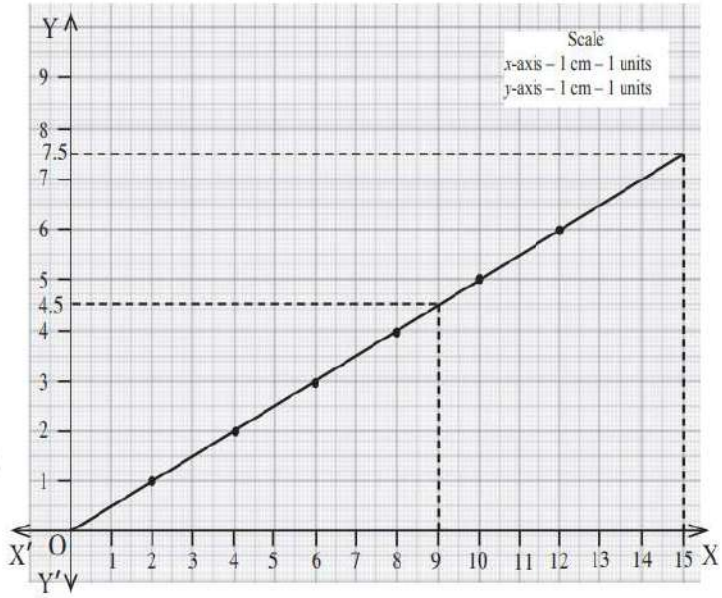
∴ Required Equation is $y = \frac{1}{2}x$

III. Points: (2, 1), (4, 2), (6, 3), (8, 4), (10, 5)

IV. Solution:

From the graph, when *x* = 9, y = 4.5

From the graph, when y = 7.5, *x* = 15



8. The following table shows the data about the number of pipes and the time taken to till the same tank.

No. of pipes (*x*)	**2**	**3**	**6**	**9**
Time Taken (in min) (y)	**45**	**30**	**15**	**10**

Draw the graph for the above data and hence

(i) find the time taken to fill the tank when five pipes are used

(ii) find the number of pipes when the time is 9 minutes.

Solution:

I. Table (Given):

No. of pipes (*x*)	2	3	6	9
Time Taken (in min) (y)	45	30	15	10

II. Variation:

When 'x' increases, 'y' also decreases. Hence, inverse variation. i.e. *xy* = k

$xy = 2\times45 = 3\times30 = \ldots..6\times15 = 9\times10 = 90$

∴ Required Equation $xy = 90$

III. Points: (2, 45), (3, 30), (6, 15), (9, 10)

IV. Solution:

$x = 5 \Rightarrow 5 \times y = 90$

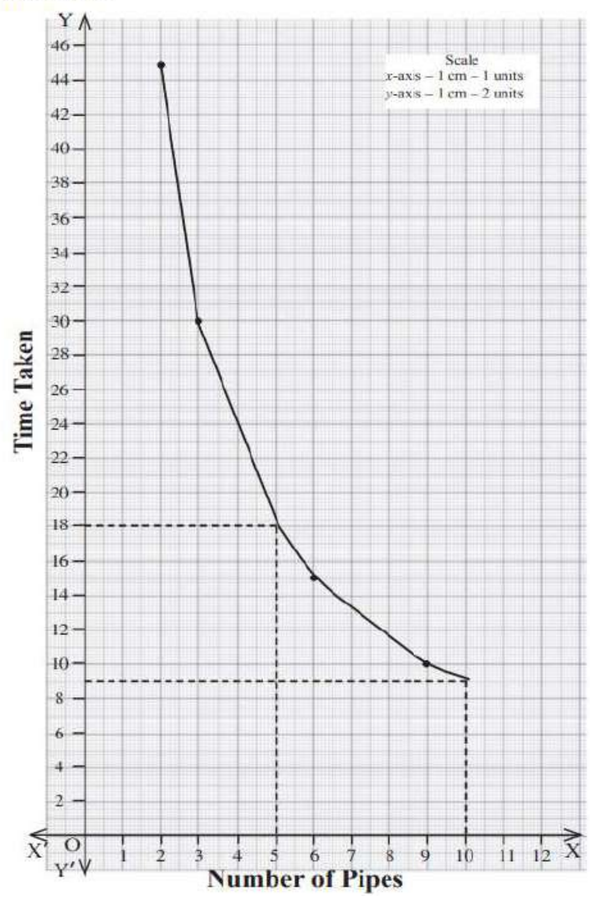
$y = \frac{90}{5} = 18$ (Verified with Graph)

Hence, the time taken to fill the tank when five pipes are used is 18.

$y = 9 \Rightarrow x \times 9 = 90$

$x = \frac{90}{9} = 10$ (Verified with Graph)

Hence, the No. of pipes when the time 9 minutes is 10



9. A school announces that for a certain competitions, the cash price will be distributed for all the participants equally as show below

No. of participants (x)	**2**	**4**	**6**	**8**	**10**
Amount for each participant in ₹ (y)	**180**	**90**	**60**	**45**	**36**

(i) Find the constant of variation.

(ii) Graph the above data and hence, find how much will each participant get if the number of participants are 12.

Solution: **I. Table(Given)**

No. of participants (x)	2	4	6	8	10
Amount for each participant in ₹ (y)	180	90	60	45	36

II. Variation:

When 'x' increases, 'y' also decreases. Hence, inverse variation. i.e. $xy = k$

$xy = 2\times180 = 4\times90 = \ldots..10\times36 = 360 = k$

$\therefore$ Required Equation $xy = 360$

III. Points: (2,180), (4,90), (6,60), (8,45), (10,36)

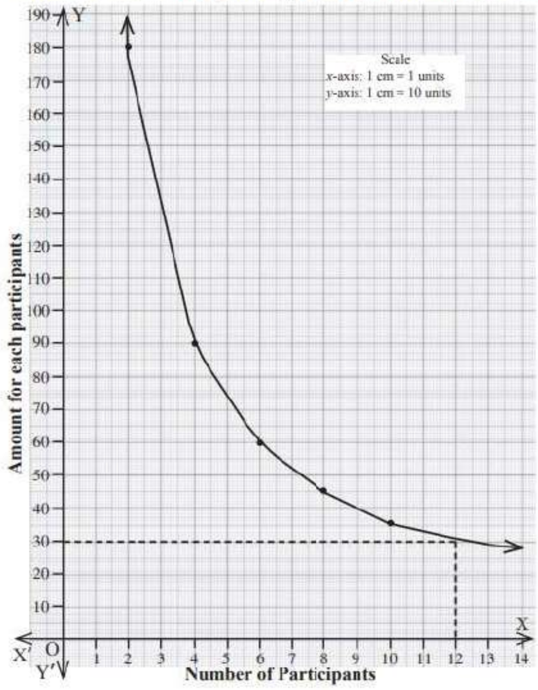
IV. Solution:

Constant of Variation: k = 360

When $x = 12 \Rightarrow xy = 360 \Rightarrow 12y = 360$

$y = \frac{360}{12} = 30$ (Verified with Graph)

Hence, When the number of participants are 12, then each participant will get ₹30



10. A two wheeler parking zone near bus stand charges as below.

Time (in hours) (x)	**4**	**8**	**12**	**24**
Amount ₹ (y)	**60**	**120**	**180**	**360**

Check if the amount charged are in direct variation or in inverse variation to the parking time. Graph the data. Also (i) find the amount to be paid when parking time is 6 hr; (ii) find the parking duration when the amount paid is ₹150.

Solution: **I. Table (Given):**

Time (in hours) (x)	4	8	12	24
Amount ₹ (y)	60	120	180	360

II. Variation:

When 'x' increases, 'y' also increases.

Thus, the variation is a direct variation.

Let $y = kx$, where k is a constant of proportionality. From the given values, we have,

$k = \frac{y}{x} = \frac{60}{4} = \frac{120}{8} = \ldots. \frac{180}{12} = \frac{360}{24} = 15 = k$

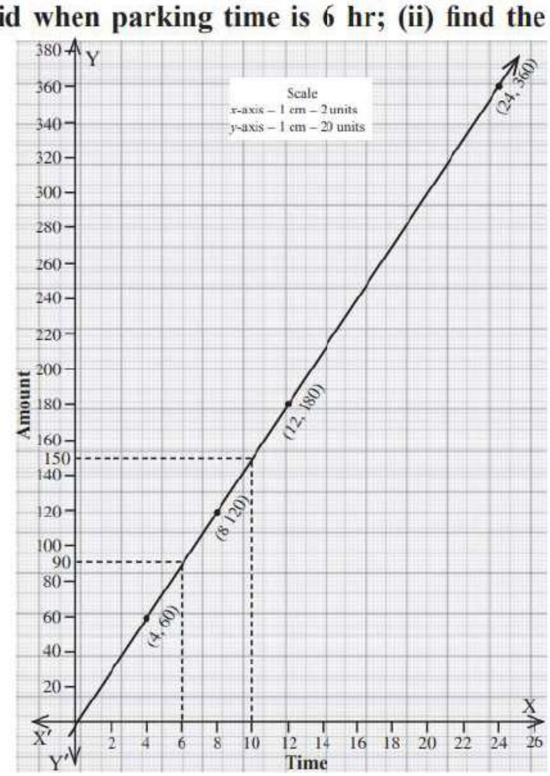
$\therefore$ Required Equation is $y = 15x$

III. Points: (4, 60), (8, 120), (12, 180), (24, 360)

IV. Solution:

From the graph, when parking time is 6 hours, then the amount to be paid is ₹ 90.

From the graph, when them amount paid is 1510, then the parking duration is 10 hours.



Relation and Function

Two Marks

1. If A= {1, 3, 5} and B= {2, 3} then find A X B and B X A.

Solution:

$A \times B = \{1,3,5\} \times \{2,3\}$
$= \{(1,2), (1,3), (3,2), (3,3), (5,2), (5,3)\}$

$B \times A = \{2,3\} \times \{1,3,5\}$
$= \{(2,1), (2,3), (2,5), (3,1), (3,3), (3,5)\}$

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2. If A × B = {(3, 2), (3, 4), (5, 2), (5, 4)} then find A and B.

Solution:

$A = \{3, 5\}$
$B = \{2, 4\}$

---

3. Find A × B, A × A and B × A.
A = {2, -2, 3} and B = {1, -4}.

Solution:

(i) $A = \{2, -2, 3\}$ **and** $B = \{1, -4\}$.

$A \times B = \{2, -2, 3\} \times \{1, -4\}$
$= \{(2,1), (2,-4), (-2,1), (-2,-4), (3,1) (3,-4)\}$

$A \times A = \{2, -2, 3\} \times \{2, -2, 3\}$
$= \{(2,2), (2,-2), (2,3), (-2,2), (-2,-2), (-2,3), (3,2), (3,-2), (3,3)\}$

$B \times A = \{1, -4\} \times \{2, -2, 3\}$
$= \{(1,2), (1,-2), (1,3), (-4,2), (-4,-2), (-4,3)\}$

(i) $A = B = \{p, q\}$.

$A \times B = \{p, q) \times \{p, q\}$
$= \{(p,p), (p,q), (q,p), (q,q)\}$

$A \times A = \{p, q) \times (p, q)$
$= \{(p,p), (p,q), (q,p), (q,q)$

$B \times A = \{p, q\} \times \{p, q\}$
$= \{(p,p), (p,q), (q,p), (q,q)\}$

(ii) $A = \{m, n\}; B = \varphi$.

$A \times B = \{m, n) \times \{\ \}$
$= \{\ \}$

$A \times A = \{m, n) \times (m, n)\}$
$= \{(m,m), (m,n), (n,m), (n,n)\}$

$B \times A = \{\ \} \times \{m, n\}$
$= \{\ \}$

---

4. Let A = {1, 2, 3} and B = {x | x is a prime number less than 10}. Find A × B and B × A.

Solution:

$A = \{1, 2, 3\}, B = \{2, 3, 5, 7\}$

$A \times B = \{(1,2), (1,3), (1,5), (1,7), (2,2), (2,3), (2,5), (2,7), (3,2), (3,3), (3,5), (3,7)\}$

$B \times A = \{(2,1), (2,2), (2,3), (3,1), (3,2), (3,3), (5,1), (5,2), (5,3), (7,1), (7,2), (7,3)\}$

---

5. If B × A = {(-2, 3), (-2, 4), (0, 3), (0, 4), (3,3), (3, 4)} find A and B.

Solution:

$B = \{-2, 0, 3\}$
$A = \{3, 4\}$

---

6. The arrow diagram shows (Fig.1.10) a relationship between the sets *P* and *Q*. Write the relation in
(a) Set builder form
(b) Roster form
(c) What is the domain and range of R.?

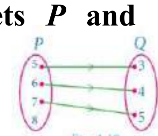

Fig. 1.10

Solution:

(i) $\{(x, y) \mid y = x - 2, x \in P, y \in Q\}$

(ii) $\{(5,3), (6,4), (7,5)\}$

Domain = {5, 6, 7}, Range = {3, 4, 5}.

---

7. Let A = {1, 2, 3}, B = {4, 5, 6, 7}, and f = {(1, 4)}, (2, 5), (3, 6) be a function from A to B. Show that f is one – one but not onto function.

Solution:

Then f is a function from A to B and for different elements in A, there aredifferent images in B.

Hence f is a one – one function.

Element 7 in the co-domain does not have any pre-image in the domain. Hence f is not onto.

f is one–one but not an onto function.

---

8. If A = {-2, -1, 0, 1, 2} and f: A→B is an onto function defined by f (x) = $x^2 + x + 1$ then Find B.

Solution:

$f(x) = x^2 + x + 1$.

$f(-2) = (-2)^2 + (-2) + 1 = 4 - 2 + 1 = 3$

$f(-1) = (-1)^2 + (-1) + 1 = 1 - 1 + 1 = 1$

$f(0) = (0)^2 + (0) + 1 = 0 + 0 + 1 = 1$
$f(1) = (1)^2 + (1) + 1 = 1 + 1 + 1 = 3$
$f(2) = (2)^2 + (2) + 1 = 4 + 2 + 1 = 7$
$\therefore B = \{1,3,7\}$

---

9. Let f be a function from R to R defined by f (x) = 3x – 5. Find the values of a and b given that (a, 4) and (1, b) belong to f.

Solution:

$f(a) = 4.$
$3a - 5 = 4$
$a = 3$
$f(1) = b.$
$3(1) - 5 = b$
$b = -2$

---

10. Let A = {1, 2, 3, 4…, 45} and R be the relation defined as "is square of" on A. Write R as a subset of A × A. Also, find the domain and range of R.

Solution

$A = \{1, 2, 3, 4 \ldots 45\}$,
$A \times A = \{(1, 1), (1, 2) \ldots (45, 45)$

subset of $A\times A = \{(1, 1), (2, 4), (3, 9), (4, 16), (5, 25), (6, 36)\}$

Domain $= \{1, 2, 3, 4, 5, 6\}$
Range $= \{1, 4, 9, 16, 25, 36\}$

---

11. A Relation R is given by the set {(x, y) / y = x + 3, x ∈ {0, 1, 2, 3, 4, 5}}. Determine its domain and range.

Solution:

$x = \{0, 1, 2, 3, 4, 5\}$;
$y = x + 3$
$x = 0 \Rightarrow y = 0 + 3 = 3$
$x = 1 \Rightarrow y = 1 + 3 = 4$
$x = 2 \Rightarrow y = 2 + 3 = 5$
$x = 3 \Rightarrow y = 3 + 3 = 6$
$x = 4 \Rightarrow y = 4 + 3 = 7$
$x = 5 \Rightarrow y = 5 + 3 = 8$
மதிப்பகம் $= \{0, 1, 2, 3, 4, 5\}$
வீச்சகம் $= \{3, 4, 5, 6, 7, 8\}$

---

12. Let X = {3, 4, 6, 8}. Determine whether the relation R = {(x, f(x)) |x ∈ X, f(x) = x² + 1} is a function from X to N?

Solution:

$f(x) = x^2 + 1$
$f(3) = 3^2 + 1 = 9 + 1 = 10$
$f(4) = 4^2 + 1 = 16 + 1 = 17$
$f(6) = 6^2 + 1 = 36 + 1 = 37$
$f(8) = 8^2 + 1 = 64 + 1 = 65$

yes, R is a function from X to N.

---

13. Let f (x) = 2x + 5. If x ≠ 0 then find $\frac{f(x+2)-f(2)}{x}$.

Solution:

$f(x) = 2x + 5$
$f(x + 2) = 2(x + 2) + 5$
$= 2x + 4 + 5$
$= 2x + 9$
$f(2) = 2(2) + 5$
$= 9$

$$\frac{f(x+2)-f(2)}{x} = \frac{2x+9-9}{x} = \frac{2x}{x} = 2$$

---

14. Let A = {1, 2, 3, 4) and B = N. Let f : A → B be defined by f(x) = x³ then,
(i) find the range of f.
(ii) identify the type of function.

Solution:

$A = \{1, 2, 3, 4\}$; $B = N$. $f: A \to B$,
$f(x) = x^3$
$f(1) = 1^3 = 1$
$f(2) = 2^3 = 8$
$f(3) = 3^3 = 27$
$f(4) = 4^3 = 64$

(ii) The range of f = {1, 8, 27, 64}
(iii) It is one-one and into function.

---

15. Find f o g and g o f when f (x) = 2x + 1 and g (x) = x² – 2.

Solution:

$f \circ g = (2x + 1) \circ (x^2 - 2)$
$f \circ g = 2\,(x^2 - 2) + 1$
$g \circ f = (x^2 - 2) \circ (2x + 1)$
$g \circ f = (2x + 1)^2 - 2$
Hence $fog \neq gof$

---

16. If f (x) = 3x - 2, g (x) = 2x + k, and if f o g = g o f, then find the value of k.

Solution:

$f \circ g = (3x - 2) \circ (2x + k)$
$f \circ g = 3(2x + k) - 2$
$= 6x + 3k - 2$

$g \circ f = (2x + k) \circ (3x - 2)$
$g \circ f = 2(3x - 2) + k$
$= 6x - 4 + k.$
$f \circ g = g \circ f$
$\therefore 6x + 3k - 2 = 6x - 4 + k$

$2k = -2$
$\Rightarrow k = -1.$

---

17. Find k if f o f (k) = 5 where f (k) = 2k – 1. f o f (k) = 5

Solution:

$f \circ f(k) = 5$
$(2k - 1) \circ (2k - 1) = 5$
$2(2k - 1) - 1 = 5$
$4k - 2 - 1 = 5$
$4k - 3 = 5$
$4k = 5 + 3$
$4k = 8$
$\therefore k = 2.$

---

18. f (x) = 3x + 2, g (x) = 6x – k. Find the value of k, such that f o g = g o f.
f(x) = 3x + 2, g(x) = 6x – k

Solution:

$f(x) = 3x + 2, g(x) = 6x - k$
$f \circ g = (3x + 2) \circ (6x - k)$
$= 3(6x - k) + 2$
$= 18x - 3k + 2$ …………… (1)
$g \circ f = (6x - k) \circ (3x + 2)$
$= 6(3x + 2) - k$
$= 18x + 12 - k$ ……………. (2)
(1) = (2)
$18x - 3k + 2 = 18x + 12 - k$
$-3k + k = 12 - 2$
$-2k = 10$
$\therefore k = -5$

---

19. If f (x) = x² – 1, g (x) = x – 2 find a, if g o f (a) = 1.

Solution:

$f(x) = x^2 - 1; g(x) = x - 2.$
$g \circ f(a) = 1$
$g \circ f(x) = (x - 2) \circ (x^2 - 1)$
$= x^2 - 1 - 2$
$= x^2 - 3$
$g \circ f(a) = a^2 - 3 = 1$
$a^2 = 4$
$a = \pm 2$

Five Marks

1. **A = {x ∈ N | 1 < x < 4}, B = {x ∈ W | 0 ≤ x < 2} and C = {x ∈ N | x < 3}. Then verify that**
   a) A × (B ∪ C) = (A × B) ∪ (A × C).
   b) A × (B ∩ C) = (A × B) ∩ (A × C).

Solution:

A = {2, 3}, B = {0, 1}, C = {1, 2}.
A × (B ∪ C) = (A × B) ∪ (A × C).
(B ∪ C) = {0, 1, 2}
A × (B ∪ C) = {2, 3} × {0, 1, 2}
= {(2, 0), (2, 1), (2, 2), (3, 0), (3, 1), (3, 2)} -----(1)
(A × B) = {2, 3} ×{0, 1}
= {(2, 0), (2, 1), (3, 0), (3, 1)}
(A × C) = {2, 3} ×{1, 2}
= {(2, 1), (2, 2), (3, 1), (3, 2)}
(A × B) ∪ (A × C) = {(2, 0), (2, 1), (2, 2) (3, 0), (3, 1), (3, 2)} --------(2)

From (1) and (2),
A × (B ∪ C) = (A × B) ∪ (A × C).

A × (B ∩ C) = (A × B) ∩ (A × C).
(B ∩ C) = {1}
A × (B ∩ C) = {2, 3} × {1}
= {(2, 1), (3, 1)} -- - (1)
(A × B) = {2, 3} ×{0, 1}
= {(2, 0), (2, 1), (3, 0), (3, 1)}
(A × C) = {2, 3} ×{1, 2}
= {(2, 1), (2, 2), (3, 1), (3, 2)}
(A × B) ∩ (A × C) = {(2, 1), (3, 1)} -- - (2)
From (1) and (2),
A × (B ∩ C) = (A × B) ∩ (A × C).

---

2. Given A = {1,2,3}, B = {2,3,5}, C = {3,4} and D = {1,3,5}, check if (A ∩ C) × (B ∩ D) = (A × B) ∩ (C × D) is true?

Solution:

A = {1, 2, 3}, B = {2, 3, 5}; C = {3,4};
D = {1,3,5}.
A ∩ C = (3)
B ∩ D = {3,5}
(A ∩ C) × (B ∩ D) = {3} × {3,5}
= {(3, 3), (3, 5)} ------(1)
A × B = {1,2,3} × {2,3,5}
= {(1,2) (1,3) (1,5) (2, 2) (2, 3) (2, 5) (3, 2) (3, 3) (3, 5)}
C × D = {3,4} × {1,3,5}
= {(3,1) (3, 3) (3, 5) (4,1) (4, 3) (4, 5)}
(A × B) ∩ (C × D) = {(3, 3) (3, 5)} -----(2)
(A ∩ C) × (B ∩ D) = (A × B) ∩ (C × D)
This is true.

---

3. Let A = {x ∈ W | x < 2}, B = {x ∈ N | 1 < x ≤ 4} and C = {3, 5}. Verify that

(i) **A × (B ∪ C) = (A × B) ∪ (A × C).**

Solution:

A = {0,1} , B = {2,3,4}, C = {3,5}

(i) A × (B ∪ C) = (A × B) ∪ (A × C).

B ∪C = {2, 3, 4, 5}

A × (B ∪ C) = {0,1} × {2,3,4,5}
= {(0, 2), (0, 3), (0,4), (0, 5), (1, 2), (1, 3), (1, 4), (1, 5)} ---(1)

(A × B) = {0,1} × {2,3, 4}
= {(0, 2), (0, 3), (0, 4), (1, 2), (1, 3), (1, 4)}

(A × C) = {0,1} × {3,5}
= {(0, 3), (0, 5), (1, 3), (1, 5)}

(A × B) ∪ (A × C) = {(0, 2), (0, 3), (0,4), (0, 5), (1, 2), (1, 3), (1, 4), (1, 5)} -------(2)

∴ Hence it is proved.

(ii) (A × (B ∩ C) = (A × B) ∩ (A × C).

(B ∩ C) = {3}

A × (B ∩ C) = {0,1} × { 3}
= {(0, 3), (1, 3)} -------- (1)

(A × B) = {0,1} × {2,3, 4}
= {(0, 2), (0, 3), (0, 4), (1, 2), (1, 3), (1, 4)}

(A × C) = {0,1} × {3,5}
= {(0, 3), (0, 5), (1, 3), (1, 5)}

(A × B) ∩ (A × C) = {(0, 3), (1, 3)} ----- (2)

∴ Hence it is proved.

(iii) (A ∪ B) × C = (A × C) ∪ (B × C).

A ∪ B = {0, 1, 2, 3, 4}

(A ∪ B) × C = {0,1,2,3,4} × { 3,5}
= {(0, 3), (0, 5), (1, 3), (1, 5), (2, 3), (2, 5), (3, 3), (3, 5), (4, 3), (4, 5)} ------- (1)

(A × C) = {0,1} × {3,5}
= {(0, 3), (0, 5), (1, 3), (1, 5)}

(B × C) = { 2,3,4} × { 3,5}
= {(2, 3), (2, 5), (3, 3), (3, 5), (4, 3), (4, 5)}

(A × C) ∪ (B × C) = {(0, 3), (0, 5), (1, 3), (1, 5), (2, 3), (2, 5), (3, 3), (3, 5), (4, 3), (4, 5)} ----------- (2)

∴ Hence it is proved.

---

4. **Let A = The set of all natural numbers less than 8; B = the set of all prime numbers less than 8; C = The set of even prime numbers. Verify that**

(i) (A ∩ B) × C = (A × C) ∩ (B × C).

Solution:

A = {1, 2, 3, 4, 5, 6, 7}, B= {2, 3, 5, 7} , C= {2}

(i) (A ∩ B) × C = (A × C) ∩ (B × C).

A ∩ B = {2, 3, 5, 7}

(A ∩ B) × C = {2, 3, 5, 7} × {2}
= {(2, 2),(3, 2),(5, 2),(7, 2)} ---------.(1)

A × C = {1,2, 3, 4, 5, 6, 7} × {2}
= {(1,2),(2, 2),(3, 2),(4, 2),(5.2) (6, 2),(7, 2)}

B × C = {2, 3, 5, 7} × {2}
= {(2, 2),(3, 2),(5, 2),(7, 2)}

(A × C) ∩ (B × C) = {(2, 2),(3, 2),(5,2), (7.2)} --------- (2)

∴ Hence it is proved.

(ii) A × (B – C) = (A × B) – (A × C).

B – C = {2, 3, 5, 7} – {2}
= {3,5,7}

A × (B – C) = {1,2, 3, 4, 5, 6,7} × {3,5,7}
= {(1, 3),(1, 5),(1, 7),(2, 3),(2, 5), (2, 7),(3, 3),(3, 5),(3, 7),(4, 3), (4, 5) (4, 7),(5, 3),(5, 5),(5, 7), (6, 3), (6, 5),(6,7),(7, 3) (7, 5), (7, 7)} -------------(1)

A × B = {1,2, 3, 4, 5, 6, 7} × {2, 3, 5,7}
= {(1, 2),(1, 3),(1,5),(1, 7),(2, 2), (2, 3),(2, 5),(2,7),(3, 2),(3, 3), (3, 5),(3, 7),(4, 2),(4,3),(4, 5), (4, 7),(5, 2),(5, 3),(5, 5),(5,7), (6, 2),(6, 3),(6, 5),(6, 7),(7, 2), (7,3),(7, 5), (7, 7)}

A × C = {1,2, 3,4, 5, 6, 7} × {2}
= {(1, 2),(2, 2),(3, 2),(4, 2),(5, 2), (6,2),(7,2)}

(A × B) – (A × C)
= {(1, 3),(1, 5), (1, 7),(2, 3),(2, 5), (2, 7),(3,3), (3, 5),(3, 7),(4, 3), (4, 5),(4,7), (5, 3),(5, 5),(5, 7), (6, 3),(6,5), (6, 7),(7, 3),(7, 5), (7, 7)} ---------.(2)

A × (B – C) = (A × B) – (A × C)

∴ Hence it is proved.

---

5. Let A = {1, 2, 3, 4} and B = {2, 5, 8, 11, 14} be two sets. Let f: A → B be a function given by f (x) = 3x − 1. Represent this function

a) By arrow diagram
b) In a table form
c) As a set of ordered pairs
d) In a graphical form.

Solution:

A = {1, 2, 3, 4} , B = {2, 5, 8, 11, 14};

f (x) = 3x − 1

f (1) = 3(1)– 1 = 3 – 1 = 2

f (2) = 3(2)– 1 = 6 – 1 = 5

f (3) = 3(3)– 1 = 9 – 1 = 8

f (4) = 3(4)– 1 = 12–1 = 11

a) By arrow diagram

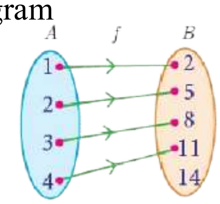

Fig. 1.19

b) In a table form is

X	1	2	3	4
F(x)	2	5	8	11

c) As a set of ordered pairs

f = {(1, 2), (2, 5), (3, 8), (4, 11)}

c) In a graphical form.

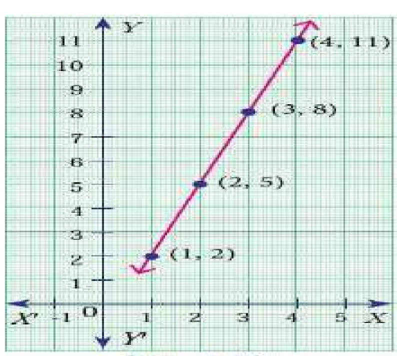

Fig. 1.20

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6. Let f be a function f: N → N be defined by f (x) = 3x + 2, x Є N

(i) Find the images of 1, 2, and 3.
(ii) Find the pre-images of 29, 53.
(iii) Identify the type of function.

Solution:

(i) f(1) = 3(1) + 2 = 3 + 2 = 5
f(2) = 3(2) + 2 = 6 + 2 = 8
f(3) = 3(3) + 2 = 9 + 2 = 11

The images 1, 2, and 3 are 5, 8, and 11

(ii) f(x) = 29.
3x + 2 = 29
3x = 27 ⇒ x = 9.
f(x) = 53.
3x + 2 = 53
3x = 51 ⇒ x = 17.

Thus, the pre-images of 29 and 53 are 9 and 17

(iii) Since different elements of N have different images in the co-domain, the function *f* is one – one function and an onto function.

---

7. A company has four categories of employees given Assistants (A), Clerks (C), Managers (M), and an Executive Officer (E). The company provides ₹10,000, ₹25,000, ₹50,000 and ₹1, 00, 000 as salaries to the people who work in the categories A, C, M, and E respectively. If A_1, A_2, A_3, A_4, and A_5 were Assistants; C_1, C_2, C_3, and C_4 were Clerks; M_1, M_2, and M_3 were managers and E_1, E_2 were Executive officers and if the relation R is defined by x R y, where x is the salary given to person y, express the relation R through an ordered pair and an arrow diagram.

Solution:

Assistants → A_1, A_2, A_3, A_4, A_5

Clerks → C_1, C_2, C_3, C_4

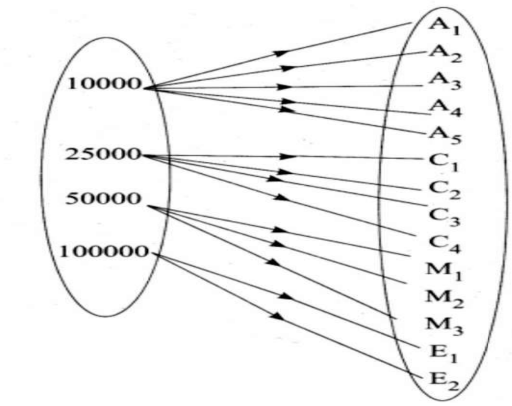
Managers → M_1, M_2, M_3

Executive officers → E_1, E_2

(i) set of ordered pairs

R = {(10000, A_1), (10000, A_2), (10000, A_3), (10000, A_4), (10000, A_5), (25000, C_1), (25000, C_2), (25000, C_3), (25000, C_4), (50000, M_1), (50000, M_2), (50000, M_3), (100000, E_1), (100000, E_2)}

(i) Arrow diagram



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8. Let f: A → B be a function defined by f(x) $=\frac{x}{2} - 1$, where A = {2, 4, 6, 10, 12}, B = {0, 1, 2, 4, 5, 9}. Represent f by
(i) Set of ordered pairs (ii) A table
(iii) An arrow diagram (iv) A graph

Solution:

A = {2,4,6, 10, 12} ,B = {0,1, 2, 4, 5, 9}

$f(x) = \frac{x}{2} - 1$

$f(2) = \frac{2}{2} - 1 = 1 - 1 = 0$

$f(4) = \frac{4}{2} - 1 = 2 - 1 = 1$

$f(6) = \frac{6}{2} - 1 = 3 - 1 = 2$

$f(10) = \frac{10}{2} - 1 = 5 - 1 = 4$

$f(12) = \frac{12}{2} - 1 = 6 - 1 = 5$

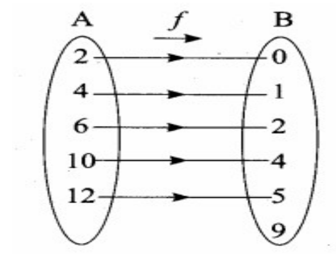
(i) As a set of ordered pairs

f = {(2, 0) (4, 1) (6, 2) (10, 4) (12, 5}

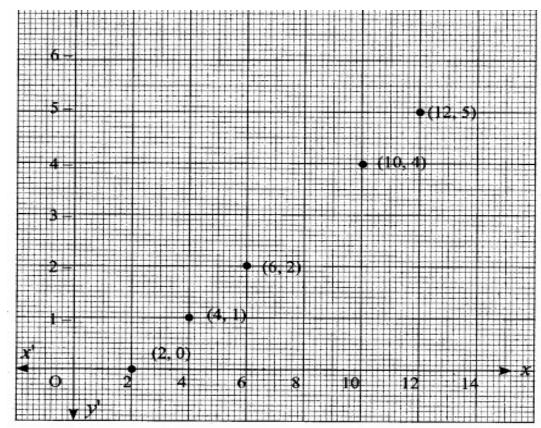
(ii) In a table form is

X	2	4	6	10	12
F (x)	0	1	2	4	5

(iii) By arrow diagram



c) iv) In a graphical form.



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9. If the function f: R→ R is defined by

$$f(x) = \begin{cases} 2x + 7; & x < -2 \ (-3, -4, -5..) \\ x^2 - 2; & -2 \le x < 3 \ (-2, -1, 0, 1, 2) \\ 3x - 2; & x \ge 3 \ (3, 4, 5, 6, ..) \end{cases}$$

then find the values of
(i) f (4) (ii) f (-2)
(iii) f (4) + 2f (1) (iv) $\frac{f(1) - 3f(4)}{f(-3)}$

Solution:

(i) $f(x) = 3x - 2$
$f(4) = 3(4) - 2 = 10$

(ii) $f(x) = x^2 - 2$
$f(-2) = (-2)^2 - 2 = 4 - 2 = 2$

(iii) $f(x) = x^2 - 2$
$f(1) = (1)^2 - 2 = 1 - 2 = -1$
$f(4) + 2f(1) = 10 + 2(-1) = 8$

(iv) $f(x) = 2x + 7$
$f(-3) = 2(-3) + 7 = -6 + 7 = 1$

$\frac{f(1) - 3f(4)}{f(-3)} = \frac{-1 - 3(10)}{1} = -31$

MATHS

10. **If the function f is defined by f(x) = $\begin{cases} x+2; & \text{if } x > 1 \\ 2; & \text{if } -1 \le x \le 1 \\ x-1; & \text{if } -3 < x < -1 \end{cases}$, then find the values of**
(i) f (3) (ii) f (0) (iii) f (-1.5)
(iv) f (2) + f (-2)

Solution: -

$$f(x)=\begin{cases} x+2; & x > 1 & (2,3,4.. \\ 2; & -1 \le x \le 1 & (-1,0,1) \\ x-1; & -3 < x < -1 & (-2) \end{cases}$$

(i) f(x) = x + 2
f (3) = 3 + 2 = 5

(ii) f(x) = 2
f(0) = 2

(iii) f(x) = x – 1
f(-1.5) = -1.5 – 1 = - 2.5

(iv) f(x) = x + 2
f(2) = 2 + 2 = 4

f(x) = x – 1
f(-2) = – 2 – 1 = – 3
f(2) + f(-2) = 4 – 3 = 1

---

11. **A function f : [-5, 9] → R is defined as follows: f(x) = $\begin{cases} 6x+1; & -5 \le x < 2 \\ 5x^2-1; & 2 \le x < 6, \\ 3x-4; & 6 \le x \le 9 \end{cases}$**
then find the values of
(i) f (-3) + f (2) (ii) f (7) – f(1)
(iii) 2 f (4) + f(8) (iv) $\frac{2f(-2)-f(6)}{f(4)+f(-2)}$

Solution: -

$$f(x)=\begin{cases} 6x+1; & -5,-4,-3,-2,-1,0,1) \\ 5x^2-1; & (2,3,4,5) \\ 3x-4; & (6,7,8,9) \end{cases}$$

(i) f(-3) + f(2)
f(x) = 6x + 1
f(-3) = 6(-3) + 1 = -18+1 = -17
f(x) = $5x^2$ – 1
f(2) = $5(2)^2$ – 1 = 5(4) – 1= 20 – 1 = 19
f (-3) + f (2) = – 17 + 19 = 2

(ii) f(7) – f(1)
f(x) = 3x – 4
f(7) = 3(7) – 4 = 21 – 4 = 17
f(x) = 6x + 1
f(1) = 6(1) + 1 = 7
f (7) – f(1) = 17 – 7= 10

(iii) 2f(4) + f(8)
f(x) = $5x^2$ – 1
f(4) = $5(4)^2$ – 1 = 5(16) – 1 = 80 – 1 = 79
f(x) = 3x – 4
f(8) = 3(8) – 4 = 24 – 4 = 20
2f(4) + f(8) = 2(79) + 20
= 158 + 20
= 178

(iv) $\frac{2f(-2)-f(6)}{f(4)+f(-2)}$
f(x) = 6x + 1
f(-2) = 6(-2) + 1 = -12 + 1 = -11
f(x) = 3x – 4
f(6) = 3(6) – 4 = 18 – 4 = 14

$$\frac{2f(-2)-f(6)}{f(4)+f(-2)} = \frac{2(-11)-14}{79-11} = \frac{-22-14}{68} = \frac{-36}{68} = \frac{-9}{17}$$

---

12. **If f (x) = 2x + 3, g (x) = 1 – 2x and h (x) = 3x. Prove that f o (g o h) = (f o g) o h.**

Solution:

f o g = (2 x + 3) o (1 – 2x)
= 2(1 – 2x) + 3
= 2 – 4x + 3 = 5 – 4x
(f o g) o h = (5 – 4x) o (3x)
= 5 – 4(3x)
= 5 – 12x .... (1)
g o h = (1 – 2x) o (3x)
= 1 – 2(3x) = 1 – 6x
f o (g o h) = (2x + 3) o (1 – 6x)
= 2(1 – 6x) + 3
= 2 – 12x + 3
= 5 – 12x .... (2)
From (1), (2), f o (g o h) = (f o g) o h..

---

13. **Consider the functions f (x), g (x), h (x) as given below. Show that (f o g) o h = f o (g o h) in each case**
(i) f (x) = x – 1, g (x) = 3x + 1 and h (x) = x^2.

Solution:

(i) f (x) = x – 1, g (x) = 3x + 1 and h (x) = x².

f o g = (x – 1) o (3x + 1)
= 3x + 1 – 1
= 3x
(f o g) o h = (3x) o (x^2)
= $3x^2$ ………. (1)
g o h = (3x + 1) o (x^2)
= $3x^2 + 1$
f o (g o h) = (x – 1) o ($3x^2 + 1$)
= $3x^2 + 1 – 1 = 3x^2$……… (2)
From (1), (2), f o (g o h) = (f o g) o h.

(ii) f (x) = x², g (x) = 2x and h (x) = x + 4.

Solution:

f o g = (x^2) o (2x)
= $(2x)^2$
(f o g) o h = $(2x)^2$ o (x+4)
= $[2(x + 4)]^2$ ……….. (1)
g o h = (2x) o (x + 4)
= 2(x+4)
f o (g o h) = (x^2) o [2(x+4)]
= $[2(x + 4)]^2$ ……… (2)
∴ From (1), (2), f o (g o h) = (f o g) o h.

(iii) f (x) = x – 4, g (x) = x² and h (x) = 3x – 5.

Solution:

f o g = (x – 4) o (x^2)
= x^2 - 4
(f o g) o h = (x^2 - 4) o (3x-5)
= $(3x – 5)^2 – 4$ ….. (1)
g o h = (x^2) o (3x-5)
= $(3x – 5)^2$
f o (g o h) = (x – 4) o $(3x – 5)^2$
= $(3x – 5)^2 – 4$ …… (2)
∴ From (1), (2), f o (g o h) = (f o g) o h

Statistics and Probability

Two Marks

L = R + S
S = L – R
R = L - S

1. **Find the range and coefficient of the range of the following data: 25, 67, 48, 53, 18, 39, and 44.**

Solution:

L = 67, S = 18
Range = L – S
= 67 – 18 = 49

Coefficient of range = $\frac{L-S}{L+S}$

$= \frac{67 - 18}{67 + 18} = \frac{49}{85} = 0.58$

---

2. **Find the range and coefficient of range of the following data.**

(i) 63, 89, 98, 125, 79,108, 117, 68

Solution:

(i) 63, 89, 98, 125, 79,108, 117, 68

L = 125, S = 63
Range = L – S
= 125 – 63 = 62

Coefficient of range = $\frac{L-S}{L+S}$

$= \frac{125 - 63}{125 + 63} = \frac{62}{188} = 0.33$

(ii) 43.5, 13.6, 18.9, 38.4, 61.4, 29.8

Solution:

L = 61. 4, S = 13. 6
Range = L – S
= 61. 4 – 13. 6 = 47. 8

Coefficient of range = $\frac{L-S}{L+S}$

$= \frac{61.4 - 13.6}{61.4 + 13.6} = \frac{47.8}{75} = 0.64$

---

3 **Find the range of the following distribution.**

Age (in years)	16 – 18	18 – 20	20 – 22	22 – 24	24 – 26	26 – 28
Number of Students	0	4	6	8	2	2

Solution:

S =28, L = 18
Range = L – S = 28 – 18 = 10

---

4. Calculate the range of the following data

Income	400 – 450	450 – 500	500 – 550	550 – 600	600 – 650
Number of Workers	8	12	30	21	6

Solution:

S = 400, L = 650
வீச்சு = L – S = 650 – 400 = 250.

MATHS

MATHS

5. If the range and the smallest value of a set of data are 36.8 and 13.4 respectively, then find the largest value.

Solution:

R= 36.8 S = 13.4

L = R + S

= 36.8 + 13.4 = 50.2

---

6. The range of a set of data is 13.67 and the largest value is 70.08. Find the smallest value.

Solution:

R = 13.67, L = 70.08

S = L – R

= 70.08 – 13.67

= 56.41.

---

7. The mean of the data is 25.6 and its coefficient of variation is 18.75. Find the standard deviation.

Solution:

Mean $\bar{x}$ = 25.6

Coefficient of variation C.V = 18.75

$$C.V = \frac{\sigma}{\bar{x}} \times 100\%$$

$$18.75 = \frac{\sigma}{25.6} \times 100$$

$$\frac{18.75 \times 25.6}{100} = \sigma$$

standard deviation σ = 4.8.

---

8. Find the standard deviation of the first 21 natural numbers.

Solution:

n = 21

$$\sigma = \sqrt{\frac{n^2-1}{12}}$$

$$= \sqrt{\frac{(21)^2-1}{12}} = \sqrt{\frac{441-1}{12}}$$

$$= \sqrt{\frac{440}{12}}$$

$$= \sqrt{36.67}$$

standard deviation σ = 6.06.

---

9. If the standard deviation of a data is 4.5 and if each value of the data is decreased by 5, then find the new standard deviation.

Solution:

If the standard deviation of a data is 4.5 and each value of the data is decreased by 5, the new standard deviation does not change and it is also 4.5

---

10. If the standard deviation of a data is 3.6 and each value of the data is divided by 3, then find the new variance and new standard deviation.

Solution:

Standard deviation = 3.6

Each data is divided by 3

New standard deviation = $\frac{3.6}{3}$ = 1.2

New Variance = $(1.2)^2$ = 1.44

---

11. The standard deviation and mean of the data are 6.5 and 12.5 respectively. Find the coefficient of variation.

Solution:

σ = 6.5, $\bar{x}$ = 12.5

$$\text{Coefficient of variation} = \frac{\sigma}{\bar{x}} \times 100\%$$

$$= \frac{6.5}{12.5} \times 100\%$$

$$= 52\%$$

Coefficient of variation (C.V) = 52%.

---

12. The standard deviation and coefficient of variation of data are 1.2 and 25.6 respectively. Find the value of the mean.

Solution:

σ = 1.2, Coefficient of variation = 25.6

$$\frac{\sigma}{\bar{x}} \text{ X } 100 = 25.6$$

$$\frac{1.2}{\bar{x}} \text{ X } 100 = 25.6$$

$$\bar{x} = \frac{120}{25.6} = \frac{120 \times 10}{256}$$

mean $\bar{x}$ = 4. 69.

---

13. If the mean and coefficient of variation of a data are 15 and 48 respectively, then find the value of standard deviation.

Solution:

Mean ($\bar{x}$)= 15, Coefficient of variation = 48

$$\frac{\sigma}{\bar{x}} \text{ X } 100 = 48$$

$$\frac{\sigma}{15} \text{ X } 100 = 48$$

$$\sigma \times 100 = 48 \times 15$$

$\sigma = \frac{48 \times 15}{100} = \frac{720}{100}$

Standard deviation $\sigma = 7.2$.

---

14. If $P(A) = \frac{2}{3}$, $P(B) = \frac{2}{5}$, $P(A \cup B) = \frac{1}{3}$, then find $P(A \cap B)$.

Solution:

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$\frac{1}{3} = \frac{2}{3} + \frac{2}{5} - P(A \cap B)$

$P(A \cap B) = \frac{2}{3} + \frac{2}{5} - \frac{1}{3}$

$= \frac{10 + 6 - 5}{15}$

$P(A \cap B) = \frac{11}{15}$

---

15. A bag contains 5 blue balls and 4 green balls. A ball is drawn at random from the bag. Find the probability that the ball drawn is (i) blue and (ii) not blue.

Solution:

$n(S) = 5 + 4 = 9$

(i) A = Event of getting blue ball $n(A) = 5$.

$P(A) = \frac{n(A)}{n(S)}$

$P(A) = \frac{5}{9}$

(ii) $\bar{A}$ = event of not getting a blue ball

$P(\bar{A}) = 1 - P(A)$

$= 1 - \frac{5}{9} = \frac{4}{9}$.

---

16. Two coins are tossed together. What is the probability of getting different faces on the coins?

Solution:

Sample space S = {HH, HT, TH, TT}

$n(S) = 4$

A = {HT, TH}

$n(A) = 2$

$P(A) = \frac{n(A)}{n(S)} = \frac{2}{4} = \frac{1}{2}$

---

17. A coin is tossed thrice. What is the probability of getting two consecutive tails?

Solution:

Sample space S = {HHH, HTH, THH, TTH, HHT, HTT, THT, TTT}

$n(S) = 8$

A = {HTT, TTH, TTT}

$n(A) = 3$

$P(A) = \frac{n(A)}{n(S)} = \frac{3}{8}$

---

18. What is the probability that a leap year selected at random will contain 53 Saturdays?

Solution:

Leap Year = 366 days

= 52 week+ 2 days

= 52 Saturdays+ 2 days

S = {Sun-Mon, Mon-Tue, Tue-Wed, Wed-Thu, Thu-Fri, Fri-Sat, Sat-Sun}

$n(S) = 7$

Let *A* be the event of getting 53rd Saturday.

Then *A* = {Fri-Sat, Sat-Sun}

$n(A) = 2$

$P(A) = \frac{n(A)}{n(S)} = \frac{2}{7}$

---

19. A die is rolled and a coin is tossed simultaneously. Find the probability that the die shows an odd number and the coin shows a head.

Solution:

Sample space

S = {1H, 1T, 2H, 2T, 3H, 3T, 4H, 4T, 5H, 5T, 6H, 6T}

$n(S) = 12$

A = {1H, 3H, 5H};

$n(A) = 3$

$P(A) = \frac{n(A)}{n(S)} = \frac{3}{12} = \frac{1}{4}$

---

20. If P (A) = 0. 37, P (B) = 0. 42, P (A ∩B) = 0. 09 then find P(A U B).

Solution:

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$= 0.37 + 0.42 - 0.09$

$= 0.7$

Five Marks

1. The number of televisions sold in each day of the week are 13, 8, 4, 9, 7, 12, and 10. Find its standard deviation.

Solution:

MATHS

x	x^2
13	169
8	64
4	16
9	81
7	49
12	144
10	100
$\sum x = 63$	$\sum x^2 = 623$

Standard deviation $\sigma = \sqrt{\frac{\sum x^2}{n} - \left(\frac{\sum x}{n}\right)^2}$

$= \sqrt{\frac{623}{7} - \left(\frac{63}{7}\right)^2}$

$= \sqrt{89 - 81}$

$= \sqrt{8} = 2.83.$

$\sigma \approx 2.83.$

----

2. Find the coefficient of variation of 24, 26, 33, 37, 29, and 31.

Solution:

$\bar{x} = \frac{24+26+29+31+33+37}{6}$

$\bar{x} = \frac{180}{6} = 30$

x	$d = x - \bar{x}$ $d = x - 30$	d^2
24	− 6	36
26	− 4	16
29	−1	1
31	1	1
33	3	9
37	7	49
	$\sum d = 0$	$\sum d^2 = 112$

$n = 6, \sum d = 6, \sum d^2 = 112$

Standard deviation $\sigma = \sqrt{\frac{\sum d^2}{n} - \left(\frac{\sum d}{n}\right)^2}$

$= \sqrt{\frac{112}{6} - 0}$

$= \sqrt{18.6}$

$\sigma = 4.32$

Coefficient of variation $= \frac{\sigma}{\bar{x}} \text{ X } 100$

$= \frac{4.32}{30} \text{ X } 100 = \frac{432}{30}$

$= 14.4\%$

----

3. The time taken (in minutes) to complete homework by 8 students in a day is given by 38, 40, 47, 44, 46, 43, 49, 53. Find the coefficient of variation.

Solution:

$\bar{x} = \frac{38+40+43+44+46+47+49+5}{8}$

$\bar{x} = \frac{360}{8} = 45$

x	$d = x - \bar{x}$ $d = x - 45$	d^2
38	− 7	49
40	− 5	25
43	−2	4
44	− 1	1
46	1	1
47	2	4
49	4	16
53	8	64
$\sum x = 360$	$\sum d = 0$	$\sum d^2 = 164$

$n = 8, \sum d = 0, \sum d^2 = 164$

Standard deviation $\sigma = \sqrt{\frac{\sum d^2}{n} - \left(\frac{\sum d}{n}\right)^2}$

$= \sqrt{\frac{164}{8} - (0)^2}$

$= \sqrt{20.5}$

$= 4.53$

Coefficient of variation $= \frac{\sigma}{\bar{x}} \text{ X } 100$

$= \frac{4.53}{45} \text{ X } 100$

$= \frac{453}{45}$

$= 10.07\%$

----

4. Two dice are rolled together. Find the probability of getting a doublet or sum of faces as 4.

Solution:

Sample Space

S = { (1,1),(1,2),(1,3),(1,4),(1,5),(1,6)
(2,1),(2,2),(2,3),(2,4),(2,5),(2,6)

(3,1),(3,2),(3,3),(3,4),(3,5),(3,6)
(4,1),(4,2),(4,3),(4,4),(4,5),(4,6)
(5,1),(5,2),(5,3),(5,4),(5,5),(5,6)
(6,1),(6,2),(6,3),(6,4),(6,5),(6,6) }

n (S) = 36

A=event of getting a doublet.

$A = \{(1, 1), (2, 2), (3, 3), (4, 4), (5, 5), (6, 6)\}$

n (A) = 6

$P(A) = \frac{n(A)}{n(S)} = \frac{6}{36}$

B=event of getting face sum 4.

$B = \{(1, 3), (2, 2), (3, 1)\}$

n (B) = 3

$P(B) = \frac{3}{36}$

$A \cap B = \{(2, 2)\}$

$n(A \cap B) = 1$

$p(A \cap B) = \frac{1}{36}$

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$= \frac{6}{36} + \frac{3}{36} - \frac{1}{36} = \frac{6+3-1}{36}$

$= \frac{8}{36}$

$= \frac{2}{9}$

---

5. In a class of 50 students, 28 opted for NCC, 30 opted for NSS, and 18 opted for both NCC and NSS. One of the students is selected at random. Find the probability that

(i) The student opted for NCC but not NSS.

(ii) The student opted for NSS but not NCC.

(iii)The student opted for exactly one of them.

Solution: -

Total n (S) = 50.

Let *A* and *B* be the events of students opted for NCC and NSS respectively.

$n(A) = 28, n(B) = 30, n(A \cap B) = 18$

$P(A) = \frac{n(A)}{n(S)} = \frac{28}{50}$

$P(B) = \frac{30}{50}$

$P(A \cap B) = \frac{18}{50}$

(i) Probability of the students opted for NCC but not NSS.

$= \frac{28}{50} - \frac{18}{50} = \frac{10}{50}$

(ii) Probability of the students opted for NSS but not NCC.

$= \frac{30}{50} - \frac{18}{50} = \frac{12}{50}$

(iii) Probability of the students opted for exactly one of them

$= \frac{10}{50} + \frac{12}{50}$

$= \frac{22}{50} = \frac{11}{25}$

---

6. Three fair coins are tossed together. Find the probability of getting

(i) all heads

(ii) at least one tail

(iii) at most one head

(iv) at most two tails

Solution:

Sample SpaceS = { HHH, HTH, THH, TTH, HHT, HTT, THT, TTT}

n (S) = 8

(i) All Heads.

A ={ HHH}

n(A) = 1

$P(A) = \frac{n(A)}{n(S)} = \frac{1}{8}$

most

(ii) At least one tail. **(1,2,3)**

B = { HTH, THH, TTH, HHT, HTT, THT, TTT}

n(B) = 7

$P(B) = \frac{7}{8}$

least

(iii) At most one head. **(1,0)**

C = {HTT, THT, TTH, TTT}

n(C) = 4

$P(C) = \frac{4}{8} = \frac{1}{2}$

least

(iv) At most two tails. **(2,1,0)**

D = {HHH, HTH, THH, TTH, HHT, HTT, THT}

n(D) = 7

$P(D) = \frac{7}{8}$

---

7. Two dice are rolled once. Find the probability of getting an even number on the first die or a total of face sum 8.

Solution: -

Sample Space

S = {(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6),
(2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6),
(3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6),
(4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6),
(5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6),
(6,1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)}

n (S) = 36

A = {(2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6),
(4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6),
(6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)}

n (A) = 18

$P(A) = \frac{n(A)}{n(S)} = \frac{18}{36}$

B = {(2, 6) (3, 5) (4, 4) (5, 3) (6, 2)}

n (B) = 5

$P(B) = \frac{n(B)}{n(S)} = \frac{5}{36}$

A ∩ B = {(2, 6) (4, 4) (6, 2)}

n (A ∩ B) = 3

$P(A \cap B) = \frac{3}{36}$

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$= \frac{18}{36} + \frac{5}{36} - \frac{5}{36}$

$= \frac{18 + 5 - 3}{36} = \frac{20}{36}$

$= \frac{5}{9}$

---

8. Three unbiased coins are tossed once. Find the probability of getting at most 2 tails or at least 2 heads.

Solution:

S = {HHH, HTH, THH, TTH,
HHT, HTT, THT, TTT}

n(S) = 8

least ↓

A = event of getting at most 2 tails.**(2,1,0)**

A = {HTT, THT, TTH, HHT, HTH, THH, HHH}

n (A) = 7

$P(A) = \frac{n(A)}{n(S)} = \frac{7}{8}$

most ↓

B = event of getting at least 2 heads. **(2, 3)**

B = {HHH, HHT, HTH, THH}

n (B) = 4

$P(B) = \frac{4}{8}$

A ∩ B = {HHH, HHT, HTH, THH}

n (A ∩ B) = 4

$P(A \cap B) = \frac{4}{8}$

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$= \frac{7}{8} + \frac{4}{8} - \frac{4}{8}$

$= \frac{7 + 4 - 4}{8}$

$= \frac{7}{8}.$

---

9. Two dice are rolled. Find the probability that the sum of outcomes is (i) equal to 4 (ii) greater than 10 (iii) less than 13

Solution:

Sample Space

S = { (1,1),(1,2),(1,3),(1,4),(1,5),(1,6)
(2,1),(2,2),(2,3),(2,4),(2,5),(2,6)
(3,1),(3,2),(3,3),(3,4),(3,5),(3,6)
(4,1),(4,2),(4,3),(4,4),(4,5),(4,6)
(5,1),(5,2),(5,3),(5,4),(5,5),(5,6)
(6,1),(6,2),(6,3),(6,4),(6,5),(6,6) }

n (S) = 36

(i) A=event of getting the sum of outcome values equal to 4

A = {(1, 3), (2,2), (3,1)}

n(A) = 3

$P(A) = \frac{n(A)}{n(S)} = \frac{3}{36} = \frac{1}{12}$

(ii) B =event of getting the sum of outcome values greater than 10

B = {(5,6), (6,5), (6,6) }

n(B) = 3

$P(B) = \frac{3}{36} = \frac{1}{12}$

(iii) C =event of getting the sum of outcomes less than 13

C = S

n(C) = 36

$P(C) = \frac{36}{36} = 1$

Algebra

Two Marks

1. Find the excluded values of the following expressions.

Solution:

a) $\frac{x + 10}{8x}$

8x = 0

$x = 0$

b) $\frac{7p+2}{8p^2+13p+5}$

$8p^2 + 13p + 5 = 0$

$(p+1)(8p+5) = 0$

$P = -1, \frac{-5}{8}$

a) $\frac{x}{x^2+1}$

$x^2+1 > 0$

There is no Excluded value.

---

2. Write down the quadratic equation in general form for which the sum and product of the roots are given below.

Solution:

a) 9, 14

The Quadratic equation is

x^2 – (sum of the roots) x + product of the roots = 0

$x^2 - 9x + 14 = 0$

---

b) $\frac{-7}{2}, \frac{5}{2}$

x^2 – (sum of the roots) x + product of the roots = 0

$x^2 + \frac{7}{2}X + \frac{5}{2} = 0$

$2x^2 + 7x + 5 = 0$

---

c) $\frac{-3}{5}, \frac{-1}{2}$

x^2 – (sum of the roots) x + product of the roots= 0

$x^2 + \frac{3}{5}x + \frac{-1}{2} = 0$

$10x^2 + 6x - 5 = 0$

---

3. Determine the quadratic equations, whose sum and product of roots are

Solution:

a) $\frac{5}{3}, 4$

The Quadratic equation is

x^2 – (sum of the roots) x + product of the roots = 0

$x^2 - \frac{5}{3}x + 4 = 0$

$3x^2 - 5x + 12 = 0$

---

b) $\frac{-3}{2}, -1$

x^2 – (sum of the roots) x + product of the roots= 0

$x^2 + \frac{3}{2}x - 1 = 0$

$2x^2 + 3x - 2 = 0$

---

4. Determine the nature of the roots for the following quadratic equations.

Solution:

a) $x^2 - x - 20 = 0$

Here, a = 1, b = −1, c = −20

$\Delta = b^2 - 4ac$

$\Delta = (-1)^2 - 4(1)(-20)$

$= 1 + 80$

$\Delta = 81 > 0.$

So, the equation will have real and unequal roots.

---

b) $9x^2 - 24x + 16 = 0$

Here, a = 9, b =−24, c = 16

$\Delta = b^2 - 4ac$

$\Delta = (-24)^2 - 4(9)(16)$

$\Delta = 576 - 576 = 0.$

So, the equation will have real and equal roots.

---

c) $2x^2 - 2x + 9 = 0$

Here, a = 2, b =−2, c = 9

$\Delta = b^2 - 4ac$

$\Delta = (-2)^2 - 4(2)(9)$

$= 4 - 72$

$\Delta = -68 < 0$

So, the equation will have no real roots.

---

5. $A = \begin{pmatrix} 1 & 3 & -2 \\ 5 & -4 & 6 \\ -3 & 2 & 9 \end{pmatrix}$, $B = \begin{pmatrix} 1 & 8 \\ 3 & 4 \\ 9 & 6 \end{pmatrix}$, find A + B.

Solution:

It is not possible to add A and Bbecause they have different orders.

---

6. Simplify $\frac{x^3}{x-y} + \frac{y^3}{y-x}$

Solution:

$= \frac{x^3}{(x-y)} - \frac{y^3}{(x-y)}$

$= \frac{x^3 - y^3}{(x-y)}$

$(a^3 - b^3) = (a - b)(a^2 + ab + b^2)$ use this

$= \frac{(x-y)(x^2+xy+y^2)}{(x-y)}$

$= x^2 + xy + y^2$

---

7. If $A = \begin{pmatrix} \sqrt{7} & -3 \\ -\sqrt{5} & 2 \\ \sqrt{3} & -5 \end{pmatrix}$ **then find the transpose of – A.**

Solution:

$A = \begin{pmatrix} \sqrt{7} & -3 \\ -\sqrt{5} & 2 \\ \sqrt{3} & -5 \end{pmatrix}$

$-A = \begin{pmatrix} -\sqrt{7} & 3 \\ \sqrt{5} & -2 \\ -\sqrt{3} & 5 \end{pmatrix}$

$(-A^T) = \begin{pmatrix} -\sqrt{7} & \sqrt{5} & -\sqrt{3} \\ 3 & -2 & 5 \end{pmatrix}$

---

8. $A = \begin{pmatrix} 5 & 2 & 2 \\ -\sqrt{17} & 0.7 & \frac{5}{2} \\ 8 & 3 & 1 \end{pmatrix}$ **then verify** $(A^T)^T = A$.

Solution:

$A^T = \begin{pmatrix} 5 & -\sqrt{17} & 8 \\ 2 & 0.7 & 3 \\ 2 & \frac{5}{2} & 1 \end{pmatrix}$

$(A^T)^T = \begin{pmatrix} 5 & 2 & 2 \\ -\sqrt{17} & 0.7 & \frac{5}{2} \\ 8 & 3 & 1 \end{pmatrix}$

$(A^T)^T = A.$

---

9. If $A = \begin{pmatrix} 0 & 4 & 9 \\ 8 & 3 & 7 \end{pmatrix}$, $B = \begin{pmatrix} 7 & 3 & 8 \\ 1 & 4 & 9 \end{pmatrix}$ **find the value of a) B – 5A**

Solution:

$B - 5A = \begin{pmatrix} 7 & 3 & 8 \\ 1 & 4 & 9 \end{pmatrix} - 5\begin{pmatrix} 0 & 4 & 9 \\ 8 & 3 & 7 \end{pmatrix}$

$= \begin{pmatrix} 7 & 3 & 8 \\ 1 & 4 & 9 \end{pmatrix} - \begin{pmatrix} 0 & 20 & 45 \\ 40 & 15 & 35 \end{pmatrix}$

$= \begin{pmatrix} 7-0 & 3-20 & 8-45 \\ 1-40 & 4-15 & 9-35 \end{pmatrix}$

$= \begin{pmatrix} 7 & -17 & -37 \\ -39 & -11 & -26 \end{pmatrix}$

---

b) $3A - 9B = 3\begin{pmatrix} 0 & 4 & 9 \\ 8 & 3 & 7 \end{pmatrix} - 9\begin{pmatrix} 7 & 3 & 8 \\ 1 & 4 & 9 \end{pmatrix}$

$= \begin{pmatrix} 0 & 12 & 27 \\ 24 & 9 & 21 \end{pmatrix} - \begin{pmatrix} 63 & 27 & 72 \\ 9 & 36 & 81 \end{pmatrix}$

$= \begin{pmatrix} 0-63 & 12-27 & 27-72 \\ 24-9 & 9-36 & 21-81 \end{pmatrix}$

$= \begin{pmatrix} -63 & -15 & -45 \\ 15 & -27 & -60 \end{pmatrix}$

---

10. Construct a 3 x 3 matrix whose elements are $a_{ij} = |i-2j|$

Solution:

$A = \begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix}$

$a_{11} = |1-2| = 1$ $a_{12} = |1-4| = 3$ $a_{13} = |1-6| = 5$

$a_{21} = |2-2| = 0$ $a_{22} = |2-4| = 2$ $a_{23} = |2-6| = 4$

$a_{31} = |3-2| = 1$ $a_{32} = |3-4| = 1$ $a_{33} = |3-6| = 3$

$A = \begin{pmatrix} 1 & 3 & 5 \\ 0 & 2 & 4 \\ 1 & 1 & 3 \end{pmatrix}$

---

11. Construct a 3 x 3 matrix whose elements are $a_{ij} = i^2j^2$.

Solution:

$A = \begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix}$

$a_{11} = 1^21^2 = 1$ $a_{12} = 1^22^2 = 4$ $a_{13} = 1^23^2 = 9$

$a_{21} = 2^21^2 = 4$ $a_{22} = 2^22^2 = 16$ $a_{23} = 2^23^2 = 36$

$a_{31} = 3^21^2 = 9$ $a_{32} = 3^22^2 = 36$ $a_{33} = 3^23^2 = 81$

$A = \begin{pmatrix} 1 & 4 & 9 \\ 4 & 16 & 36 \\ 9 & 36 & 81 \end{pmatrix}$

Five Marks

1. A passenger train takes 1 hr. more than an express train to travel a distance of 240 km from Chennai to Virudhachalam.

The speed of the express train is more than that of the passenger train by 20 km per hour. Find the average speed of both trains.

Solution:

The average speed of the passenger train be x km/hr.

Then the average speed of the express train will be (x +20) km/hr.

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

$$T_1 - T_2 = 1$$

$$\frac{240}{x} - \frac{240}{x+20} = 1$$

$$240\left[\frac{1}{x} - \frac{1}{x+20}\right] = 1$$

$$240\left[\frac{x+20-x}{x(x+2\ )}\right] = 1$$

$$\Rightarrow 240\left[\frac{20}{x^2+20x}\right] = 1$$

$$4800 = (x^2 + 20x)$$

$x^2 + 20x - 4800 = 0$ — **- 4800** → **80**, **-60**

$(x + 80)(x - 60) = 0$

$x = -80$ or 60.

$x = 60$ ($x = -80$ negative)

The average speed of the passenger train is 60 km/hr.

The average speed of the express train is 80 km/hr.

---

2. Pari needs 4 hours to complete a work. His friend Yuvan needs 6 hours to complete the same work. How long will it take to complete if they work together?

Solution:

A →Pari can complete the work = 4 hrs.

B →Yuvan can complete the work = 6 hrs.

In 1 hr. $A = \frac{1}{4}$ Part $B = \frac{1}{6}$ Part

$$A + B = \frac{1}{4} + \frac{1}{6}$$

$$= \frac{6+4}{24} = \frac{10}{24} = \frac{5}{12}$$

$$A + B = \frac{5}{12} = 2.4 \text{ hrs.}$$

[∵ (0.4) hrs. = 0.4 × 60 = 24 min]

= 2 hrs. 24 min.

---

2. A bus covers a distance of 90 km at a uniform speed. Had the speed been 15 km/hour more it would have taken 30 minutes less for the journey. Find the original speed of the journey.

Solution:

Let the original speed of the bus be "x" km/hr.

After increasing the speed by 15 km/hr.

$$\frac{90}{x} - \frac{90}{x+15} = \frac{1}{2}$$

$$90\left[\frac{1}{x} - \frac{1}{x+15}\right] = \frac{1}{2}$$

$$90\left[\frac{x+15-x}{x(x+15)}\right] = \frac{1}{2}$$

$$90 X 2\left[\frac{15}{x^2+15x}\right] = 1$$

$$2700 = x^2 + 15x$$

$x^2 + 15x - 2700 = 0$ — **-2700** → **60**, **- 45**

$(x + 60)(x - 45) = 0$

$x = -60$ or $x = 45$

∴ The original speed of the bus = 45 km/hr.

---

4. Find the square root of the following polynomials by division method

$37x^2 - 28x^3 + 4x^4 + 42x + 9$

Solution:

$x^4 - 28x^3 + 37x^2 + 42x + 9$

	2 - 7 - 3
2	**4 - 28 + 37 + 42 + 9**
	(-) 4
4 - 7	**- 28 + 37**
	(+) - 28 (-) + 49
4 – 14 -3	**- 12 + 4 2 + 9**
	(+) - 12 (-) + 42 (-) + 9
	0

∴ **$|2x^2 - 7x - 3|$**

5. Find the values of a and b if the following polynomials are perfect squares.

Solution:

$100 + 220x + 361x^2 + bx^3 + ax^4$

	10 + 11 + 12
10	100 + 220 + 361 + b + a
	(-)100
20 + 11	+ 220 + 361
	(-) + 220 (-) + 121
20+22+12	+ 240 + b + a
	+ 240 + 264 + 144
	0

∴ a = 144 மற்றும் b = 264

---

6. **Find the values of m and n if the following expressions are perfect squares.**
$x^4 - 8x^3 + mx^2 + nx + 16$

Solution:

	1 - 4 + 4
1	1 - 8 + m + n + 16
	(-) 1
2 - 4	- 8 + m
	(+) - 8 (-) + 16
2 – 8 + 4	+ m - 16 + n + 16
	+ 8 - 32 + 16
	0

m – 16 = 8

∴ m = 24 and n = – 32

7.Find the values of a and b if the following expressions are perfect squares.
$9x^4 + 12x^3 + 28x^2 + ax + b$

Solution:

	3 + 2 + 4
3	9 + 12 + 28 + a + b
	(-) 9
6 + 2	+ 12 + 28
	(-) + 12 (-) + 4
6 + 4 + 4	+ 24 + a + b
	+ 24 + 16 + 16
	0

∴ a = 16 and b = 16

---

8. Find the square root of thepolynomial by division method
$x^4 - 12x^3 + 42x^2 - 36x + 9$

Solution:

	1 - 6 + 3
1	1 - 12 + 42 - 36 + 9
	(-)1
2 - 6	- 12 + 42
	(+) - 12 (-) + 36
2 –12 + 3	+ 6 - 36 + 9
	(-) + 6 (+) - 36 (-) + 9
	0

∴ $|x^2 - 6x + 3|$

---

9. Find the square root of the polynomial $16x^4 + 8x^2 + 1$

Solution:

$16x^4 + 0x^3 + 8x^2 + 0x + 1$

	4 + 0 + 1
4	16 + 0 + 8 + 0 + 1
	(-)16
8 + 0	+ 0 + 8
	(-) + 0 (-) + 0
8 + 0 + 1	+ 8 + 0 + 1
	(-) + 8 (-) + 0 (-) + 1
	0

∴ $|4x^2 + 0x + 1|$

---

10. Find the square root of the polynomial $121x^4 - 198x^3 - 183x^2 + 216x + 144$

Solution:

	11 - 9 - 12
11	121 - 198 - 183 + 216 + 144
	(-)121
22 - 9	- 198 - 183
	(+) - 198 (-) + 81
22–18 -12	- 264 + 216 + 144
	(+) - 264 (-)+ 216 (-) + 144
	0

∴ $|11x^2 - 9x + 12|$

---

11. Find the values of a and b if the following expressions are perfect squares. $4x^4 - 12x^3 + 37x^2 + bx + a$

Solution:

	2 - 3 + 7
2	4 - 12 + 37 + b + a
	(-)4
4 - 3	- 12 + 37
	(+) - 12 (-) + 9
4 – 6 + 7	+ 28 + b + a
	+ 28 - 42 + 49
	0

∴ a = 49 and b = - 42

---

12. Find the values of m and n if the following expressions are perfect squares. $36x^4 - 60x^3 + 61x^2 - mx + n$

Solution:

	6 - 5 + 3
6	36 - 60 + 61 - m + n
	(-)36
12 - 5	- 60 + 61
	(+) - 60 (-) + 25
12–10 +3	+ 36 - m + n
	+ 36 - 30 + 9
	0

∴ m = 30 and n = 9

---

13. Find the square root of the polynomial $64x^4 - 16x^3 + 17x^2 - 2x + 1$

Solution:

MATHS

	8 - 1 + 1
8	64 - 16 + 17 -2 + 1
	(-)64
16 - 1	- 16 + 17
	(+) - 16 (-) + 1
16 – 2 + 1	+ 16 -2 + 1
	(-) + 16 (+) - 2 (-) + 1
	0

∴ $| 8x^2 - 1x + 1 |$

---

14. **If** $A = \begin{pmatrix} 1 & 2 & 1 \\ 2 & -1 & 1 \end{pmatrix}$, $B = \begin{pmatrix} 2 & -1 \\ -1 & 4 \\ 0 & 2 \end{pmatrix}$

Verify that $(AB)^T = B^T A^T$.

Solution:

$$A = \begin{pmatrix} 1 & 2 & 1 \\ 2 & -1 & 1 \end{pmatrix}, B = \begin{pmatrix} 2 & -1 \\ -1 & 4 \\ 0 & 2 \end{pmatrix}$$

$$AB = \begin{pmatrix} 1 & 2 & 1 \\ 2 & -1 & 1 \end{pmatrix} \text{x} \begin{pmatrix} 2 & -1 \\ -1 & 4 \\ 0 & 2 \end{pmatrix}$$

$$= \begin{pmatrix} 2+(-2)+0 & -1+8+2 \\ 4+1+0 & -2+(-4)+2 \end{pmatrix}$$

$$= \begin{pmatrix} 0 & 9 \\ 5 & -4 \end{pmatrix}$$

$$(AB)^T = \begin{pmatrix} 0 & 5 \\ 9 & -4 \end{pmatrix} \text{ ------ (1)}$$

$$B = \begin{pmatrix} 2 & -1 \\ -1 & 4 \\ 0 & 2 \end{pmatrix}, B^T = \begin{pmatrix} 2 & -1 & 0 \\ -1 & 4 & 2 \end{pmatrix}$$

$$A = \begin{pmatrix} 1 & 2 & 1 \\ 2 & -1 & 1 \end{pmatrix}, A^T = \begin{pmatrix} 1 & 2 \\ 2 & -1 \\ 1 & 1 \end{pmatrix}$$

$$B^T A^T = \begin{pmatrix} 2 & -1 & 0 \\ -1 & 4 & 2 \end{pmatrix} \text{x} \begin{pmatrix} 1 & 2 \\ 2 & -1 \\ 1 & 1 \end{pmatrix}$$

$$= \begin{pmatrix} 2-2+0 & 4+1+0 \\ -1+8+2 & -2-4+2 \end{pmatrix}$$

$$B^T A^T = \begin{pmatrix} 0 & 5 \\ 9 & -4 \end{pmatrix} \text{ ------ (2)}$$

From (1) and (2) we get, $(AB)^T = B^T A^T$

---

15. **If** $A = \begin{pmatrix} 5 & 2 & 9 \\ 1 & 2 & 8 \end{pmatrix}$, $B = \begin{pmatrix} 1 & 7 \\ 1 & 2 \\ 5 & -1 \end{pmatrix}$

Verify that $(AB)^T = B^T A^T$

Solution:

$$A = \begin{pmatrix} 5 & 2 & 9 \\ 1 & 2 & 8 \end{pmatrix}, B = \begin{pmatrix} 1 & 7 \\ 1 & 2 \\ 5 & -1 \end{pmatrix}$$

$$AB = \begin{pmatrix} 5 & 2 & 9 \\ 1 & 2 & 8 \end{pmatrix} \text{x} \begin{pmatrix} 1 & 7 \\ 1 & 2 \\ 5 & -1 \end{pmatrix}$$

$$= \begin{pmatrix} 5+2+45 & 35+4-9 \\ 1+2+40 & 7+4-8 \end{pmatrix}$$

$$= \begin{pmatrix} 52 & 30 \\ 43 & 3 \end{pmatrix}$$

$$(AB)^T = \begin{pmatrix} 52 & 43 \\ 30 & 3 \end{pmatrix} \text{ ------ (1)}$$

$$B = \begin{pmatrix} 1 & 7 \\ 1 & 2 \\ 5 & -1 \end{pmatrix}; B^T = \begin{pmatrix} 1 & 1 & 5 \\ 7 & 2 & -1 \end{pmatrix}$$

$$A = \begin{pmatrix} 5 & 2 & 9 \\ 1 & 2 & 8 \end{pmatrix}; A^T = \begin{pmatrix} 5 & 1 \\ 2 & 2 \\ 9 & 8 \end{pmatrix}$$

$$B^T A^T = \begin{pmatrix} 1 & 1 & 5 \\ 7 & 2 & -1 \end{pmatrix} \text{x} \begin{pmatrix} 5 & 1 \\ 2 & 2 \\ 9 & 8 \end{pmatrix}$$

$$= \begin{pmatrix} 5+2+45 & 1+2+40 \\ 35+4-9 & 7+4-8 \end{pmatrix}$$

$$= \begin{pmatrix} 52 & 43 \\ 30 & 3 \end{pmatrix} \text{ ------ (2)}$$

From (1) and (2) we get, $(AB)^T = B^T A^T$

---

16. **If** $A = \begin{pmatrix} 3 & 1 \\ -1 & 2 \end{pmatrix}$ **show that** $A^2 - 5A + 7I_2 = 0$.

Solution:

$$A = \begin{pmatrix} 3 & 1 \\ -1 & 2 \end{pmatrix}$$

MATHS

$A^2 = \begin{pmatrix} 3 & 1 \\ -1 & 2 \end{pmatrix} \times \begin{pmatrix} 3 & 1 \\ -1 & 2 \end{pmatrix}$

$A^2 = \begin{pmatrix} 9-1 & 3+2 \\ -3-2 & -1+4 \end{pmatrix} = \begin{pmatrix} 8 & 5 \\ -5 & 3 \end{pmatrix}$

L.H.S = $A^2 - 5A + 7I_2$

$= \begin{pmatrix} 8 & 5 \\ -5 & 3 \end{pmatrix} - 5 \begin{pmatrix} 3 & 1 \\ -1 & 2 \end{pmatrix} + 7 \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

$= \begin{pmatrix} 8 & 5 \\ -5 & 3 \end{pmatrix} + \begin{pmatrix} -15 & -5 \\ +5 & -10 \end{pmatrix} + \begin{pmatrix} 7 & 0 \\ 0 & 7 \end{pmatrix}$

$= \begin{pmatrix} 8-15+7 & 5-5+0 \\ -5+5+0 & 3-10+7 \end{pmatrix}$

$= \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix} = 0 =$ R.H.S

$\therefore A^2 - 5A + 7I_2 = 0$

---

17. If $A = \begin{pmatrix} 4 & 3 & 1 \\ 2 & 3 & -8 \\ 1 & 0 & -4 \end{pmatrix}$, $B = \begin{pmatrix} 2 & 3 & 4 \\ 1 & 9 & 2 \\ -7 & 1 & -1 \end{pmatrix}$ **and** $C = \begin{pmatrix} 8 & 3 & 4 \\ 1 & -2 & 3 \\ 2 & 4 & -1 \end{pmatrix}$ **then verify that**

A + (B + C) = (A + B) + C.

Solution:

$B + C = \begin{pmatrix} 2 & 3 & 4 \\ 1 & 9 & 2 \\ -7 & 1 & -1 \end{pmatrix} + \begin{pmatrix} 8 & 3 & 4 \\ 1 & -2 & 3 \\ 2 & 4 & -1 \end{pmatrix}$

$= \begin{pmatrix} 10 & 6 & 8 \\ 2 & 7 & 5 \\ -5 & 5 & -2 \end{pmatrix}$

A + (B + C) =

$\begin{pmatrix} 4 & 3 & 1 \\ 2 & 3 & -8 \\ 1 & 0 & -4 \end{pmatrix} + \begin{pmatrix} 10 & 6 & 8 \\ 2 & 7 & 5 \\ -5 & 5 & -2 \end{pmatrix}$

$= \begin{pmatrix} 14 & 9 & 9 \\ 4 & 10 & -3 \\ -4 & 5 & -6 \end{pmatrix}$ ---------- (1)

$A + B = \begin{pmatrix} 4 & 3 & 1 \\ 2 & 3 & -8 \\ 1 & 0 & -4 \end{pmatrix} + \begin{pmatrix} 2 & 3 & 4 \\ 1 & 9 & 2 \\ -7 & 1 & -1 \end{pmatrix}$

$= \begin{pmatrix} 6 & 6 & 5 \\ 3 & 12 & -6 \\ -6 & 1 & -5 \end{pmatrix}$

(A + B) + C =

$\begin{pmatrix} 6 & 6 & 5 \\ 3 & 12 & -6 \\ -6 & 1 & -5 \end{pmatrix} + \begin{pmatrix} 8 & 3 & 4 \\ 1 & -2 & 3 \\ 2 & 4 & -1 \end{pmatrix}$

$= \begin{pmatrix} 14 & 9 & 9 \\ 4 & 10 & -3 \\ -4 & 5 & -6 \end{pmatrix}$ ---------- (2)

From (1) and (2) we get,

A + (B + C) = (A + B) + C

---

18. If A = (1 -1 2), $B = \begin{pmatrix} 1 & -1 \\ 2 & 1 \\ 1 & 3 \end{pmatrix}$,

$C = \begin{pmatrix} 1 & 2 \\ 2 & -1 \end{pmatrix}$ **Show that (AB)C = A (BC).**

Solution:

$AB = (1 \;\; -1 \;\; 2) \begin{pmatrix} 1 & -1 \\ 2 & 1 \\ 1 & 3 \end{pmatrix}$

$= (1 - 2 + 2 \quad -1 \;\; -1 + 6)$

$= (1 \;\; 4)$

$(AB)\,C = (1 \;\; 4) \begin{pmatrix} 1 & 2 \\ 2 & -1 \end{pmatrix}$

$= (1 + 8 \quad 2 - 4)$

$= (9 \;\; -2)$ --------------(1)

$BC = \begin{pmatrix} 1 & -1 \\ 2 & 1 \\ 1 & 3 \end{pmatrix} \begin{pmatrix} 1 & 2 \\ 2 & -1 \end{pmatrix}$

$= \begin{pmatrix} 1-2 & 2+1 \\ 2+2 & 4-1 \\ 1+6 & 2-3 \end{pmatrix}$

$= \begin{pmatrix} -1 & 3 \\ 4 & 3 \\ 7 & -1 \end{pmatrix}$

$A\,(BC) = (1 \;\; -1 \;\; 2) \begin{pmatrix} -1 & 3 \\ 4 & 3 \\ 7 & -1 \end{pmatrix}$

$= (-1 - 4 + 14 \quad 3 - 3 - 2)$

$= (9 \; -2)$ --------------(2)

From (1) and (2) we get, (AB) C = A (BC)

Numbers and Sequences

Two Marks

1. **'a' and 'b' are two positive integers such that $a^b \times b^a = 800$. Find 'a' and 'b'.**

Solution:

$800 = 2 \times 2 \times 2 \times 2 \times 2 \times 5 \times 5$

$800 = 2^5 \times 5^2$

a = 2 , b = 5 or a = 5 , b = 2

----

2. **If $13824 = 2^a \times 3^b$ then find a and b.**

Solution:

$13824 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3$

$13824 = 2^9 \times 3^3$

a = 9 , b = 3.

----

3. **Find the number of terms in the A.P. 3, 6, 9, 12. . . 111.**

Solution:

a = 3, d = 6 – 3 = 3 , l =111

$n = \frac{l-a}{d} + 1$

$n = \frac{111-3}{3} + 1$

$n = \frac{108}{3} + 1$

n = 36 + 1= 37

----

4. **A man has 532 flower pots. He wants to arrange them in rows so that each row contains 21 flower pots. Find the number of completed rows and how many flower pots are left over.**

Solution:

Using Euclid's division algorithm,

a = bq + r

532 = 21 × 25 + 7.

The remainder is 7.

Number of completed rows = 25, Leftover flower pots = 7 pots.

----

5. **What is the time 100 hours after 7 a.m.?**

Solution:

$100 \equiv x \pmod{12}$

$100 \equiv 4 \pmod{12}$

```
     8
12) 100
     96
      4
```

The time repeated after

7 am is 7 + 4 = 11 o'clock (or) 11 am.

----

6. **What is the time 15 hours before 11 p.m.?**

Solution:

```
    11
12) 15
    12
     3
```

$15 \equiv x \pmod{12}$

$15 \equiv 3 \pmod{12}$

The time is 15 hrs. Before 11 O'clock is 11 – 3 = 8 O' clock i.e. 8 p.m.

----

7. **Find the 19^{th} term of an A. P – 11, – 15, – 19…**

Solution:

a = –11, d = –15 – (–11) = –15 + 11 = - 4,

n = 19

$t_n = a + (n - 1) d$

$t_n = -11 + 18(-4)$

$t_{19} = -11 - 72$

$t_{19} = -83$

----

8 **Which term of an A.P. 16, 11, 6, 1… Is –54?**

Solution:

a = 16, d = –5 , l = – 54

$n = \frac{l-a}{d} + 1$

$n = \frac{-54-1}{-5} + 1$

$n = \frac{-70}{-5} + 1$

n = 14 + 1=15

∴n = 15

----

9 . **If $1^3 + 2^3 + 3^3 + \ldots\ldots\ldots + K^3 = 44100$ then Find $1 + 2 + 3 + \ldots\ldots + k$**

Solution:

$1^3 + 2^3 + 3^3 + \ldots\ldots\ldots + k^3 = 44100$

$$\left[\frac{k(k+1)}{2}\right]^2 = 44100$$

$$\frac{k(k+1)}{2} = \sqrt{44100} = 210$$

---

10 **Find the sum of the following: -**
$1^2 + 2^2 + 3^2 + \ldots\ldots + 19^2$

Solution:

$$1^2 + 2^2 + 3^2 + \ldots\ldots + 19^2 = \frac{19 \times 20 \times 39}{6}$$

$$= \frac{14820}{6} = 2470.$$

---

11. **Find the sum of the following: -**
$5^2 + 10^2 + 15^2 + \ldots\ldots + 105^2$

Solution:

$5^2 + 10^2 + 15^2 + \ldots\ldots + 105^2$

$= 5^2 (1^2 + 2^2 + 3^2 + \ldots\ldots + 21^2)$

$$= 25 \times \frac{21 \times 22 \times 43}{6} = \frac{496650}{6} = 82775.$$

Five Marks

1. **Find the HCF of 396, 504, and 636.**

Solution:

To find the HCF of three givens numbers, first, we have to find the HCF of the first twoNumbers.

a = bq + r

$504 = 396 (1) + 108, \; 108 \neq 0$

$396 = 108 (3) + 72, \quad 72 \neq 0$

$108 = 72 (1) + 36, \quad 36 \neq 0$

$72 = 36 (2) + 0$

∴HCF of 396, 504 is 36

To find HCF of 636, 36

$636 = 36 (17) + 24, \quad 24 \neq 0$

$36 = 24 (1) + 12, \quad 12 \neq 0$

$24 = 12 (2) + 0,$

∴ HCF of 636, 36 is 12

∴ HCF of 396,504 and 636 are 12.

---

2. **Find the sum of all natural numbers between 300 and 600 which are divisible by 7.**

Solution:

$a = 300 + 1 = 301; \quad d = 7;$

$l = 600 - 5 = 595.$

$$n = \left(\frac{l - a}{d}\right) + 1$$

$$= \left(\frac{595 - 301}{7}\right) + 1$$

$$= \left(\frac{294}{7}\right) + 1 = 42+1$$

$= 43$

$$S_n = \frac{n}{2}[a + l],$$

$$S_{43} = \frac{43}{2}[301 + 595]$$

$$= \frac{43}{2}[806]$$

$= 43 \times 448$

$=19264.$

---

3. **The sum of the first n, 2n, and 3n terms of an A.P. are S_1, S_2 and S_3 respectively, Prove that $S_3 = 3(S_2 - S_1)$.**

Solution:

If S_1, S, and S, are the sum of the first n, 2n, and 3n terms of an A.P. respectively then

$$S_1 = \frac{n}{2}(a + l),$$

$$S_2 = \frac{2n}{2}(a + l)$$

$$S_3 = \frac{3n}{2}(a + l)$$

$$3(S_2 - S_1) = 3\left[\frac{2n}{2}(a + l) - \frac{n}{2}(a + l)\right]$$

$$= \frac{3n}{2}(a + l)$$

$= S_3.$

∴ $S_3 = 3(S_2 - S_1)$

---

4. **Find the sum to n terms of the series 5 + 55 + 555 + …**

Solution:

$S_n = 5 + 55 + 555 + \ldots$ to n terms

$= 5 [1 + 11 + 111 + \ldots.$ to n terms]

$= \frac{5}{9}[9 + 99 + 999 + \ldots.$ to n terms]

$= \frac{5}{9}[(10 - 1) + (100 - 1) + (1000 - 1) +$

…… to n terms]

$= \frac{5}{9}$ [(10 + 100 + 1000 +…
n to n terms) – n]

(a = 10, r = 10, Sn $= \frac{a(r^n - 1)}{r-1}$)

$= \frac{5}{9}\left[\frac{10(10^n - 1)}{10-1} - n\right]$

$Sn = \frac{5}{9}\left[\frac{10(10^n - 1)}{9} - n\right]$

---

5. **3 + 33 + 333 + ………… to n terms.**

Solution:

Sn = 3 + 33 + 333 + …. n to n terms

= 3[1 + 11 + 111 + …. n to n terms]

$= \frac{3}{9}$ [9 + 99 + 999 + …. n to n terms]

$= \frac{1}{3}$ [(10 – 1) + (100 – 1) + (1000 – 1) +
n to n terms]

$= \frac{1}{3}$ [(10 +100+1000 +… n to n terms) – n]

(a = 10, r = 10, Sn $= \frac{a(r^n - 1)}{r-1}$)

$= \frac{1}{3}\left[\frac{10(10^n - 1)}{10-1} - n\right]$

$Sn = \frac{1}{3}\left[\frac{10(10^n - 1)}{9} - n\right]$

---

6. If $p_1^{x_1} \times p_2^{x_2} \times p_3^{x_3} \times p_4^{x_4} = 113400$ where p_1 p_2, p_3, p_4 are primes in ascending order and x_1, x_2, x_3, x_4, are integers, find the value of p_1,p_2,p_3,p_4 and x_1,x_2,x_3,x_4

Solution:

$113400 = p_1^{x_1} \times p_2^{x_2} \times p_3^{x_3} \times p_4^{x_4}$

113400 = 2× 2× 2×3 ×3 ×3 ×3 × 5 × 5 × 7

$113400 = 2^3 \times 3^4 \times 5^2 \times 7^1$ -

$113400 = p_1^{x_1} \times p_2^{x_2} \times p_3^{x_3} \times p_4^{x_4}$

compare with

$P_1 = 2, x_1 = 3$ $P_2 = 3, x_2 = 4$

$P_3 = 5, x_3 = 2$ $P_4 = 7, x_4 = 1$

---

7. The sum of three consecutive terms in A.P. is 27 and their product is 288. Find the three terms.

Solution:

Let the three consecutive terms be

a – d, a, a + d

Their sum

a – d + a + a + d = 27

3a = 27

a = 9

Their product

(a – d) (a) (a + d) = 288

$9(a^2 - d^2) = 288$

$9(9 - d^2) = 288$

$9(81 - d^2) = 288$

$81 - d^2 = 32$

$-d^2 = 32 - 81$

$d^2 = 49$

⇒ d = ± 7

Case (i): -

If a = 9, d = 7

a – d, a, a + d = 9 – 7, 9 , 9 + 7

= 2, 9, 16

A.P. 2, 9, 16

Case (ii): -

If a = 9, d = –7

9 – (–7), 9, 9 + (–7) = 16, 9, 2

A.P. 16 , 9 , 2

---

8. The ratio of 6^th^ and 8^th^ term of an A.P is 7:9. Find the ratio of 9^th^ term to 13^th^ term.

Solution:

$t_n = a + (n - 1)d$

$t_6 : t_8 = 7 : 9$

$\frac{a+5d}{a+7d} = \frac{7}{9}$

9 (a + 5 d) = 7 (a + 7d)

9a + 45 d = 7a + 49d

9a – 7a = 49d – 45d

2a = 4d

a = 2d

$t_9 : t_{13} = \frac{a+8d}{a+12d}$

$= \frac{2d+8d}{2d+12}$

$= \frac{10d}{14} = \frac{5}{7}$

∴ $t_9 : t_{13} = 5 : 7$

---

9. Find the sum of the series $6^2 + 7^2 + 8^2 + ……. + 21^2$

MATHS

Solution:

$= (1^2 + 2^2 + 3^2 + \ldots\ldots\ldots + 21^2)$
$\quad - (1^2 + 2^2 + 3^2 + \ldots\ldots\ldots\ldots + 5^2)$

$1^2 + 2^2 + 3^2 + \text{---} + n^2 = \frac{n(n+1)(2n+1)}{6}$

$= \frac{21 \times 22 \times 43}{6} - \frac{5 \times 6 \times 11}{6}$

$= 3311 - 55$

$= 3256$

---

10. Find the sum of the series $10^3 + 11^3 + 12^3 + \ldots\ldots + 20^3$

Solution:

$10^3 + 11^3 + 12^3 + \ldots\ldots + 20^3$

$= (1^3 + 2^3 + 3^3 + \ldots\ldots\ldots\ldots + 20^3)$
$\quad - (1^3 + 2^3 + 3^3 + \ldots\ldots\ldots\ldots + 9^3)$

$1^3 + 2^3 + 3^3 + \ldots\ldots\ldots + n^3 = \left(\frac{n(n+1)}{2}\right)^2$

$= \left[\frac{20 \times 21}{2}\right]^2 - \left[\frac{9 \times 10}{2}\right]^2$

$= 210^2 - 45^2 = 44100 - 2025$

$= 42075$

---

11. Find the sum of the series $15^2 + 16^2 + 17^2 + \ldots\ldots + 28^2$

Solution:

$15^2 + 16^2 + 17^2 + \ldots\ldots + 28^2$

$= (1^2 + 2^2 + 3^2 + \ldots\ldots\ldots\ldots + 28^2)$
$\quad - (1^2 + 2^2 + 3^2 + \ldots\ldots\ldots\ldots + 14^2)$

$1^2 + 2^2 + 3^2 + \ldots\ldots\ldots + n^2 = \frac{n(n+1)(2n+1)}{6}$

$= \frac{28 \times 29 \times 57}{6} - \frac{14 \times 15 \times 29}{6}$

$= 7714 - 1015$

$= 6699$

---

12. Rekha has 15 square colour papers of sizes 10cm, 11cm, 12cm …24cm. How much area can be decorated with these colour papers?

Solution:

$10^2 + 11^2 + 12^2 + \ldots\ldots + 24^2$

$= (1^2 + 2^2 + 3^2 + \ldots\ldots + 24^2)$
$\quad - (1^2 + 2^2 + 3^2 + \ldots\ldots + 9^2)$

$1^2 + 2^2 + 3^2 + \ldots + n^2 = \frac{n(n+1)(2n+1)}{6}$

$= \frac{24 \times 25 \times 49}{6} - \frac{9 \times 10 \times 19}{6}$

$= 100 \times 49 - 15 \times 19$

$= 4900 - 285$

$= 4615 \text{ cm}^2$

The colour paper decorated area is 4615cm^2.

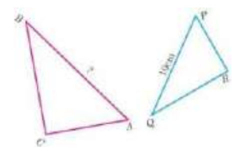
Geometry

Two Marks

1. The perimeters of two similar triangles ABC and PQR are respectively 36 cm and 24 cm. If PQ = 10 cm, find AB.

Solution:

Since $\Delta ABC \sim \Delta PQR$,



$\frac{\text{Perimeter of } \Delta ABC}{\text{Perimeter of } \Delta PQR} = \frac{AB}{PQ}$

$\frac{36}{24} = \frac{AB}{10}$

$AB = \frac{36 \times 10}{24} = 15 \text{ cm.}$

---

2. If Δ ABC is similar to Δ DEF such that BC = 3 cm, EF = 4 cm, and the area of Δ ABC = 54 cm². Find the area of Δ DEF.

Solution:

$\frac{\text{Area of } \Delta ABC}{\text{Area of } \Delta DEF} = \frac{BC^2}{EF^2} \Rightarrow$

$\frac{54}{\text{Area of } \Delta DEF} = \frac{3^2}{4^2}$

$\text{Area of } \Delta DEF = \frac{54 \times 16}{3} = 96 \text{ cm}^2.$

---

3. In Fig. 4.39, AD is the bisector of ∠ A. If BD = 4 cm, DC = 3 cm and AB = 6 cm, Find AC.

Solution:

In ΔABC, AD is the bisector of ∠ A

By Angle Bisector Theorem,

$\frac{BD}{DC} = \frac{AB}{AC}$

$\frac{4}{3} = \frac{6}{AC}$

$\Rightarrow 4AC = 18.$

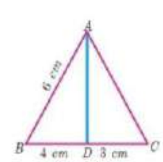


Fig. 4.39

Hence, AC = $\frac{18}{4}$ = 4.5 cm.

---

4. **If the radii of two concentric circles are 4 cm and 5 cm then find the length of the chord of one circle which is tangent to the other circle.**

Solution:

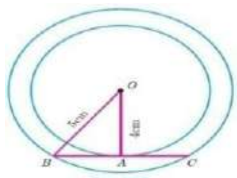


Fig. 4.66

AB= $\sqrt{5^2 - 4^2}$

= $\sqrt{25 - 16}$

= $\sqrt{9}$

AB = 3 cm

BC = 2AB hence BC = 2 x 3= 6 cm.

---

5. If ΔABC ~ ΔDEF such that the area of ΔABC is 9cm^2 the area of ΔDEF is 16 cm^2 and BC = 2.1 cm. Find the length of EF.

Solution:

Given ΔABC ~ ΔDEF

$$\frac{\text{Area of } \Delta ABC}{\text{Area of } \Delta DEF} = \frac{BC^2}{EF^2}$$

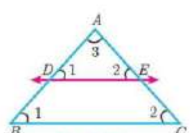


Fig. 4.29

$$\frac{9}{16} = \frac{2.1^2}{EF^2}$$

$$\left(\frac{3}{4}\right)^2 = \left(\frac{2.1}{EF}\right)^2$$

$$\frac{3}{4} = \frac{2.1}{EF}$$

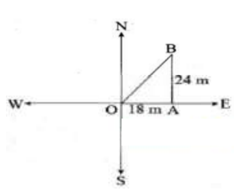
$$EF = \frac{4 \times 2.1}{3} = 2.8 \text{ cm}$$

---

6. **A man goes 18 m due east and then 24 m due north. Find the distance of his current position from the starting point.**

Solution:

By Pythagoras theorem



OB= $\sqrt{18^2 + 24^2}$

= $\sqrt{324 + 576}$

= $\sqrt{900}$

= 30

The Distance of his current position is 30m.

---

7. What length of ladder is needed to reach base of the ladder is 4 ft. from the wall? Round off your answer to the next tenth place.

Solution:

By Pythagoras's theorem

AB= $\sqrt{7^2 + 4^2}$

= $\sqrt{49 + 16}$

= $\sqrt{65}$

= 8.1

The length of the ladder is 8.1 ft. (Approx)

Five Marks

1. Thales Theorem / Basic Proportionality Theorem.

Statement: -

A straight line drawn parallel to a side of a triangle intersecting the other two sides divides the sides in the same ratio.

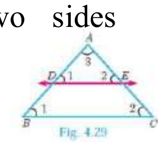


Fig. 4.29

Proof: -

Given: In ΔABC,*D* is a point on AB and E is a point on AC.

To prove: $\frac{AD}{DB} = \frac{AE}{EC}$

Construction: Draw a line DE || BC

Prove: For ΔABC &ΔADE

No	Statement	Reason
1	∠B = ∠D = ∠ 1	Corresponding angles are equal because DE ∥ BC
2	∠C = ∠E = ∠ 2	Corresponding angles are equal because DE ∥ BC
3	∠A = ∠A = ∠ 3	Both triangles have a common angle
4	ΔABC ~ ΔADE	By AAA Similarity
	$\frac{AB}{AD} = \frac{AC}{AE}$	The corresponding sides are proportional
	$\frac{AD + DB}{AD} = \frac{AE + EC}{AE}$	Split AB and AC using the points D and E
	$1 + \frac{DB}{AD} = 1 + \frac{EC}{AE}$	On Simplification
	$\frac{DB}{AD} = \frac{EC}{AE}$	Cancelling 1 on both sides
	$\frac{AD}{DB} = \frac{AE}{EC}$	Taking Reciprocals
	Hence Proved.	

MATHS

2. Angle Bisector Theorem.

Statement: -

The internal bisector of an angle of a triangle divides the opposite side internally in the ratio of the corresponding sides containing the angle.

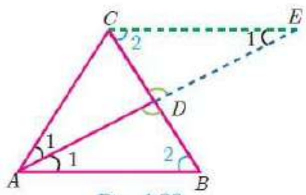


Fig. 4.33

Proof: -

Given:

In Δ ABC, AD is the internal bisector

To prove: $\frac{AB}{AC} = \frac{BD}{CD}$

Construction:

Draw a line through *C* parallel to *AB*. Extend *AD* to meet line through *C* at*E*

Prove: For ΔABD &ΔBAE

No	Statement	Reason
1	∠AEC = ∠BAE = ∠ 1 ∠ABD = ∠ECD = ∠ 2	Two parallel lines cut by a transversal make alternate angles equal.
2	ΔACE is isosceles AC = CE... (1)	In ΔACE, ∠CAE = ∠CEA
3	ΔABD ~ ΔECD $\frac{AB}{CE} = \frac{BD}{CD}$	By AA Similarity, the corresponding sides are in proportion
4	$\frac{AB}{AC} = \frac{BD}{CD}$	From (1) AC = CE
	Hence Proved.	

---

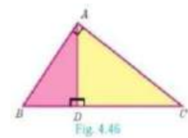
3. **Pythagoras Theorem**.

Statement:

In a right-angle triangle, the square on the hypotenuse is equal to the sum of the squares on the other two sides.

Proof: -

Given: In ΔABC ∠A = 90°



To prove: $AB^2 + AC^2 = BC^2$

Construction: Draw AD ⊥ BC

Prove:

No	Statement	Reason
1	Compare Δ ABC &Δ DBA ∠B = ∠B -------- Common ∠ BAC = ∠BDA = 90° Therefore, Δ ABC ~Δ DBA $\frac{AB}{BD} = \frac{BC}{AB}$ AB^2 = BC x BD - - - - -(1)	Given ∠ BAC = 90° and by construction ∠BDA = 90° By AA Similarity
2	Compare Δ ABC &Δ DAC ∠C = ∠C - - - - - Common ∠ BAC = ∠ADC = 90° Therefore, Δ ABC ~Δ DAC $\frac{BC}{AC} = \frac{AC}{DC}$ AC^2 = BC x DC - - - - - - (2)	Given ∠ BAC = 90° and by construction ∠ADC = 90° By AA Similarity
3	$AB^2 + AC^2$ = (BC x BD) + (BC x DC) = BC (BD + DC) = BC x BC = BC^2	Adding (1) and (2) we get
	⇒ $AB^2 + AC^2 = BC^2$, Hence the theorem is proved.	

Coordinate Geometry

Two Marks

1. **Show that the points P (– 1.5, 3), Q (6, – 2), and R (– 3, 4) are collinear.**

Solution:

Area of ΔPQR

$$= \frac{1}{2}\begin{bmatrix} X_1 - X_2 & X_1 - X_3 \\ Y_1 - Y_2 & Y_1 - Y_3 \end{bmatrix}$$

$$= \frac{1}{2}\begin{bmatrix} -1.5 - 6 & -1.5 + 3 \\ 3 + 2 & 3 - 4 \end{bmatrix}$$

$$= \frac{1}{2}\begin{pmatrix} -7.5 & 1.5 \\ 5 & -1 \end{pmatrix}$$

$= \frac{1}{2}\{7.5 - 7.5\}$

$= 0$

Therefore, the given points are collinear.

---

2. **The line p passes through the points (3, – 2), (12, 4) and the line q passes through the points(6, – 2), and (12, 2). Is p parallel to q?**

Solution:

$$m_1 = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m_1 = \frac{4+2}{12-3} = \frac{6}{9} = \frac{2}{3}$$

$$m_2 = \frac{2+2}{12-6} = \frac{4}{6} = \frac{2}{3}$$

$$m_1 = m_2$$

$\therefore$ line p $\parallel$ q

---

3. **Find the equation of a line passing through the point (3,-4) and having a slope $\frac{-5}{7}$.**

Solution:

$$m = \frac{-5}{7} \quad (3,-4) = (x_1, y_1)$$

Equation of straight line

$$y - y_1 = m(x - x_1)$$

$$y + 4 = \frac{-5}{7}(x - 3)$$

$$7(y + 4) = -5(x - 3)$$

$$7y + 28 = -5x + 15$$

$$5x + 7y + 13 = 0$$

---

4. **Find the equation of a line passing through point A(1, 4) and perpendicular to the line joining points (2, 5) and (4, 7).**

Solution:

$$(2,5) = (x_1, y_1), \quad (4,7) = (x_2, y_2)$$

$$m_1 = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7-5}{4-2} = \frac{2}{2} = 1$$

Equation of the required straight – line

$$m = -1, \quad (1,4) = (x_1, y_1)$$

$$y - y_1 = m(x - x_1)$$

$$y - 4 = -1(x - 1)$$

$$y - 4 = -x + 1$$

$$x + y - 5 = 0$$

---

5. **Find the equation of a straight line passing through (5, – 3) and (7, – 4).**

Solution:

$$(5,-3) = (x_1, y_1), \quad (7,-4) = (x_2, y_2)$$

Equation of a required line

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

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

$$\frac{y+3}{-1} = \frac{x-5}{2}$$

$$2(y+3) = -1(x-5)$$

$$2y + 6 = -x + 5$$

$$x + 2y + 1 = 0$$

---

6. **Find the slope of the line which is (i) parallel to 3x – 7y = 11 and (ii) perpendicular to 2x – 3y + 8 = 0.**

Solution:

(i) $m_1 = m_2$

$$3x - 7y - 11 = 0$$

$$\text{slope} = \frac{-a}{b}$$

$$m = \frac{-3}{-7} = \frac{3}{7}$$

slope is $\frac{3}{7}$

(ii) $m_1 \times m_2 = -1$

$$2x - 3y + 8 = 0$$

$$\text{slope} = \frac{-a}{b}$$

$$m = \frac{-2}{-3} = \frac{2}{3} \longrightarrow m_1$$

Slope of two lines perpendicular to is $\frac{-3}{2}$

---

7. **Find the equation of a straight line that is parallel to the line 3x – 7y = 12 and passes through the point (6, 4).**

Solution:

Equation of the straight line,
parallel to 3x – 7y – 12 = 0 is

$$3x - 7y + k = 0$$

Since it passes through the point (6, 4)

$$3(6) - 7(4) + k = 0$$

$k = 28 - 18 = 10$

Therefore, equation of the required straight line is $3x - 7y + 10 = 0$.

---

8. Find the slope of a line joining the points $(\sin\theta - \cos\theta)$ and $(-\sin\theta, \cos\theta)$

Solution:

$(\sin\theta, -\cos\theta) = (x_1, y_1)$,

$(-\sin\theta, \cos\theta) = (x_2, y_2)$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{\cos\theta + \cos\theta}{-\sin\theta - \sin\theta}$$

$$= \frac{2\cos\theta}{-2\sin\theta} = -\frac{\cos\theta}{\sin\theta}$$

$$m = -\cot\theta$$

---

9. **Find the equation of a line whose intercepts on the x and y axes are given below.**

(i)4, – 6 **(ii) – 5, $\frac{3}{4}$**

Solution:

(i) $a = 4, \quad b = -6$

Equation of a line is

$$\frac{x}{a} + \frac{y}{b} = 1$$

$$\frac{x}{4} + \frac{y}{-6} = 1$$

$$\frac{x}{4} - \frac{y}{6} = 1$$

$6x - 4y = 24$

∴ The equation of a line is

$$3x - 2y - 12 = 0$$

(ii) $a = -5 \quad b = \frac{3}{4}$

Equation of a line is

$$\frac{x}{a} + \frac{y}{b} = 1$$

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

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

$-3x + 20y = 15$

$-3x + 20y - 15 = 0$

∴ The equation of a line is

$$3x - 20y + 15 = 0$$

---

10. **Find the intercepts made by the following lines on the coordinate axes.**

(i) 3x−2y−6 =0 **(ii) 4x+3y+12=0**

Solution:

$$3x - 2y = 6$$

$$\div 6 \Rightarrow \frac{3x}{6} - \frac{2y}{6} = \frac{6}{6}$$

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

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

$$\frac{x}{a} + \frac{y}{b} = 1$$

compare with above

∴ $a = 2 \quad , \quad b = -3$

(i) $4x + 3y = -12$

$$\div -12 \Rightarrow \frac{4x}{-12} + \frac{3y}{-12} = \frac{-12}{-12}$$

$$\frac{x}{-3} + \frac{y}{-4} = 1$$

$$\frac{x}{a} + \frac{y}{b} = 1$$

compare with above

∴ $a = -3, b = -4$

Five Marks

1. **If the area of the triangle formed by the vertices A (– 1, 2), B (k, – 2), and C (7, 4) (taken in order) is 22 sq. units, find the value of k.**

Solution:

Area of triangle $= 22$ sq. units

$$\frac{1}{2}\begin{bmatrix} x_1 - x_2 & x_1 - x_3 \\ y_1 - y_2 & y_1 - y_3 \end{bmatrix} = 22$$

$$\frac{1}{2}\begin{bmatrix} -1 - k & -1 - 7 \\ 2 + 2 & 2 - 4 \end{bmatrix} = 22$$

$$\frac{1}{2}\begin{bmatrix} -1 - k & -8 \\ 4 & -2 \end{bmatrix} = 22$$

$$\frac{1}{2}[\,(-1-k)(-2) + 32\,] = 22$$

$\frac{1}{2}$ [2 + 2k + 32] = 22

34 + 2k = 44

2k = 44 – 34

2k = 10

∴ K = 5

---

2. **Find the area of the quadrilateral whose vertices are at (– 9, – 2),(– 8,– 4),(2,2), and (1, – 3).**

Solution:

Let A (– 9, – 2), B (– 8,– 4), C(1, – 3) and D (2, 2)

Area of the Quadrilateral.

$= \frac{1}{2}\begin{bmatrix} x_1 - x_3 & x_2 - x_4 \\ y_1 - y_3 & y_2 - y_4 \end{bmatrix}$

$= \frac{1}{2}\begin{bmatrix} -9-1 & -8-2 \\ -2+3 & -4-2 \end{bmatrix}$

$= \frac{1}{2}\begin{bmatrix} -10 & -10 \\ 1 & -6 \end{bmatrix}$

$= \frac{1}{2}$ [60 +10]

$= \frac{1}{2}$ [70]

= 35 sq. units

---

3. **Find the area of the quadrilateral whose vertices are at (– 9, 0),(– 8,6),(– 1,– 2), and (– 6, – 3).**

Solution:

Let A(– 1, – 2), B (– 8, 6),C (– 9, 0), and D (– 6,– 3)

Area of the Quadrilateral.

$= \frac{1}{2}\begin{bmatrix} x_1 - x_3 & x_2 - x_4 \\ y_1 - y_3 & y_2 - y_4 \end{bmatrix}$

$= \frac{1}{2}\begin{bmatrix} -1+9 & -8+6 \\ -2+0 & 6+3 \end{bmatrix}$

$= \frac{1}{2}\begin{bmatrix} 8 & -2 \\ -2 & 9 \end{bmatrix}$

$= \frac{1}{2}$ [72 - 4]

$= \frac{1}{2}$ [68]

= 34 sq. units

---

4. **Find the value of k, if the area of a quadrilateral is 28 sq. units, whose vertices are taken in the order (– 4, – 2), (– 3, k), (3, – 2), and (2, 3).**

Solution:

Area of quadrilateral=28 sq units

$\frac{1}{2}\begin{bmatrix} x_1 - x_2 & x_1 - x_3 \\ y_1 - y_2 & y_1 - y_3 \end{bmatrix} = 28$

$\frac{1}{2}\begin{bmatrix} -4-3 & -3-2 \\ -2+2 & k-3 \end{bmatrix} = 8$

$\frac{1}{2}\begin{bmatrix} -7 & -5 \\ 0 & k-3 \end{bmatrix} = 28$

[(-7) (k-3) + 0] = 28 x 2

-7k + 21 = 56

-7k = 56 – 21

-7k = 35

- k = $\frac{35}{7}$

∴ k = -5

---

5. Find the area of the quadrilateral formed by the points (8, 6), (5, 11), (– 5, 12) and (– 4, 3).

Solution:-

Let A (8, 6), B (5, 11), C (– 5, 12) and D (– 4, 3).

Area of quadrilateral ABCD

$= \frac{1}{2}\begin{bmatrix} x_1 - x_3 & x_2 - x_4 \\ y_1 - y_3 & y_2 - y_4 \end{bmatrix}$

$= \frac{1}{2}\begin{bmatrix} 8+5 & 5+4 \\ 6-12 & 11-3 \end{bmatrix}$

$= \frac{1}{2}\begin{bmatrix} 13 & 9 \\ -6 & 9 \end{bmatrix}$

$= \frac{1}{2}$ [104 + 54]

$= \frac{1}{2}$ [158]

= 79 sq. units

---

6. **Without using Pythagoras theorem, show that the points (1, – 4), (2, – 3) and (4, – 7) form a right-angled triangle.**

Solution:-

Let A (1, – 4), B (2, – 3) and C (4, – 7).

The slope of a line $m = \frac{y_2 - y_1}{x_2 - x_1}$

Slope of AB $= \frac{-3+4}{2-1} = \frac{1}{1} = 1$

Slope of BC $= \frac{-7+3}{4-2} = \frac{-4}{2} = -2$

Slope of AC $= \frac{-7+4}{4-1} = \frac{-3}{3} = -1$

Slope of AB x Slope of AC = 1 x (–1) = – 1

AB is perpendicular to AC. $\angle A = 90°$

Therefore, Δ ABC is a right-angled triangle.

---

7 . **Let A (1, – 3), B (9, – 4), (5, – 7), and D (7, – 7). Show that ABCD is a trapezium.**

Solution:

The slope of a line $m = \frac{y_2 - y_1}{x_2 - x_1}$

Slope of AB $= \frac{-4-(-4)}{9-3} = \frac{-4+4}{6} = \frac{0}{6} = 0$

Slope of BC $= \frac{-7-(-4)}{5-9} = \frac{-7+4}{-4} = \frac{-3}{-4} = \frac{3}{4}$

Slope of CD $= \frac{-7-(-7)}{5-7} = \frac{-7+7}{-2} = \frac{0}{-2} = 0$

Slope of AD $= \frac{-7-(-4)}{7-3} = \frac{-7+4}{4} = \frac{-3}{4}$

The slope of AB and CD are equal.

AD and BC are not parallel.

∴ The Quadrilateral ABCD is a trapezium.

---

8. **Find the equation of the median and altitude of ΔABC through A where the vertices are A (6,2), B (– 5, – 1), and C (1,9).**

Solution:-

$B(-5,-1) = (x_1, y_1)$, $C(1,9)$ (x_2, y_2)

(i) Mid-point of BC $= \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

$= (\frac{-5+1}{2}, \frac{-1+9}{2}) = (\frac{-4}{2}, \frac{8}{2}) = (-2, 4)$

*Med*ian AM = $A(6,2)(x_1, y_1)$ and $B(-2,4)(x_2, y_2)$

Equation of AM

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

$$\frac{y-2}{4-2} = \frac{x-6}{-2-6}$$

$$\frac{y-2}{2} = \frac{x-6}{-8}$$

$$-8(y-2) = 2(x-16)$$

$$-8y + 16 = 2x - 12$$

$$-2x - 8y + 16 + 12 = 0$$

$-2x - 8y + 28 = 0$ (÷2)

$x + 4y - 14 = 0$

(i) Slope of BC $= \frac{y_2 - y_1}{x_2 - x_1} = \frac{9+1}{1+5} = \frac{10}{6} = \frac{5}{3}$

Perpendicular slope $m = \frac{-3}{5}$

Equation is

$A(6,2)$, $m = \frac{-3}{5}$

$$y - y_1 = m(x - x_1)$$

$$y - 2 = \frac{-3}{5}(x - 6)$$

$$5(y-2) = -3(x-6)$$

$$5y - 10 = -3x + 18$$

$$3x + 5y - 28 = 0$$

---

9 . **Find the equation of the perpendicular bisector of the line joining the points A (– 4,2), and B(6,– 4).**

Solution:-

Midpoint $= \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

$= \left(\frac{-4+6}{2}, \frac{2-4}{2}\right)$

$= \left(\frac{2}{2}, -\frac{2}{2}\right)$

$= (1, -1)$

Slope of AB $= \frac{y_2 - y_1}{x_2 - x_1} = \frac{-4-2}{6+4}$

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$= \frac{-6}{10} = \frac{-3}{5}$

The slope of the perpendicular line $= \frac{5}{3}$

Equation of perpendicular bisector,

$$y - y_1 = m(x - x_1)$$

$$y + 1 = \frac{5}{3}(x - 1)$$

$$3(y + 1) = 5x - 5$$

$$3y + 3 = 5x - 5$$

∴The required equation is $5x - 3y - 8 = 0$

Trigonometry

Two marks

1. **prove that $\sec\theta - \cos\theta = \tan\theta \sin\theta$**

Solution:-

$$\sec\theta - \cos\theta = \frac{1}{\cos\theta} - \cos\theta$$

$$= \frac{1-\cos^2\theta}{\cos\theta} = \frac{\sin^2\theta}{\cos\theta}$$

$$= \frac{\sin\theta}{\cos\theta} \times \sin\theta$$

$$= \tan\theta \sin\theta$$

---

2. **prove that $\sqrt{\frac{1+\cos\theta}{1-\cos\theta}} = \operatorname{cosec}\theta + \cot\theta$**

Solution:

$$\sqrt{\frac{1+\cos}{1-\cos}} = \sqrt{\frac{1+\cos\theta}{1-\cos} \text{ x } \frac{1+\cos\theta}{1+\cos\theta}}$$

$$= \sqrt{\frac{(1+\cos\theta)^2}{1-\cos^2\theta}} = \sqrt{\frac{(1+\cos\theta)^2}{\sin^2\theta}}$$

$[\therefore 1 - \cos^2\theta = \sin^2\theta]]$

$$= \frac{1+\cos}{\sin\theta} = \frac{1}{\sin\theta} + \frac{\cos\theta}{\sin\theta}$$

$$= \operatorname{cosec}\theta + \cot\theta$$

---

3. Prove the identitie $\cot\theta + \tan\theta = \operatorname{cosec}\theta$

Solution:

L. H. S = $\cot\theta + \tan\theta$

$$= \frac{\cos\theta}{\sin\theta} + \frac{\sin\theta}{\cos\theta}$$

$$= \frac{1}{\sin\theta\cos\theta} [\cos^2\theta + \sin^2\theta = 1$$

$= \sec\theta$ x $\operatorname{cosec}\theta$

= R. H. S

---

4. Prove the identitie $\sqrt{\frac{1+\sin\theta}{1-\sin\theta}} = \sec\theta + \tan\theta$

Solution:

$$\sqrt{\frac{1+\sin\theta}{1-\sin\theta}} = \sqrt{\frac{1+\sin\theta}{1-\sin\theta} \text{ x } \frac{1+\sin\theta}{1+\sin\theta}}$$

$$= \sqrt{\frac{(1+\sin\theta)^2}{1-\sin^2\theta}}$$

$$= \sqrt{\frac{(1+\sin\theta)^2}{\cos^2\theta}} \quad [1 - \sin^2\theta = \cos^2\theta]$$

$$= \frac{1+\sin\theta}{\cos\theta}$$

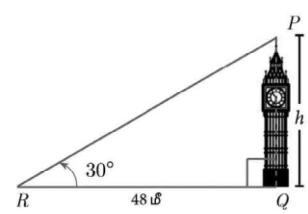
$$= \frac{1}{\cos\theta} + \frac{\sin\theta}{\cos\theta}$$

$$= \sec\theta + \tan\theta$$

---

5. A tower stands vertically on the ground. From a point on the ground, which is 48 m away from the foot of the tower, the angle of elevation of the top of the tower is 30°. Find the height of the tower.

Solution:



In the right angle triangle ABC

$$\tan 30° = \frac{h}{48}$$

$$\frac{1}{\sqrt{3}} = \frac{h}{48}$$

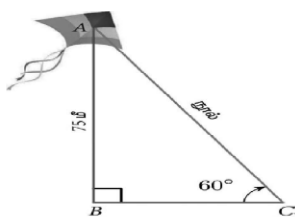
$$h = \frac{48}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$$

$$h = 16\sqrt{3}\,\text{m}$$

----

2. A kite is flying at a height of 75 m above the ground. The string attached to the kite is temporarily tied to a point on the ground. The inclination of the string with the ground is 60°. Find the length of the string, assuming that there is no slack in the string.

Solution:



Let *AB* be the height of the kite above the ground. Then, *AB* = 75.

$$\text{Sin } 60° = \frac{75}{AC}$$

$$\frac{\sqrt{3}}{2} = \frac{75}{AC}$$

$$\Rightarrow AC = \frac{150}{\sqrt{3}} = 50\sqrt{3}$$

Hence, the length of the string is $50\sqrt{3}$m.

----

7. A player sitting on the top of a tower of height 20 m observes the angle of depression of a ball lying on the ground as 60°. Find the distance between the foot of the tower and the ball. ($\sqrt{3}$ = 1.732)

Solution:

BC = 20 m and ∠XCB= 60° = ∠CAB

Let AB = x metres.

In the right angled ΔABC

$$\tan 60° = \frac{BC}{AB}$$

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

$$x = \frac{20 \times \sqrt{3}}{\sqrt{3} \times \sqrt{3}} = \frac{20 \times 1.732}{3} = 11.55$$

Hence, the distance between the foot of the tower and the ball are 11.55 m.

----

8. Find the angle of elevation of the top of a tower from a point on the ground, which is 30 m away from the foot of a tower of height $10\sqrt{3}$ m.

Solution:

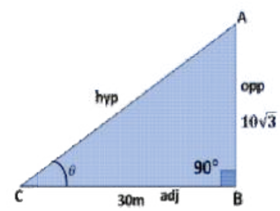
In the right triangle ABC,

$$\tan\theta = \frac{10\sqrt{3}}{30}$$

$$\tan\theta = \frac{\sqrt{3}}{3}$$

$$\tan\theta = \frac{\sqrt{3}}{\sqrt{3}\times\sqrt{3}}$$

$$\tan\theta = \frac{1}{\sqrt{3}}$$



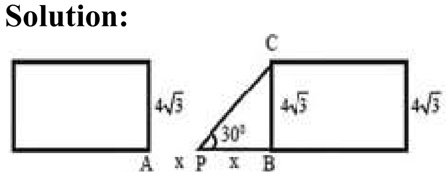
$$\Rightarrow \theta = 30°$$

Angle of elevation is 30°

----

9. A road is flanked on either side by continuous rows of houses of height $4\sqrt{3}$m with no space in between them. A pedestrian is standing on the median of the road facing a row house. The angle of elevation from the pedestrian to the top of the house is 30°. Find the width of the road.

Solution:



In the right triangle PBC,

$$\tan 30° = \frac{BC}{PB}$$

$$\frac{1}{\sqrt{3}} = \frac{4\sqrt{3}}{PB}.$$

$$PB = 4\sqrt{3} \times \sqrt{3}$$

$$PB = 4 \times 3 = 12$$

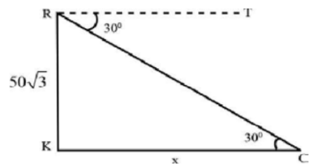
$$AP = 12$$

width of the road 12 m + 12 m = 24 m.

----

10. From the top of a rock $50\sqrt{3}$m high, the angle of depression of a car on the ground is observed to be 30°. Find the distance of the car from the rock.

Solution:



In the right triangle KRC,

$$\tan 30° = \frac{KR}{KC}$$

$$\frac{1}{\sqrt{3}} = \frac{50\sqrt{3}}{x}$$

$$x = 50 \times 3$$

$$x = 150 \text{ m}$$

---

11. The horizontal distance between two buildings is 70 m. The angle of depression of the top of the first building when seen from the top of the second building is 45°. If the height of the second building is 120 m, find the height of the first building.

Solution:

In the right triangleABC,

$$\tan 45° = \frac{120-h}{70}$$

$$1 = \frac{120-h}{70}$$

$$70 = 120 - h$$

$$h = 120 - 70$$

$$h = 50$$

The height of the first building = 50 metre

Five Marks

1. **Two ships are sailing in the sea on either side of a lighthouse. The angle of elevation of the top of the lighthouse as observed from the ships are 30° and 45° respectively. If the lighthouse is 200 m high, find the distance between the two ships. ($\sqrt{3}$ = 1.732) AB= 200 m, $\angle ACB$ = 30°, $\angle ADB$ = 45° .**

Solution:

AB be the lighthouse. Let *C* and *D* be the positions of the two ships.

Then, AB = 200 m.

In the right angled ΔABC,

$$\tan 30° = \frac{AB}{AC}$$

$$\frac{1}{\sqrt{3}} = \frac{200}{AC}$$

$AC = 200\sqrt{3}$ = 200 X 1.732

= 346.4 m -------------- (1)

In the right angled ΔABD,

$$\tan 45° = \frac{AB}{AD}$$

$1 = \frac{200}{AD} \Rightarrow AD = 200$ m -------- (2)

$CD = AC + AD$ = 346.4 + 200 = 546.4 m.

Distance between two ships is 546.4 m.

---

2. **From a point on the ground, the angles of elevation of the bottom and top of a tower fixed at the top of a 30 m high building are 45° and 60° respectively. Find the height of the tower. ($\sqrt{3}$ = 1.732)**

Solution:

Let *AC* be the height of the tower.

Let *AB* be the height of the building.

Then, $AC = h$ metres, AB = 30 m

In the right angled ΔCBP, $\angle CPB$= 60°

$\tan 60° = \frac{AB+AC}{BP}$

$\Rightarrow \sqrt{3} = \frac{30+h}{BP}$............. (1)

In the right angled ΔABP,

$\tan 45° = \frac{30}{BP}$

$\Rightarrow BP = 30$ ....(2)

Substituting (2) in (1), we get

$\sqrt{3} = \frac{30+h}{BP}$

$h = 30(\sqrt{3} - 1)$

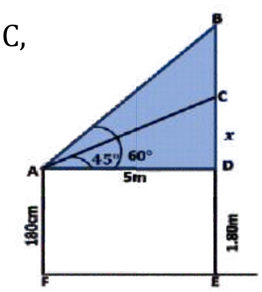
$= 30(1.732 - 1) = 30(0.732) = 21.96$

Hence, the height of the tower is 21.96 m.

3. To a man standing outside his house, the angles of elevation of the top and bottom of a window are 60^0 and 45^0 respectively. If the height of the man is 180cm and if he is 5 m away from the wall, what is the height of the window? ($\sqrt{3} = 1.732$).

Solution:

In the right triangle ADC,



$\tan 45° = \frac{x}{5}$

$1 = \frac{x}{5}$

$x = 5$ m

In the right triangle ABD,

$\tan 60° = \frac{BC+CD}{5}$

$\sqrt{3} = \frac{BC+CD}{5}$

$\sqrt{3} = \frac{h+5}{5}$

$5\sqrt{3} = h + 5$

$h = 5\sqrt{3} - 5$

$h = 5(\sqrt{3} - 1)$

$h = 5(1.732 - 1)$

$h = 5(0.732)$

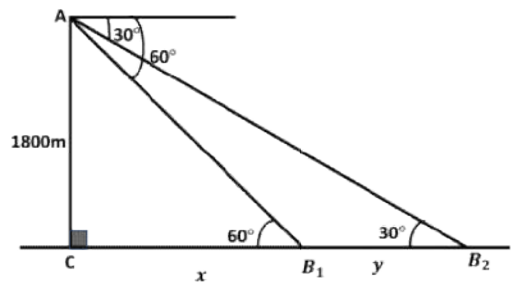
$h = 3.66$ m.

$\therefore$ height of the window is 3.66 m.

----

4. An aeroplane at an altitude of 1800 m finds that two boats are sailing towards it in the same direction. The angle of depression of the boats as observed from the aeroplane are 60^0 and 30^0 respectively. Find the distance between the two boats.

Solution:



In the right triangle AB_1C

$\tan 60° = \frac{1800}{x}$

$\sqrt{3} = \frac{1800}{x}$

$x = \frac{1800}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$

$= 600\sqrt{3}$

In the right triangle AB_2C

$\tan 30° = \frac{1800}{x+y}$

$\frac{1}{\sqrt{3}} = \frac{1800}{x+y}$

$x + y = 1800\sqrt{3}$

$y = 1800\sqrt{3} - 600\sqrt{3}$

$y = 1200\sqrt{3}$

$y = 1200 \times 1.732$

$y = 2078.4$ metres.

----

5. From the top of a lighthouse, the angle of depression of two ships on the opposite sides of it are observed to be 300 and 600. If the height of the lighthouse is h meters and

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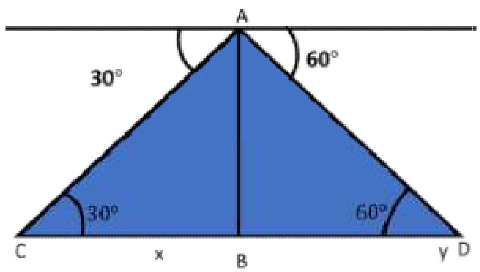
the line joining the ships passes through the foot of the lighthouse, show that the distance between the ships is $\frac{4h}{\sqrt{3}}$ m.

Solution:



In the right triangle ABC

$$\tan 30° = \frac{AB}{BC}$$

$$\frac{1}{\sqrt{3}} = \frac{h}{x}$$

$$x = \sqrt{3}\,h$$

In the right triangle ABD

$$\tan 60° = \frac{AB}{BD}$$

$$\sqrt{3} = \frac{h}{y}$$

$$y = \frac{h}{\sqrt{3}}$$

$$\therefore\ x + y = \sqrt{3}h + \frac{h}{\sqrt{3}}$$

$$= \frac{3h+h}{\sqrt{3}}$$

$$= \frac{4h}{\sqrt{3}}.\ \text{Metres.}$$

Mensuration

Two Marks

1. **A cylindrical drum has a height of 20 cm and a base radius of 14 cm. Find its curved surface area and the total surface area.**

Solution:

$h = 20$ cm ; $r = 14$ cm

C.S.A. of the cylinder = $2\pi rh$ sq. units

$= 2 \times \frac{22}{7} \times 14 \times 20$

$= 2 \times 22 \times 2 \times 20 = 1760$ sq. cm

T.S.A. of the cylinder

$= 2\pi r\,(h + r)$ sq. units

$= 2 \times \frac{22}{7} \times 14 \times (20 + 14)$

$= 2 \times \frac{22}{7} \times 14 \times 34$

$= 2992$ sq. cm

---

2. **The curved surface area of a right circular cylinder of height 14 cm is 88 cm^2. Find the diameter of the cylinder.**

Solution:

C.S.A. of the cylinder = 88 sq. cm

$2\pi rh = 88$

$2 \times \frac{22}{7} \times r \times 14 = 88$ (h=14 cm)

$2\,r = \frac{88 \times 7}{22 \times 14} = 2$

Therefore, diameter = 2 cm.

---

3. **If the total surface area of a cone of radius 7cm is 704 cm2, then find its slant height.**

Solution:

$r = 7$ cm

T.S.A of the cone = $\pi r\,(l + r)$sq. units

$704 = \frac{22}{7} \times 7\,(l + 7)$

$32 = l + 7$

$l = 25$ cm

---

4. **Find the diameter of a sphere whose surface area is 154 m^2.**

Solution:

Surface area of the sphere = 154 m^2

$4\,\pi r^2 = 154$

$\pi\,(2r)^2 = 154$

$(2r)^2 = 154\times\frac{7}{22}$

$(2r)^2 = 7\times7$

$2r = 7$

Therefore, the diameter is 7 m.

---

5. The radius of a spherical balloon increases from 12 cm to 16 cm as air is pumped into it. Find the ratio of the surface area of the balloons in the two cases.

Solution:

Let r_1 and r_2 be the radii of the balloons.

$\frac{r_1}{r_2} = \frac{12}{16} = \frac{3}{4}$

Ratio of C.S.A. of balloons $= \frac{4\pi r_1^2}{4\pi r_2^2}$

$\frac{r_1^2}{r_2^2} = \frac{3 \times 3}{4 \times 4}$

$= \frac{9}{16}$

Therefore, the ratio of C.S.A. of balloons is 9:16

---

6. If the base area of a hemispherical solid is 1386 sq. meters, then find its total surface area.

Solution:

Given that, base area $= \pi r^2 = 1386$ sq. m

T.S.A. $= 3\pi r^2$ sq. m

$= 3 \times 1386$

$= 4158\text{ m}^2$.

---

7. The slant height of a frustum of a cone is 5 cm and the radii of its ends are 4 cm and 1 cm. Find its curved surface area.

Solution:

$l = 5$ cm, $R = 4$ cm, $r = 1$ cm

C.S.A. of the frustum $= \pi r\,(l + r)$ sq. units

$= \frac{22}{7}\times 5 \times (4 + 1)$

$= \frac{550}{7} = 78.57\text{ cm}^2$

---

8. Find the volume of a cylinder whose height is 2 m and whose base area is 250 sq.m.

Solution:

$h = 2$ m, base area is $(\pi r^2) = 250$ sq.m.

The volume of a cylinder $= \pi r^2 h$ cu. units

$= \text{base} \times \text{height}$

$= 250\times2 = 500\text{ cm}^3$

---

9. The volume of a solid right circular cone is 11088 cm³. If its height is 24 cm then find the radius of the cone.

Solution:

h = 24 cm

The volume of the cone = 11088 cm³

$\frac{1}{3}\pi r^2 h = 11088$

$\frac{1}{3}\times\frac{22}{7}\times r^2 \times 24 = 11088$

$r^2 = 441$

$r = 21$ cm.

---

10. If the ratio of radii of two spheres is 4 : 7, find the ratio of their valumes.

Solution:

$\frac{r_1}{r_2} = \frac{4}{7}$

Ratio of Volume of the spheres $\frac{V_1}{V_2} = \frac{\frac{4}{3}\pi {r_1}^3}{\frac{4}{3}\pi {r_2}^3}$

$= \frac{{r_1}^3}{{r_2}^3}$

$= \frac{4\times4\times4}{7\times7\times7} = \frac{64}{343}$

Ratio of their valumes is 64 : 343.

Five Marks

1. If the radii of the circular ends of a frustum which is 45 cm high are 28 cm and 7 cm, find the volume of the frustum.

Solution:

$h = 45$ cm, $R = 28$ cm, $r = 7$ cm

Volume $= \frac{1}{3}\pi\,(R^2 + Rr + r^2)\times h$ cu. units

$= \frac{1}{3}\times\frac{22}{7}\times[28^2 + (28\times7) + 7^2]\times 45$

$= \frac{1}{3}\times\frac{22}{7}\times 1029\times 45 = 48510$

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∴ The volume of the frustum is 48510 cm^3.

---

2. **A toy is in the shape of a cylinder surmounted by a hemisphere. The height of the toy is 25 cm. Find the total surface area of the toy if its common diameter is 12 cm.**

Solution:

Diameter $d = 12$ cm, radius $r = 6$ cm

Total height of the toy is 25 cm

Therefore, height of the cylindrical portion = 25−6 = 19 cm

T.S.A. of the toy = C.S.A. of the cylinder + C.S.A. of the hemisphere + Base Area of the cylinder

$= 2\pi rh + 2\pi r^2 + \pi r^2$

$= \pi r\,(2h + 3r)$

$= \frac{22}{7} \times 6 \times (38 + 18)$

$= \frac{22}{7} \times 6 \times 56 = 1056$

∴ T.S.A. of the toy is 1056 cm^2.

---

3. **A metallic sphere of radius 16 cm is melted and recast into small spheres each of radius 2 cm. How many small spheres can be obtained?**

Solution:

$R = 16$ cm, $r = 2$ cm

No of a small sphere

$= \frac{\text{Volume of big metallic sphere}}{\text{Volume of small sphere}}$

$= \frac{\frac{4}{3}\pi R^3}{\frac{4}{3}\pi r^3}$

$= \frac{16^3}{2^3}$

$= \frac{16 X 16 X 16}{2 X 2 X 2}$

$= 512$

∴ There will be 512 small spheres.

---

4. **A cone of height 24 cm is made up of modelling clay. A child reshapes it in the form of a cylinder of same radius as cone. Find the height of the cylinder.**

Solution:

Height of the cone $h_1 = 24$ cm;

Radius of the cone and cylinder $r = 6$ cm

Let height of the cylinder h_2 cm

Since, Volume of cylinder = Volume of cone

$\pi r^2 h_2 = \frac{1}{3}\pi r^2 h_1$

$h_2 = \frac{1}{3} \times h_1$

$h_2 = \frac{1}{3} \times 24 = 8$

∴ Height of cylinder is 8 cm.

---

5. **A right circular cylindrical container of base radius 6 cm and height 15 cm is full of ice cream. The ice cream is to be filled in cones of height 9 cm and base radius 3 cm, having a hemispherical cap. Find the number of cones needed to empty the container.**

Solution:

	radius r	height h
cylinder	6 cm	15 cm
cone	3 cm	9 cm
hemispher	3 cm	–

No. of cones

$= \frac{\text{volume of the cylinder}}{V \text{ of the cone} + V \text{ of the hemispherical cap}}$

$= \frac{\pi r^2 h}{\frac{1}{3}\pi r_1{}^2 h_1 + \frac{2}{3}\pi r_1{}^3}$

$= \frac{6 \times 6 \times 15}{\frac{1}{3} 3 \times 3 [9 + 2 \times 3]}$

$= \frac{2 \times 6 \times 15}{15}$

$= 12$

Thus 12 ice cream cones are required to empty the cylindrical container.

---

6. **A cylindrical glass with diameter 20 cm has water to a height of 9 cm. A small cylindrical metal of radius 5 cm and height 4 cm is immersed completely. Calculate the raise of the water in the glass?**

Solution:

cylindrical glass $r = 10$ cm, $h_1 = 9$ cm
cylindrical metal $R = 5$ cm, $H = 4$ cm

Raise of the water in the glass = h cm

Volume of the raised water =

Volume of the cylindrical metal

$$\pi r^2 h = \pi r^2 H$$

$$10 \times 10 \times h = 5 \times 5 \times 4$$

$$h = \frac{5 \times 5 \times 4}{10 \times 10}$$

$$= 1 \text{ cm}$$

∴ Water raised = 1 cm.

---

7. A container open at the top is in the form of a frustum of a cone of height 16 cm with radii of its lower and upper ends are 8 cm and 20 cm respectively. Find the cost of milk which can completely fill a container at the rate of ₹ 40 per litre.

Solution:

h = 16 cm, R = 20 cm, r = 8 cm.

Volume of the frustum

$$= \frac{1}{3}\pi (R^2 + Rr + r^2) \times h \text{ cu. units}$$

$$= \frac{1}{3} \times \frac{22}{7} [\, 20^2 + (20 \times 8) + 8^2 \,] \times 16$$

$$= \frac{1}{3} \times \frac{22}{7} [\, 400 + 160 + 64 \,] \times 16$$

$$= \frac{22 \times 16 \times 624}{3 \times 7}$$

$$= \frac{22 \times 16 \times 208}{3 \times 7}$$

$$= \frac{73216}{7} = 10459.43 \text{ cm}^3$$

$$= \frac{10459.43}{1000} = 10.45943$$

$$= 10.45943 \text{ Litre}$$

Cost of the milk = 10.459 × 40 = ₹ 418.36

---

8. A capsule is in the shape of a cylinder with two hemispheres stuck to each of its ends. If the length of the entire capsule is 12 mm and the diameter of the capsule is 3 mm, how much medicine it can hold?

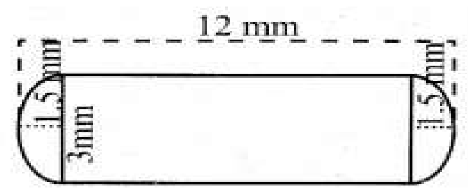
Solution:

Radius of a hemisphere = Radius of a cylinder

d = 3 mm

r = 1.5 mm

Height of the cylindrical portion h = 12 - 3
= 9 mm



Volume of the capsule

$$= \pi r^2 h + 2 \times \frac{2}{3}\pi r^3 \text{ cu. units}$$

$$= \pi r^2 \left(h + \frac{4}{3} r\right)$$

$$= \frac{22}{7} \times 1.5 \times 1.5 \left(9 + \frac{4}{3} \times 1.5\right)$$

$$= \frac{22}{7} \times 1.5 \times 1.5 \, (9+2)$$

$$= \frac{22}{7} \times 1.5 \times 1.5 \times 11$$

$$= 77.78$$

∴Volume of the capsule = 77.8 cu. mm.

---

9. An aluminium sphere of radius 12 cm is melted to make a cylinder of radius 8 cm. Find the height of the cylinder.

Solution:

Sphere – Radius $r_1 = 12$ cm

Cylinder – Radius $r_2 = 8$ cm

Cylinder - height h_2 = ?

Volume of cylinder = Volume of sphere melted

$$\pi r_2^2 h_2 = \frac{4}{3}\pi r_1^3$$

$$\frac{22}{7} \times 8 \times 8 \times h_2 = \frac{4}{3} \times \frac{22}{7} \times 12 \times 12 \times 12$$

$$h_2 = \frac{4}{3} \times 12 \times 12 \times 12 \times \frac{1}{8} \times \frac{1}{8}$$

$$h_2 = 36.$$

∴ Height of the cylinder made is 36 cm.

---

10. Nathan, an engineering student was asked to make a model shaped like a cylinderwith two cones attached at its two ends. The diameter of the model is 3 cm and itslength is 12 cm. If each cone has a

height of 2 cm, find the volume of the model thatNathan made.

Solution:

Cylinder - Radius $r = \frac{3}{2}$ cm

Height $h_1 = 12 - 4 = 8$ cm

cone - Height $h_2 = 2$ cm

Radius $r = \frac{3}{2}$ cm

Volume of the model

= Volume of the cylinder + 2 Volume of the cone

$= \pi r^2 h_1 + 2 \, \frac{1}{3} \pi r^2 h_2$

$= \pi r^2 \, [\, h_1 + 2 \frac{1}{3} h_2]$

$= \frac{22}{7} \times \frac{3}{2} \times \frac{3}{2} \; [\, 8 + 2 \times \frac{1}{3} \times 2 \,]$

$= \frac{11}{7} \times \frac{3}{2} \times \frac{3}{2} \times \frac{28}{3}$

= 66 Cubic. cm

---

11. **A girl wishes to prepare birthday caps in the form of right circular cones for herbirthday party, using a sheet of paper whose area is 5720 cm, how many caps can bemade with radius 5 cm and height 12 cm.**

Solution:

Cone - Radius r = 5 cm

Height h = 12 cm

Slant Height $l = \sqrt{12^2 + 5^2}$

$= \sqrt{144 + 25}$

$= \sqrt{169} = 13$ cm

Number of Caps $= \frac{5720}{\pi r l}$

$= \frac{5720}{\frac{22}{7} X \, 5 \, X \, 13}$

$= \frac{5720 \, X \, 7}{22 \, X \, 5 \, X \, 13}$

= 28 Caps

Unit-1: RELATIONS & FUNCTIONS

1. If $n(A \times B) = 6$ and $A = \{1, 3\}$ then $n(B)$ is
   (1) 1 (2) 2 (3) 3 (4) 6

2. $A = \{a, b, p\}$, $B = \{2,3\}$, $C = \{p, q, r, s\}$ then $n[(A \cup C) \times B]$ is
   (1) 8 (2) 20 (3) 12 (4) 16

3. If $A = \{1,2\}$, $B = \{1,2,3,4\}$, $C = \{5,6\}$ and $D = \{5,6,7,8\}$ then state which of the following statement is true.
   (1) $(A \times C) \subset (B \times D)$ (2) $(B \times D) \subset (A \times C)$
   (3) $(A \times B) \subset (A \times D)$ (4) $(D \times A) \subset (B \times A)$

4. If there are 1024 relations from a set $A = \{1,2,3,4,5\}$ to a set B, then the number of elements in B is (1) 3 (2) 2 (3) 4 (4) 8

5. The range of the relation $R = \{(x, x^2) \mid x$ is a prime number less than 13$\}$ is
   (1) $\{2,3,5,7\}$ (2) $\{2,3,5,7,11\}$ (3) $\{4,9,25,49,121\}$ (4) $\{1,4,9,25,49,121\}$

6. If the ordered pairs $(a + 2, 4)$ and $(5, 2a + b)$ are equal then (a, b) is
   (1) (2, –2) (2) (5,1) (3) (2,3) (4) (3, –2)

7. Let $n(A) = m$ and $n(B) = n$ then the total number of non-empty relations that can be defined from A to B is (1) m^n (2) n^m (3) $2^{mn} - 1$ (4) 2^{mn}

8. If $\{(a, 8), (6, b)\}$ represents an identity function, then the value of a and b are respectively
   (1) (8, 6) (2) (8, 8) (3) (6, 8) (4) (6, 6)

9. Let $A = \{1,2,3,4\}$ and $B = \{4,8,9,10\}$. A function $f : A \to B$ given by $f = \{(1,4), (2,8), (3,9), (4,10)\}$ is a
   (1) Many-one function (2) Identity function
   (3) One-to-one function (4) Into function

10. If $f(x) = 2x^2$ and $g(x) = \frac{1}{3x}$, then $f \circ g$ is
   (1) $\frac{3}{2x^2}$ (2) $\frac{2}{3x^2}$ (3) $\frac{2}{9x^2}$ (4) $\frac{1}{6x^2}$

11. If $f : A \to B$ is a bijective function and if $n(B) = 7$, then $n(A)$ is equal to
   (1) 7 (2) 49 (3) 1 (4) 14

12. Let f and g be two functions given by
   $f = \{(0,1), (2,0), (3,-4), (4,2), (5,7)\}$
   $g = \{(0,2), (1,0), (2,4), (-4,2), (7,0)\}$ then the range of $f \circ g$ is
   (1) $\{0,2,3,4,5\}$ (2) $\{-4,1,0,2,7\}$ (3) $\{1,2,3,4,5\}$ (4) $\{0,1,2\}$

13. Let $f(x) = \sqrt{1+x^2}$ then
    (1) $f(xy) = f(x).f(y)$ (2) $f(xy) \geq f(x).f(y)$
    (3) $f(xy) \leq f(x).f(y)$ (4) None of these

14. If $g = \{(1,1),(2,3),(3,5),(4,7)\}$ is a function given by $g(x) = \alpha x + \beta$ then the values of α and β are (1) $(-1,2)$ (2) $(2,-1)$ (3) $(-1,-2)$ (4) $(1,2)$

15. $f(x) = (x+1)^3 - (x-1)^3$ represents a function which is
    (1) linear (2) cubic (3) reciprocal (4) quadratic

Unit-2: NUMBERS & SEQUENCES

1. Euclid's division lemma states that for positive integers a and b, there exist unique integers q and r such that $a = bq + r$, where r must satisfy
   (1) $1 < r < b$ (2) $0 < r < b$ (3) $0 \leq r < b$ (4) $0 < r \leq b$

2. Using Euclid's division lemma, if the cube of any positive integer is divided by 9 then the possible remainders are (1) 0, 1, 8 (2) 1, 4, 8 (3) 0, 1, 3 (4) 1, 3, 5

3. If the HCF of 65 and 117 is expressible in the form of $65m - 117$, then the value of m is
   (1) 4 (2) 2 (3) 1 (4) 3

4. The sum of the exponents of the prime factors in the prime factorization of 1729 is
   (1) 1 (2) 2 (3) 3 (4) 4

5. The least number that is divisible by all the numbers from 1 to 10 (both inclusive) is
   (1) 2025 (2) 5220 (3) 5025 (4) 2520

6. $7^{4k} \equiv$ ________ (mod 100) (1) 1 (2) 2 (3) 3 (4) 4

7. Given $F_1 = 1$, $F_2 = 3$ and $F_n = F_{n-1} + F_{n-2}$ then F_5 is
   (1)3 (2)5 (3)8 (4)11

8. The first term of an arithmetic progression is unity and the common difference is 4. Which of the following will be a term of this A.P. (1) 4551 (2) 10091 (3) 7881 (4) 13531

9. If 6 times of 6^{th} term of an A.P. is equal to 7 times the 7^{th} term, then the 13^{th} term of the A.P. is
   (1) 0 (2) 6 (3) 7 (4) 13

10. An A.P. consists of 31 terms. If its 16^{th} term is m, then the sum of all the terms of this A.P. is
    (1) $16m$ (2) $62m$ (3) $31m$ (4) $\frac{31}{2}m$

11. In an A.P., the first term is 1 and the common difference is 4. How many terms of the A.P. must be taken for their sum to be equal to 120?
    (1) 6 (2) 7 (3) 8 (4) 9

12. If $A = 2^{65}$ and $B = 2^{64} + 2^{63} + 2^{62} + ... + 2^0$ which of the following is true?
(1) B is 2^{64} more than A (2) A and B are equal
(3) B is larger than A by 1 (4) A is larger than B by 1

13. The next term of the sequence $\frac{3}{16}, \frac{1}{8}, \frac{1}{12}, \frac{1}{18}, \ldots$ is
(1) $\frac{1}{24}$ (2) $\frac{1}{27}$ (3) $\frac{2}{3}$ (4) $\frac{1}{81}$

14. If the sequence $t_1, t_2, t_3, \ldots$ are in A.P. then the sequence $t_6, t_{12}, t_{18}, \ldots$ is
(1) a Geometric Progression (2) an Arithmetic Progression
(3) neither an A.P. nor a G.P. (4) a constant sequence

15. The value of $(1^3 + 2^3 + 3^3 + \cdots + 15^3) - (1+2+3+ \ldots +15)$ is
(1) 14400 (2) 14200 (3) 14280 (4) 14520

MATHS

Unit-3: ALGEBRA

1. A system of three linear equations in three variables is inconsistent if their planes
(1) intersect only at a point (2) intersect in a line
(3) coincides with each other (4) do not intersect

2. The solution of the system $x + y - 3x = -6, \ -7y + 7z = 7, \ 3z = 9$ is
(1) $x = 1, \ y = 2, \ z = 3$ (2) $x = -1, \ y = 2, \ z = 3$
(3) $x = -1, \ y = -2, \ z = 3$ (4) $x = 1, \ y = 2, \ z = 3$

3. If $(x - 6)$ is the HCF of $x^2 - 2x - 24$ and $x^2 - kx - 6$ then the value of k is
(1) 3 (2) 5 (3) 6 (4) 8

4. $\frac{3y-3}{y} \div \frac{7y-7}{3y^2}$ is
(1) $\frac{9y}{7}$ (2) $\frac{9y^2}{(21y-21)}$ (3) $\frac{21y^2 - 42y + 21}{(21y-21)}$ (4) $\frac{7(y^2 - 2y + 1)}{y^2}$

5. $y^2 + \frac{1}{y^2}$ is not equal to
(1) $\frac{y^4+1}{y^2}$ (2) $\left[y + \frac{1}{y}\right]^2$ (3) $\left[y - \frac{1}{y}\right]^2 + 2$ (4) $\left[y + \frac{1}{y}\right]^2 - 2$

6. $\frac{x}{x^2 - 25} - \frac{8}{x^2 + 6x + 5}$ gives
(1) $\frac{x^2-7x+40}{(x-5)(x+5)}$ (2) $\frac{x^2+7x+40}{(x-5)(x+5)(x+1)}$
(3) $\frac{x^2-7x+40}{(x^2-25)(x+1)}$ (4) $\frac{x^2+10}{(x^2-25)(x+1)}$

7. The square root of $\frac{256\, x^8 y^4 z^{10}}{25 x^6 y^6 z^6}$ is equal to
(1) $\frac{16}{5}\left|\frac{x^2 z^4}{y^2}\right|$ (2) $\frac{16}{5}\left|\frac{y^2}{x^2 z^4}\right|$ (3) $\frac{16}{5}\left|\frac{y}{xz^2}\right|$ (4) $\frac{16}{5}\left|\frac{xz^2}{y}\right|$

8. Which of the following should be added to make $x^4 + 64$ a perfect square
(1) $4x^2$ (2) $16x^2$ (3) $8x^2$ (4) $-8x^2$

9. The solution of $(2x-1)^2 = 9$ is equal to
(1) -1 (2) 2 (3) – 1, 2 (4) None of these

10. The values of a and b if $4x^4 - 24x^3 + 76x^2 + ax + b$ is a perfect square are
(1) 100,120 (2) 10,12 (3) -120 ,100 (4) 12,10

11. If the roots of the equation $q^2x^2 + p^2x + r^2 = 0$ are the squares of the roots of the equation $qx^2 + px += r = 0$, then q, p, r are in ___________
(1) *A.P* (2) *G.P* (3) Both *A.P* and *G.P* (4) none of these

12. Graph of a linear polynomial is a
(1) straight line (2) circle (3) parabola (4) hyperbola

13. The number of points of intersection of the quadratic polynomial $x^2 + 4x + 4$ with the X axis is (1) 0 (2) 1 (3) 0 or 1 (4) 2

14. For the given matrix $A = \begin{bmatrix} 1 & 3 & 5 & 7 \\ 2 & 4 & 6 & 8 \\ 9 & 11 & 13 & 15 \end{bmatrix}$ the order of the matrix A^T is
(1) 2×3 (2) 3×23 (3) 3×4 (4) 4×3

15. If A is a 2×3 matrix and B is a 3×4 matrix, how many columns does AB have
(1) 3 (2) 4 (3) 2 (4) 5

16. If number of columns and rows are not equal in a matrix then it is said to be a
(1) diagonal matrix (2) rectangular matrix
(3) square matrix (4) identity matrix

17. Transpose of a column matrix is
(1) unit matrix (2) diagonal matrix (3) column matrix (4) row matrix

18. Find the matrix X if $2X + \begin{pmatrix} 1 & 3 \\ 5 & 7 \end{pmatrix} = \begin{pmatrix} 5 & 7 \\ 9 & 5 \end{pmatrix}$
(1) $\begin{pmatrix} -2 & -2 \\ 2 & -1 \end{pmatrix}$ (2) $\begin{pmatrix} 2 & 2 \\ 2 & -1 \end{pmatrix}$ (3) $\begin{pmatrix} 1 & 2 \\ 2 & 2 \end{pmatrix}$ (4) $\begin{pmatrix} 2 & 1 \\ 2 & 2 \end{pmatrix}$

19. Which of the following can be calculated from the given matrices $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$, (i) A^2 (ii) B^2 (iii) AB (iv) BA
(1) (i) and (ii) only (2) (ii) and (iii) only
(3) (ii) and (iv) only (4) all of these

20. If $A = \begin{pmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \end{pmatrix}$, $B = \begin{pmatrix} 1 & 0 \\ 2 & -1 \\ 0 & 2 \end{pmatrix}$ and $C = \begin{pmatrix} 0 & 1 \\ -2 & 5 \end{pmatrix}$. Which of the following statements are correct? (i) $AB + C = \begin{pmatrix} 5 & 5 \\ 5 & 5 \end{pmatrix}$ (ii) $BC = \begin{pmatrix} 0 & 1 \\ 2 & -3 \\ -4 & 10 \end{pmatrix}$

(iii) $BA + C = \begin{pmatrix} 2 & 5 \\ 3 & 0 \end{pmatrix}$ (iv) $(AB)C = \begin{pmatrix} -8 & 20 \\ -8 & 13 \end{pmatrix}$

(1) (i) and (ii) only (2) (ii) and (iii) only
(3) (iii) and (iv) only (4) all of these

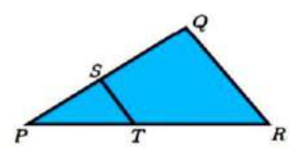
Unit-4: GEOMETRY

1. If in triangles ABC and EDF, $\frac{AB}{DE} = \frac{BC}{FD}$, then they will be similar, when
(1) $\angle B = \angle E$ (2) $\angle A = \angle D$ (3) $\angle B = \angle D$ (4) $\angle A = \angle F$

2. In ΔLMN, $\angle L = 60°$, $\angle M = 50°$. If $\Delta LMN \sim \Delta PQR$ then the value of $\angle R$ is
(1) 40° (2) 70° (3) 30° (4) 110°

3. If ΔABC is an isosceles triangle with $\angle C = 90°$ and $AC = 5$ cm, then AB is
(1) 2.5 cm (2) 5 cm (3) 10 cm (4) $5\sqrt{2}$ cm

4. In a given figure $ST \parallel QR$, $PS = 2$ cm and $SQ = 3$ cm. Then the ratio of the area of ΔPQR to the area of ΔPST is
(1) 25 : 4 (2) 25 : 7 (3) 25 : 11 (4) 25 : 13

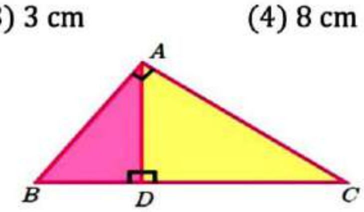


5. The perimeters of two similar triangles ΔABC and ΔPQR are 36 cm and 24 cm respectively. If $PQ = 10$ cm, then the length of AB is
(1) $6\frac{2}{3}$ cm (2) $\frac{10\sqrt{6}}{3}$ cm (3) $66\frac{2}{3}$ cm (4) 15 cm

6. If in ΔABC, DE ∥ BC. $AB = 3.6$ cm, $AC = 2.4$ cm and $AD = 2.1$ cm then the length of AE is
(1) 1.4 cm (2) 1.8 cm (3) 1.2 cm (4) 1.05 cm

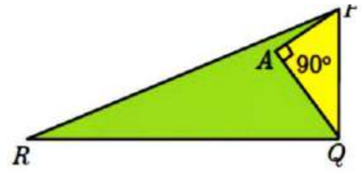
7. In a ΔABC, AD is the bisector of $\angle BAC$. If $AB = 8$ cm, $BD = 6$ cm and $DC = 3$ cm. The length of the side AC is (1) 6 cm (2) 4 cm (3) 3 cm (4) 8 cm

8. In the adjacent figure $\angle BAC = 90°$ and $AD \perp BC$ then
(1) $BD \cdot CD = BC^2$ (2) $AB \cdot AC = BC^2$
(3) $BD \cdot CD = AD^2$ (4) $AB \cdot AC = AD^2$



9. Two poles of heights 6 m and 11 m stand vertically on a plane ground. If the distance between their feet is 12 m, what is the distance between their tops?
(1) 13 m (2) 14 m (3) 15 m (4) 12.8 m

10. In the given figure, $PR = 26$ cm, $QR = 24\ cm$, $\angle PAQ = 90°$, $PA = 6$ cm and $QA = 8\ cm$. Find $\angle PQR$
    (1) 80° (2) 85° (3) 75° (4) 90°

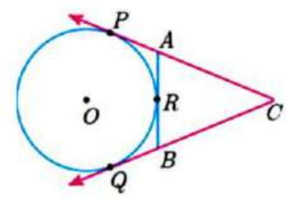


11. A tangent is perpendicular to the radius at the
    (1) centre (2) point of contact (3) infinity (4) chord

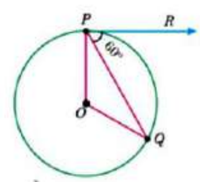
12. How many tangents can be drawn to the circle from an exterior point?
    (1) one (2) two (3) infinite (4) zero

13. The two tangents from an external points P to a circle with centre at O are PA and PB. If $\angle APB = 70°$ then the value of $\angle AOB$ is
    (1) 100° (2) 110° (3) 120° (4) 130°

14. In figure CP and CQ are tangents to a circle with centre at O. ARB is another tangent touching the circle at R. If $CP = 11$ cm and $BC = 7$ cm, then the length of BR is
    (1) 6 cm (2) 5 cm (3) 8 cm (4) 4 cm



15. In figure if PR is tangent to the circle at P and O is the centre of the circle, then $\angle POQ$ is
    (1) 120° (2) 100°
    (3) 110° (4) 90°



Unit-5: COORDINATE GEOMETRY

1. The area of triangle formed by the points $(-5,0)$, $(0,-5)$ and $(5,0)$ is
   (1) 0 sq.units (2) 25 sq.units (3) 5 sq.units (4) none of these

2. A man walks near a wall, such that the distance between him and the wall is 10 units. Consider the wall to be the Y axis. The path travelled by the man is
   (1) $x = 10$ (2) $y = 10$ (3) $x = 0$ (4) $y = 0$

3. The straight line given by the equation $x = 11$ is
   (1) parallel to X axis (2) parallel to Y axis
   (3) passing through the origin (4) passing through the point $(0,11)$

4. If $(5,7), (3,p)$ and $(6,6)$ are collinear, then the value of p is
   (1) 3 (2) 6 (3) 9 (4) 12

5. The point of intersection of $3x - y = 4$ and $x + y = 8$ is
   (1) $(5,3)$ (2) $(2,4)$ (3) $(3,5)$ (4) $(4,4)$

6. The slope of the line joining $(12,3)$, $(4,a)$ is $\frac{1}{8}$. The value of 'a' is
   (1) 1 (2) 4 (3) -5 (4) 2

7. The slope of the line which is perpendicular to line joining the points (0, 0) and (−8, 8) is

(1) −1 (2) 1 (3) $\frac{1}{3}$ (4) −8

8. If slope of the line PQ is $\frac{1}{\sqrt{3}}$ then the slope of the perpendicular bisector of PQ is

(1) $\sqrt{3}$ (2) $-\sqrt{3}$ (3) $\frac{1}{\sqrt{3}}$ (4) 0

9. If A is a point on the Y axis whose ordinate is 8 and B is a point on the X axis whose abscissae is 5 then the equation of the line AB is

(1) $8x + 5y = 40$ (2) $8x - 5y = 40$ (3) $x = 8$ (4) $y = 5$

10. The equation of a line passing through the origin and perpendicular to the line $7x - 3y + 4 = 0$ is

(1) $7x - 3y + 4 = 0$ (2) $3x - 7y + 4 = 0$ (3) $3x + 7y = 0$ (4) $7x - 3y = 0$

11. Consider four straight lines

(i) $l_1 : 3y = 4x + 5$ (ii) $l_2 : 4y = 3x - 1$ (iii) $l_3 : 4y + 3x = 5$ (iv) $l_4 : 4x + 3y = 2$

Which of the following statement is true ?

(1) l_1 and l_2 are perpendicular (2) l_1 and l_4 are parallel

(3) l_2 and l_4 are perpendicular (4) l_2 and l_3 are parallel

12. A straight line has equation $8y = 4x + 21$. Which of the following is true

(1) The slope is 0.5 and the y intercept is 2.6

(2) The slope is 5 and the y intercept is 1.6

(3) The slope is 0.5 and the y intercept is 1.6

(4) The slope is 5 and the y intercept is 2.6

13. When proving that a quadrilateral is a trapezium, it is necessary to show

(1) Two sides are parallel. (2) Two parallel and two non-parallel sides.

(3) Opposite sides are parallel. (4) All sides are of equal length.

14. When proving that a quadrilateral is a parallelogram by using slopes you must find

(1) The slopes of two sides (2) The slopes of two pair of opposite sides

(3) The lengths of all sides (4) Both the lengths and slopes of two sides

15. (2, 1) is the point of intersection of two lines.

(1) $x - y - 3 = 0;\ 3x - y - 7 = 0$ (2) $x + y = 3;\ 3x + y = 7$

(3) $3x + y = 3;\ x + y = 7$ (4) $x + 3y - 3 = 0;\ x - y - 7 = 0$

Unit-6: TRIGONOMETRY

1. The value of $sin^2\theta + \frac{1}{1+tan^2\theta}$ is equal to

(1) $tan^2\theta$ (2) 1 (3) $cot^2\theta$ (4) 0

2. $tan\theta\ cosec^2\theta - tan\theta$ is equal to

(1) $sec\theta$ (2) $cot^2\theta$ (3) $sin\theta$ (4) $cot\theta$

3. If $(sin\alpha + cosec\alpha)^2 + (cos\alpha + sec\alpha)^2 = k + tan^2\alpha + cot^2\alpha$, then the value of k is equal to
   (1) 9 (2) 7 (3) 5 (4) 3

4. If $sin\theta + cos\theta = a$ and $sec\theta + cosec\theta = b$, then the value of $b(a^2 - 1)$ is equal to
   (1) $2a$ (2) $3a$ (3) 0 (4) $2ab$

5. If $5x = sec\theta$ and $\frac{5}{x} = tan\theta$, then $x^2 - \frac{1}{x^2}$ is equal to
   (1) 25 (2) $\frac{1}{25}$ (3) 5 (4) 1

6. If $sin\theta = cos\theta$, then $2tan^2\theta + sin\theta - 1$ is equal to
   (1) $\frac{-3}{2}$ (2) $\frac{3}{2}$ (3) $\frac{2}{3}$ (4) $\frac{-2}{3}$

7. If $x = atan\theta$ and $y = bsec\theta$ then
   (1) $\frac{y^2}{b^2} - \frac{x^2}{a^2} = 1$ (2) $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ (3) $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ (4) $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 0$

8. $(1 + tan\,\theta + sec\,\theta)(1 + cot\theta - cosec\theta)$ is equal to
   (1) 0 (2) 1 (3) 2 (4) -1

9. $a\,cot\theta + b\,cosec\theta = p$ and $b\,cot\theta + a\,cosec\,\theta = q$ then $p^2 - q^2$ is equal to
   (1) $a^2 - b^2$ (2) $b^2 - a^2$ (3) $a^2 + b^2$ (4) $b - a$

10. If the ratio of the height of a tower and the length of its shadow is $\sqrt{3} : 1$, then the angle of elevation of the sun has measure
    (1) 45° (2) 30° (3) 90° (4) 60°

11. The electric pole subtends an angle of 30° at a point on the same level as its foot. At a second point 'b' metres above the first, the depression of the foot of the pole is 60°. The height of the pole (in metres) is equal to
    1) $\sqrt{3}\,b$ (2) $\frac{b}{3}$ (3) $\frac{b}{2}$ (4) $\frac{b}{\sqrt{3}}$

12. A tower is 60 m high. Its shadow is x metres shorter when the sun's altitude is 45° than when it has been 30°, then x is equal to
    (1) 41.92 m (2) 43.92 m (3) 43 m (4) 45.6 m

13. The angle of depression of the top and bottom of 20 m tall building from the top of a multistoried building are 30° and 60° respectively. The height of the multistoried building and the distance between two buildings (in metres) is
    (1) 20, $10\sqrt{3}$ (2) 30, $5\sqrt{3}$ (3) 20, 10 (4) 30, $10\sqrt{3}$

14. Two persons are standing 'x' metres apart from each other and the height of the first person is double that of the other. If from the middle point of the line joining their feet an observer finds the angular elevations of their tops to be complementary, then the height of the shorter person (in metres) is
    (1) $\sqrt{2}\,x$ (2) $\frac{x}{2\sqrt{2}}$ (3) $\frac{x}{\sqrt{2}}$ (4) $2x$

15. The angle of elevation of a cloud from a point h metres above a lake is β. The angle of depression of its reflection in the lake is 45°. The height of location of the cloud from the lake is (1) $\frac{h(1+tan\beta)}{1-tan\beta}$ (2) $\frac{h(1-tan\beta)}{1+tan\beta}$ (3) $h\ tan(45° - \beta)$ (4) none of these

Unit-7: MENSURATION

MATHS

1. The curved surface area of a right circular cone of height 15 cm and base diameter 16 cm is
   (1) $60\pi\ cm^2$ (2) $68\pi\ cm^2$ (3) $120\pi\ cm^2$ (4) $136\pi\ cm^2$

2. If two solid hemispheres of same base radius r units are joined together along their bases, then curved surface area of this new solid is
   (1) $4\pi r^2$ sq. units (2) $6\pi r^2$ sq. units (3) $3\pi r^2$ sq. units (4) $8\pi r^2$ sq. units

3. The height of a right circular cone whose radius is 5 cm and slant height is 13 cm will be
   (1) 12 cm (2) 10 cm (3) 13 cm (4) 5 cm

4. If the radius of the base of a right circular cylinder is halved keeping the same height, then the ratio of the volume of the cylinder thus obtained to the volume of original cylinder is
   (1) 1:2 (2) 1:4 (3) 1:6 (4) 1:8

5. The total surface area of a cylinder whose radius is $\frac{1}{3}$ of its height is
   (1) $\frac{9\pi h^2}{8}$ sq. units (2) $24\pi h^2$ sq. units (3) $\frac{8\pi h^2}{9}$ sq. units (4) $\frac{56\pi h^2}{9}$ sq. units

6. In a hollow cylinder, the sum of the external and internal radii is 14 cm and the width is 4 cm. If its height is 20 cm, the volume of the material in it is
   (1) $5600\pi\ cm^3$ (2) $11200\pi\ cm^3$ (3) $56\pi\ cm^3$ (4) $3600\pi\ cm^3$

7. If the radius of the base of a cone is tripled and the height is doubled then the volume is
   (1) made 6 times (2) made 18 times (3) made 12 times (4) unchanged

8. The total surface area of a hemi-sphere is how much times the square of its radius.
   (1) π (2) π (3) 3π (4) 2π

9. A solid sphere of radius $x\ cm$ is melted and cast into a shape of a solid cone of same radius. The height of the cone is
   (1) $3x\ cm$ (2) $x\ cm$ (3) $4x\ cm$ (4) $2x\ cm$

10. A frustum of a right circular cone is of height 16cm with radii of its ends as 8cm and 20cm. Then, the volume of the frustum is
    (1) $3328\,\pi\ cm^3$ (2) $3228\,\pi\ cm^3$ (3) $3240\,\pi\ cm^3$ (4) $3340\,\pi\ cm^3$

11. A shuttle cock used for playing badminton has the shape of the combination of
    (1) a cylinder and a sphere (2) a hemisphere and a cone
    (3) a sphere and a cone (4) frustum of a cone and a hemisphere

12. A spherical ball of radius r_1 units is melted to make 8 new identical balls each of radius r_2 units. Then $r_1 : r_2$ is (1) 2 : 1 (2) 1 : 2 (3) 4 : 1 (4) 1 : 4

13. The volume (in cm^3) of the greatest sphere that can be cut off from a cylindrical log of wood of base radius 1 cm and height 5 cm is
(1) $\frac{4}{3}\pi$ (2) $\frac{10}{3}\pi$ (3) 5π (4) $\frac{20}{3}\pi$

14. The height and radius of the cone of which the frustum is a part are h_1 units and r_1 units respectively. Height of the frustum is h_2 units and radius of the smaller base is r_2 units. If $h_2 : h_1 = 1 : 2$ then $r_2 : r_1$ is
(1) 1 : 3 (2) 1 : 2 (3) 2 : 1 (4) 3 : 1

15. The ratio of the volumes of a cylinder, a cone and a sphere, if each has the same diameter and same height is (1) 1:2:3 (2) 2:1:3 (3) 1:3:2 (4) 3:1:2

Unit-8: STATISTICS & PROBABILITY

1. Which of the following is not a measure of dispersion?
(1) Range (2) Standard deviation (3) Arithmetic mean (4) Variance

2. The range of the data 8, 8, 8, 8, 8...8 is
(1) 0 (2) 1 (3) 8 (4) 3

3. The sum of all deviations of the data from its mean is
(1) Always positive (2) always negative (3) zero (4) non-zero integer

4. The mean of 100 observations is 40 and their standard deviation is 3. The sum of squares of all deviations is (1) 40000 (2) 160900 (3) 160000 (4) 30000

5. Variance of first 20 natural numbers is (1) 32.25 (2) 44.25 (3) 33.25 (4) 30

6. The standard deviation of a data is 3. If each value is multiplied by 5 then the new variance is
(1) 3 (2) 15 (3) 5 (4) 225

7. If the standard deviation of x, y, z is p then the standard deviation of $3x + 5$, $3y + 5$, $3z + 5$ is (1) $3p + 5$ (2) $3p$ (3) $p + 5$ (4) $9p + 15$

8. If the mean and coefficient of variation of a data are 4 and 87.5% then the standard deviation is
(1) 3.5 (2) 3 (3) 4.5 (4) 2.5

9. Which of the following is incorrect?
(1) P (A) > 1 (2) $0 \leq P(A) \leq 1$ (3) $P(\emptyset) = 0$ (4) $P(A)+P(\bar{A}) = 1$

10. The probability of a red marble selected at random from a jar containing p red, q blue and r green marbles is (1) $\frac{q}{p+q+r}$ (2) $\frac{p}{p+q+r}$ (3) $\frac{p+q}{p+q+r}$ (4) $\frac{p+r}{p+q+r}$

11. A page is selected at random from a book. The probability that the digit at units place of the page number chosen is less than 7 is (1) $\frac{3}{10}$ (2) $\frac{7}{10}$ (3) $\frac{3}{9}$ (4) $\frac{7}{9}$

12. The probability of getting a job for a person is $\frac{x}{3}$. If the probability of not getting the job is $\frac{2}{3}$ then the value of x is (1) 2 (2) 1 (3) 3 (4) 1.5

13. Kamalam went to play a lucky draw contest. 135 tickets of the lucky draw were sold. If the probability of Kamalam winning is $\frac{1}{9}$, then the number of tickets bought by Kamalam is
(1) 5 (2) 10 (3) 15 (4) 20

14. If a letter is chosen at random from the English alphabets $\{a, b, \ldots, z\}$, then the probability that the letter chosen precedes x (1) $\frac{12}{13}$ (2) $\frac{1}{13}$ (3) $\frac{23}{26}$ (4) $\frac{3}{26}$

15. A purse contains 10 notes of Rs.2000, 15 notes of Rs.500, and 25 notes of Rs.200. One note is drawn at random. What is the probability that the note is either a Rs.500 note or Rs.200 note? (1) $\frac{1}{5}$ (2) $\frac{3}{10}$ (3) $\frac{2}{3}$ (4) $\frac{4}{5}$

Answers - Bookback

Unit – 1: Relations and Functions

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(3)	(3)	(1)	(2)	(3)	(4)	(3)	(1)	(3)	(3)	(1)	(4)	(3)	(2)	(4)

Unit –2: Numbers and Sequences

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(3)	(1)	(2)	(3)	(4)	(1)	(4)	(3)	(1)	(3)	(3)	(4)	(2)	(2)	(3)

Unit – 3: Algebra

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
(4)	(1)	(2)	(1)	(2)	(3)	(4)	(2)	(3)	(3)	(2)	(1)	(2)	(4)	(2)	(2)	(4)	(2)	(2)	(1)

Unit – 4: Geometry

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(3)	(2)	(4)	(1)	(4)	(1)	(2)	(3)	(1)	(4)	(2)	(2)	(2)	(4)	(1)

Unit – 5: Coordinate Geometry

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(2)	(1)	(2)	(3)	(3)	(4)	(2)	(2)	(1)	(3)	(3)	(1)	(2)	(1)	(2)

Unit –6: Trigonometry

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(2)	(4)	(2)	(1)	(2)	(2)	(1)	(3)	(2)	(4)	(2)	(2)	(4)	(2)	(1)

Unit – 7: Mensuration

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(4)	(1)	(1)	(2)	(3)	(2)	(2)	(3)	(3)	(1)	(4)	(1)	(1)	(2)	(4)

Unit – 8: Statistics and Probability

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(3)	(1)	(3)	(2)	(3)	(4)	(2)	(1)	(1)	(2)	(2)	(2)	(3)	(3)	(4)