1

CBSE

SAMPLE PAPER

SOLVED

MATHEMATICS

(BASIC)

Time Allowed: 90 Minutes *Maximum Marks: 40*

General Instructions:

(i) The question paper contains THREE parts A, B and C.

(ii) Section A consists of 20 questions of 1 mark each. Any 16 questions are to be attempted.

(iii) Section B consists of 20 questions of 1 mark each. Any 16 questions are to be attempted.

(iv) Section C consists of 10 questions based on two Case Studies. Attempt any 8 questions.

(v) There is no negative marking.

SECTION A **16 marks**

Section A consists of 20 questions of 1 mark each. Any 16 questions are to be attempted

1. A box contains cards numbered 6 to 50. A card is drawn at random from the box. The probability that the drawn card has a number which is a perfect square like 4,9.... is :

(a) $\frac{1}{45}$ **(b)** $\frac{2}{15}$

(c) $\frac{4}{45}$ **(d)** $\frac{1}{9}$ 1

Ans. *(d) P(perfect Square)=* $\frac{5}{45} = \frac{1}{9}$.

Explanation: Total number of cards from 6 to 50 = 45

Perfect square from 6 to 50

= {9, 16, 25, 36, 49}

Number of perfect squares = 5

$\therefore$ P(perfect square) = $\frac{5}{45} = \frac{1}{9}$

2. In a circle of diameter 42cm, if an arc subtends an angle of 60° at the centre where $\pi = \frac{22}{7}$, then the length of the arc is:

(a) $\frac{22}{7}$ **cm** **(b) 11cm**

(c) 22 cm **(d) 44 cm** 1

Ans. *(c) length of the arc =* $\frac{\theta}{360^\circ}(2\pi r)$

$= \left(\frac{60^\circ}{360^\circ}\right) \times 2 \times \left(\frac{22}{7}\right) \times 21 = 22\,cm$

Explanation: Diameter of circle = 42 cm

$\therefore$ Radius (r) or circle = $\frac{42}{2}$ = 21cm

Central angle (θ) = 60°

$\therefore$ Length of arc = $\frac{\theta}{360} \times 2\pi r$

$= \frac{60}{360} \times 2 \times \frac{22}{7} \times 21$

= 22 cm

3. **If $\sin\theta = x$ and $\sec\theta = y$, then $\tan\theta$ is:**

(a) xy **(b)** $\frac{x}{y}$

(c) $\frac{y}{x}$ **(d)** $\frac{1}{xy}$ 1

Ans. *(a)* $\tan\theta = \frac{\sin\theta}{\cos\theta} = \sin\theta \times \sec\theta = xy$

Explanation: We know,

$$\tan\theta = \frac{\sin\theta}{\cos\theta}$$
$$= \sin\theta \times \frac{1}{\cos\theta} = \sin\theta \sec\theta$$
$$\left[\because \sec\theta = \frac{1}{\cos\theta}\right]$$

$\therefore$ $\tan\theta = x \times y = xy$

4. **The pair of linear equations $y = 0$ and $y = -5$ has:**

(a) One solution

(b) Two solutions

(c) Infinitely many solutions

(d) No solution 1

Ans. *(d) The lines are parallel. Hence, no solution.*

Explanation: Pair of linear equation $y = 0$ and $y = -5$ represent parallel lines and parallel lines never intersect. Thus, it has no solution.

5. **A fair die is thrown once. The probability of even composite number is:**

(a) 0 **(b)** $\frac{1}{3}$

(c) $\frac{3}{4}$ **(d)** 1 1

Ans. *(b)* $P(\text{even composite no.}) = \frac{2}{6} = \frac{1}{3}$

Explanation: On throwing a die once,

total number of outcomes = 6

Even composite numbers in total automes = {4, 6}

$\therefore$ Number of favourable outcomes = 2

$\therefore$ P(even composite number) = $\frac{2}{6} = \frac{1}{3}$

6. **8 chairs and 5 tables cost ₹ 10500, while 5 chairs and 3 tables cost ₹ 6450. The cost of each chair will be :**

(a) ₹ 750 **(b)** ₹ 600

(c) ₹ 850 **(d)** ₹ 900 1

Ans. *(a) Let the cost of one chair = ₹ x. Let the cost of one table = ₹ y*

$8x + 5y = 10500$

$5x + 3y = 6450$

Solving the above equations.

Cost of each chair = x = ₹ 750

Explanation: Let the cost of one chair be ₹x and the cost of one table be ₹y.

ATQ,

Then, $8x + 5y = 10500$ ....(i)

and $5x + 3y = 6450$ ....(ii)

Eq. (i) × 3 – Eq. (iii) × 5, we get

$$24x + 15y = 31500$$
$$25x + 15y = 32250$$
$$- \quad - \quad -$$

$\Rightarrow$ $-x = -750$

or $x = 750$

$\therefore$ Cost of one chair = ₹x = ₹ 750

7. **If $\cos\theta + \cos^2\theta = 1$, the value of $\sin^2\theta + \sin^4\theta$ is :**

(a) –1 **(b)** 0

(c) 1 **(d)** 2 1

Ans. *(c)* $\cos\theta = 1 - \cos^2\theta = \sin^2\theta$

Therefore, $\sin^2\theta + \sin^4\theta = \cos\theta + \cos^2\theta = 1$

Explanation: We have,

$\cos\theta + \cos^2\theta = 1$ ....(i)

$\Rightarrow$ $\cos\theta = 1 - \cos^2\theta = \sin^2\theta$

$[\because \cos^2\theta + \sin^2\theta = 1]$....(ii)

Now, $\sin^2\theta + \sin^4\theta = \sin^2\theta + (\sin^2\theta)^2$

$= \cos\theta + (\cos\theta)^2$ [Using (ii)]

$= \cos\theta + \cos^2\theta$

$= 1$ [From (i)]

8. **The decimal representation of $\frac{23}{2^3 \times 4^2}$ will be :**

(a) Terminating

(b) Non-terminating

(c) Non-terminating and repeating

(d) Non-terminating and non-repeating 1

Ans. *(a) Terminating*

Explanation: Terminating, the denominator of the given rational number is of the form 2^m5^n, where m, n are non-negative integers.

$\therefore$Its decimal representation is terminating

9. **The LCM of $2^3 \times 3^2$ and $2^2 \times 3^3$ is :**

(a) 2^3 **(b)** 3^3

(c) $2^3 \times 3^3$ **(d)** $2^2 \times 3^2$ 1

Ans. *(c)* $2^3 \times 3^3$

Explanation:

Let $p = 2^3 \times 3^2$ and $q = 2^2 \times 3^3$

$\therefore$ LCM $(p, q) = 2^3 \times 3^3$

10. **The HCF of two numbers is 18 and their product is 12960. Their LCM will be:**

(a) 420 **(b) 600**

(c) 720 **(d) 800** 1

Ans. *(c) 1^{st} No. x 2^{nd} No. = HCF × LCM*

12960 =18 × LCM

∴ LCM = 720

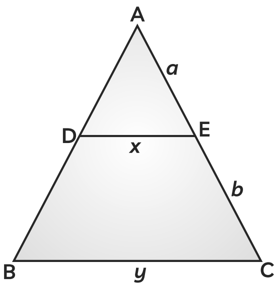
Explanation: We know,

LCM × HCF = Product of two numbers

$\Rightarrow$ LCM × 18 = 12960

$\Rightarrow$ LCM $= \dfrac{12960}{18} = 720$

11. **In the given figure, DE II BC. Which of the following is true?**



(a) $x = \dfrac{a+b}{ay}$ **(b)** $y = \dfrac{ax}{a+b}$

(c) $x = \dfrac{ay}{a+b}$ **(d)** $\dfrac{x}{y} = \dfrac{a}{b}$ 1

Ans. *(c)* $\dfrac{AE}{AC} = \dfrac{DE}{BC} = \dfrac{a}{a+b} = \dfrac{x}{y}$

$X = \dfrac{ay}{(a+b)}$

Explanation: Since, BE || BC

Then, ∠ADE = ∠ABC and ∠AED = ∠ACB (alternate pair of angles)

∴ ΔADE ~ ΔADC (by AA similarity)

∴ $\dfrac{AE}{AC} = \dfrac{DE}{BC}$

[∵ corresponding sides of similar triangles are proportional]

$\Rightarrow$ $\dfrac{a}{AE+EC} = \dfrac{x}{y}$

$\Rightarrow$ $\dfrac{a}{a+b} = \dfrac{x}{y}$

or, $x = \dfrac{ay}{a+b}$

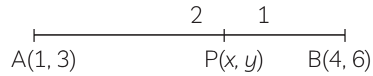
12. **The co-ordinates of the point P dividing the line segment joining the points A (1,3) and B (4, 6) internally in the ratio 2 : 1 are:**

(a) (2, 4) **(b) (4, 6)**

(c) (4, 2) **(d) (3, 5)** 1

Ans. *(d)* $\dfrac{(2\times4+1\times1)}{3}, \dfrac{(2\times6+1\times3)}{3} = (3, 5)$

Explanation: Let the coordinates of point P be (x, y).



Then, by section formula,

$$P(x, y) = \left(\frac{2\times4+1\times1}{2+1}, \frac{2\times6+1\times3}{2+1}\right)$$

$$= \left(\frac{9}{3}, \frac{15}{3}\right) = (3, 5)$$

13. **The prime factorisation of 3825 is:**

(a) $3 \times 5^2 \times 21$ **(b) $3^2 \times 5^2 \times 35$**

(c) $3^2 \times 5^2$ x 17 **(d) 3^2 x 25 x 17** 1

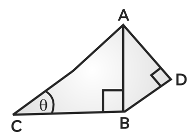
Ans. (c) 3825 = 3^2 x 5^2 x 17

Explanation: Prime factors of 3825 is :

5	3825
5	765
3	153
3	51
17	17
	1

3825 = $3^2 \times 5^2 \times 17$

14. **In the figure given below, AD = 4 cm, BD = 3 cm and CB = 12 cm, then cot θ equals :**



(a) $\dfrac{3}{4}$ **(b)** $\dfrac{5}{12}$

(c) $\dfrac{4}{3}$ **(d)** $\dfrac{12}{5}$ 1

Ans. *(d) $AB^2 = AD^2 + BD^2$*

AB = 5cm

$AC^2 = AB^2 + CB^2$

AC = 13 cm

cot θ = $\dfrac{CB}{AB} = \dfrac{12}{5}$

Explanation: In ΔABD, by Pythagoras theorem,

$AB^2 = AD^2 + BD^2$

$= 4^2 + 3^2$

(∵ AD = 4 cm, BD = 3 cm)

= 16 + 9 = 25

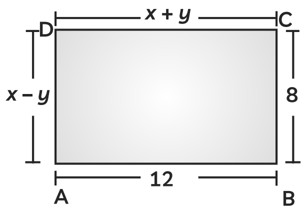
$\Rightarrow$ AB = 5

Now, in ΔABC,

cot θ = $\dfrac{BC}{AB} = \dfrac{12}{5}$

(∵ BC = 12 cm)

15. **If ABCD is a rectangle, find the values of x and y :**



(a) x = 10, y = 2 **(b) x = 12, y = 8**
(c) x = 2, y = 10 **(d) x = 20, y = 0** 1

Ans. *(a) $x + y = 12, x - y = 8$*
Solving the above equations x =10, y = 2

Explanation: Since, ABCD is a rectangle, so its opposite sides are equal

$\therefore$ AB = CD; AD = BC

$\Rightarrow$ $12 = x + y$ =m $12; x - y = 8$

Adding the two equations, we get

$2x = 20 \Rightarrow x = 10$

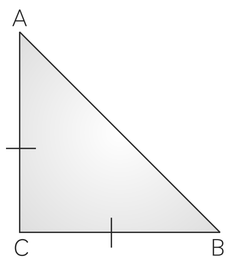
$\therefore$ $y = 12 - x = 12 - 10 = 2$

$\therefore$ $x = 10, y = 2$

16. **In an isosceles triangle ABC, if AC = BC and $AB^2 = 2AC^2$, then the measure of angle C will be :**
(a) 30° **(b) 45°**
(c) 60° **(d) 90°** **1**

Ans. *(d)* $AB^2 = AC^2 + AC^2$
$= AC^2 + BC^2$
Hence, angle C = 90°

Explanation: We have, ΔABC, in which AC = BC



$AB^2 = 2AC^2$ (Given)
$= AC^2 + AC^2$
$= AC^2 + BC^2$ [$\because$ BC = AC]

$\therefore$ By the converse of Pythagoras theorem,

Angle opposite to hypotenuse AB is 90°. *i.e.,* $\angle C = 90°$.

17. **If –1 is a zero of the polynomial $p(x) = x^2 - 7x - 8$, then the other zero is :**
(a) –8 **(b) –7**
(c) 1 **(d) 8** 1

Ans. *(d) Let–the zeroes be a and b Then, a=–1 , a + b = $-\dfrac{-(-7)}{1}$*
Hence, b = 7 + 1 = 8

Explanation: Let the other zero be α.

Then, product of zeroes = $\dfrac{\text{constant term}}{\text{coefficient of } x^2}$

$\Rightarrow$ $-1 \times \alpha = \dfrac{-8}{1}$

($\because$ one zeros = – 1)

$\Rightarrow$ $\alpha = 8$

18. **In a throw of a pair of dice, the probability of the same number on each die is :**

(a) $\frac{1}{6}$ **(b) $\frac{1}{3}$**

(c) $\frac{1}{2}$ **(d) $\frac{5}{6}$** **1**

Ans. *(a) P(same no on each die) = $\dfrac{6}{36} = \dfrac{1}{6}$*

Explanation: On throwing a pair of dice,

Total number of outcomes = 36

Outcomes with same number on each dice = {(1, 1) (2, 2) (3, 3) (4, 4) (5, 5) (6, 6)}

$\therefore$ Favourable outcomes = 6

$\therefore$ P(same number on each dice) = $\dfrac{6}{36} = \dfrac{1}{6}$

19. **The mid-point of (3p, 4) and (–2, 2q) is (2, 6). Find the value of $p + q$:**
(a) 5 **(b) 6**
(c) 7 **(d) 8** 1

Ans. *(b)* $(2, 6) = \dfrac{(3p-2)}{2}, \dfrac{4+2q}{2}$
$3p - 2 = 4, 4 + 2q = 12$
$p = 2, q = 4$
hence, $p + q = 6$

Explanation: Using mid-point formula,

$$(2, 6) = \left(\frac{3p+(-2)}{2}, \frac{4+2q}{2}\right)$$

$\Rightarrow$ $2 = \dfrac{3p-2}{2}; 6 = \dfrac{4+2q}{2}$

$\Rightarrow$ $3p = 4 + 2; 2q = 12 - 4$

$\Rightarrow$ $3p = 6; 2q = 8$

$\Rightarrow$ $p = 2; q = 4$

$\therefore$ $p + q = 2 + 4 = 6$

20. **The decimal expansion of $\frac{147}{120}$ will terminate after how many places of decimals?**
(a) 1 **(b) 2**
(c) 3 **(d) 4** 1

Ans. *(c)* $\dfrac{147}{120} = \dfrac{49}{40} = \dfrac{49}{2^3 \times 5}$

Explanation: Prime factor of 120 are–

2	120
2	60
2	30
3	15
5	5
	1

$$\frac{147}{120} = \frac{147}{2^3 \times 3 \times 5} = \frac{49}{2^3 \times 5}$$
$$= \frac{49 \times 5^2}{2^3 \times 5^3} = \frac{1225}{(10)^3}$$
$$= 1.225$$

So, $\frac{147}{120}$ will terminate after 3 decimal places.

SECTION B

16 marks

Section B consists of 20 questions of 1 mark each. Any 16 questions are to be attempted.

21. The perimeter of a semicircular protractor whose radius is '*r*' is :

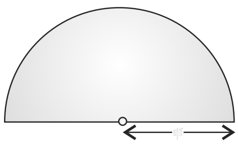
(a) π + 2r **(b) π + r**

(c) πr **(d) πr + 2r** 1

Ans. *(d) Perimeter of protractor = Circumference of semi-circle + 2 x radius*

= πr + 2r

Explanation: Perimeter of semi-circular protractor.



$= \text{Diameter} + \text{Semi-circular arc}$

$= 2r + \frac{1}{2}(2\pi r)$

$= 2r + \pi r = r(\pi + 2)$ unit

22. If P (E) denotes the probability of an event E, then:

(a) 0< P(E) ≤ 1 **(b) 0 < P(E) < 1**

(c) 0 ≤ P(E) ≤ 1 **(d) 0 ≤ P(E) < 1** 1

Ans. *(c) 0≤ P(E) ≤1*

Explanation: This is the range of probability of an event.

23. In ΔABC, ∠B = 90° and BD ⊥ AC. If AC = 9 cm and AD = 3 cm then BD is equal to :

(a) 2√2 cm **(b) 3√2 cm**

(c) 2√3 cm **(d) 3√3 cm** 1

Ans. *(b)* $\frac{CD}{CB} = \frac{BD}{AD}$

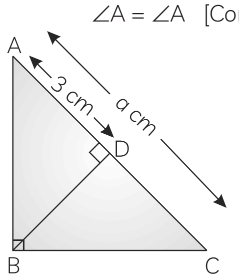
$BD^2 = CD \times AD = 6 \times 3$

$BD = 3\sqrt{2}$ cm

Explanation: In ΔABD and ΔABC,

∠ADB = ∠ABC = 90°

∠A = ∠A [Common angle]



∴ By AA similarity criterian,

ΔADB ~ ΔABC ....(i)

Similarly, ΔABC ~ ΔBDC ....(ii)

From (i) and (ii)

ΔADB ~ ΔBDC

$\therefore \quad \frac{AD}{BD} = \frac{BD}{DC}$

(corresponding sides of similar triangles)

$\Rightarrow \quad \frac{AD}{BD} = \frac{BD}{AC - AD}$

$\Rightarrow \quad \frac{3}{BD} = \frac{BD}{9 - 3}$

$\Rightarrow \quad BD^2 = 18$

$\Rightarrow \quad BD = \sqrt{18} = 3\sqrt{2}$

24. The pair of linear equations 3*x* + 5*y* = 3 and 6*x* + *ky* = 8 do not have a solution if:

(a) *k* = 5 **(b) *k* = 10**

(c) *k* ≠ 10 **(d) *k* ≠ 5** 1

Ans. *(b)* $\frac{3}{6} = \frac{5}{k} \Rightarrow k = 10$

Explanation: The given pair of linear equations will have no solution, if

$\Rightarrow \quad \frac{3}{6} = \frac{5}{k} \neq \frac{-3}{-8}$

$\Rightarrow \quad \frac{3}{6} = \frac{5}{k};\ \frac{5}{k} \neq \frac{3}{8}$

$\Rightarrow \quad k = 10;\ k \neq \frac{40}{3}$

25. If the circumference of a circle increases from 2π to 4π then its area ......the original area :

(a) Half **(b) Double**

(c) Three times **(d) Four times** 1

Ans. *(d)* $\frac{C_1}{C_2} = \frac{2\pi r}{2\pi R}$

$\frac{2\pi}{4\pi} = \frac{2\pi r}{2\pi R}$

$\frac{r}{R} = \frac{1}{2}$

$\frac{A_1}{A_2} = \frac{\pi r^2}{\pi R^2} = \left(\frac{r}{R}\right)^2 = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$

$A_2 = 4A_1$

Explanation: Let r_1 be the original radius and r_2 be the increased radius of the circle. Then according to question,

$$\frac{C_1}{C_2} = \frac{2\pi}{4\pi} \Rightarrow \frac{2\pi r_1}{4\pi r_2} = \frac{2\pi}{4\pi}$$

$$\Rightarrow \quad \frac{r_1}{r_2} = \frac{1}{2}$$

Now, ratio of their areas

$$\Rightarrow \quad \frac{A_1}{A_2} = \frac{\pi r_1^2}{\pi r_2}$$

$$= \left(\frac{r_1}{r_2}\right)^2 = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$$

∴ New area is four times of the original area.

26. Given that $\sin\theta = \frac{a}{b}$, then $\tan\theta$ is equal to:

(a) $\frac{b}{\sqrt{a^2+b^2}}$ **(b)** $\frac{b}{\sqrt{b^2-a^2}}$

(c) $\frac{a}{\sqrt{a^2-b^2}}$ **(d)** $\frac{a}{\sqrt{b^2-a^2}}$ 1

Ans. *(d)* $\sin\theta = \frac{a}{b}$

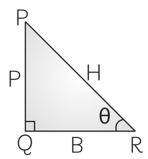
$H^2 = P^2 + B^2$

$b^2 = a^2 + B^2$

$B = \sqrt{(a^2-b^2)}$

$\tan\theta = \frac{P}{B} = \frac{a}{\sqrt{(b^2-a^2)}}$

Explanation: Given, $\sin\theta = \frac{a}{b} = \frac{P}{H}$



∴ Using Pythagoras theorem,

$$B^2 = H^2 - P^2 = b^2 - a^2$$

$$\Rightarrow \quad B = \sqrt{b^2-a^2}$$

Now, $\tan\theta = \frac{P}{B} = \frac{a}{\sqrt{b^2-a^2}}$

27. If $x = 2\sin^2\theta$ and $y = 2\cos^2\theta + 1$ then $x + y$ is:

(a) 3 **(b)** 2

(c) 1 **(d)** 1/2 1

Ans. *(a)* $x + y = 2\sin^2\theta + 2\cos^2\theta + 1$

$= 2(\sin^2\theta + \cos^2\theta) + 1$

$= 2 + 1 = 3$

28. If the difference between the circumference and the radius of a circle is 37cm, $\pi = 22/7$, the circumference (in cm) of the circle is:

(a) 154 **(b)** 44

(c) 14 **(d)** 7 1

Ans. *(b)* $2\pi r - r = 37$

$r\left\{2\times\left(\frac{22}{7}\right)-1\right\} = 37$

$r = 37 \times \frac{7}{37}$

$r = 7$

circumference $= 2\times\frac{22}{7}\times 7 = 44$ cm

Explanation: Let r cm be the radius of the circle. Now, according to the question,

Circumference – Radius = 37 cm

$$\Rightarrow \quad 2\pi r - r = 37$$

$$\Rightarrow \quad r(2\pi - 1) = 37$$

$$\Rightarrow \quad r\left(2\times\frac{22}{7}-1\right) = 37$$

$$\Rightarrow \quad r\left(\frac{44-7}{7}\right) = 37$$

$$\Rightarrow \quad r\left(\frac{37}{7}\right) = 37$$

$$\Rightarrow \quad r = 7$$

$$\therefore \quad \text{Circumference} = 2\pi r$$

$$= 2\times\frac{22}{7}\times 7$$

$$= 44 \text{ cm}$$

29. The least number that is divisible by all the numbers from 1 to 10 (both inclusive):

(a) 100 **(b)** 1000

(c) 2520 **(d)** 5040 1

Ans. *(c)* 1 = 1

2 = 2 × 1

3 = 3 × 1

4 = 2 × 2

5 = 5 × 1

6 = 2 × 3

7 = 7 × 1

8 = 2 × 2 × 2

9 = 3 × 3

10 = 2 × 5

So, LCM of these numbers = 1 × 2 × 2 × 2 × 3 × 3 × 5 × 7 = 2520

Hence, least number divisible by all the numbers from 1 to 10 is 2520

Explanation: Required number = LCM (1, 2, 3, 4, 5, 6, 7, 8, 9, 10)

∵ 2 = 2, 3 = 3, $4 = 2^2$; 5 = 5 × 1; 6 = 2 × 3, 7 = 7 × 1; $8 = 2^3$; $9 = 3^2$; 10 = 2 × 5

∴ Required number $= 2^3 \times 3^2 \times 5 \times 7$

$= 2520$

30. Three bells ring at intervals of 4, 7 and 14 minutes. All three rang at 6 AM. When will they ring together again?

(a) 6:07 AM **(b)** 6:14 AM

(c) 6:28 AM **(d)** 6:25 AM 1

Ans. *(c) LCM of 4,7,14=28*

Bells will ring together again at 6:28 AM.

Explanation: Time at which bells will ring together = LCM (4, 7, 14)

= LCM (2^2, 7, 2 × 7) = $2^2 \times 7$

= 28 minutes

∵ Since they all rang at 6 AM,

∴ Next they will ring together at 6 + 28 min *i.e.*, 6 : 28 AM

31. What is the age of father, if the sum of the ages of a father and his son in years is 65 and twice the difference of their ages in years is 50?

(a) 40 years **(b) 45 years**

(c) 55 years **(d) 65 years** 1

Ans. *(c) Let age of Father = x years*

Let, age of son = y years

$\therefore x + y = 65$

$2(x - y) = 50$

Solving the above equations

Father's Age = x = 45 years

Explanation: Let the age of the father be x years and that of son be y years.

Then, according to the question,

$\Rightarrow \quad x + y = 65 \quad$ ....(i)

$\Rightarrow \quad 2(x - y) = 50$

$\Rightarrow \quad x - y = 25 \quad$ ....(ii)

Adding equations (i) and (ii), we get

$\Rightarrow \quad 2x = 90$

$\Rightarrow \quad x = 45$

∴ Age of father = x = 45 years

32. What is the value of $(\tan\theta \operatorname{cosec}\theta)^2 - (\sin\theta \sec\theta)^2$:

(a) –1 **(b) 0**

(c) 1 **(d) 2** 1

Ans. *(c)* $(\tan\theta \,.\, \operatorname{cosec}\theta)^2 - (\sin\theta \,.\, \sec\theta)^2$

$= \tan^2\theta \,.\, \operatorname{cosec}^2\theta - \sin^2\theta \,.\, \sec^2\theta$

$$= \left(\frac{\sin^2\theta}{\cos^2\theta}\right)\times\frac{1}{\sin^2\theta} - \sin^2\theta\times\frac{1}{\cos^2\theta}$$

$$= \left(\frac{1-\sin^2\theta}{\cos^2\theta}\right) = \frac{\cos^2\theta}{\cos^2\theta} = 1$$

Explanation: $(\tan\theta \operatorname{cosec}\theta)^2 - (\sin\theta \sec\theta)^2$

$$= \left(\frac{\sin\theta}{\cos\theta}\times\frac{1}{\sin\theta}\right) - \left(\sin\theta\times\frac{1}{\cos\theta}\right)^2$$

$$= \left(\frac{1}{\cos\theta}\right)^2 - \left(\frac{\sin\theta}{\cos\theta}\right)^2$$

$$= \sec^2\theta - \tan^2\theta = 1$$

33. The perimeters of two similar triangles are 26 cm and 39 cm.The ratio of their areas will be :

(a) 2 : 3 **(b) 6 : 9**

(c) 4 : 6 **(d) 4 : 9** 1

Ans. *(a)* $\frac{A_1}{A_2} = \left(\frac{P_1}{P_2}\right)^2 = \left(\frac{26}{39}\right)^2$

$\frac{A_1}{A_2} = \left(\frac{2}{3}\right)^2 = \frac{4}{9}$

Explanation: We know,

Ratio of areas of similar triangles

= (Ratio of their perimeters)^2

= $[26 : 39]^2$

= $[2 : 3]^2$

= (4 : 9)

34. There are 20 vehicles-cars and motor-cycles in a parking area. If there are 56 wheels together, how many cars are there?

(a) 8 **(b) 10**

(c) 12 **(d) 20** 1

Ans. *(a) Let no of cars = x*

Let no of motorcycles = y

$x + y = 20$

$4x + 2y = 56$

Solving the above equations

No. of cars = x = 8.

Explanation: Let the number of cars be x and number of motorcycles be y.

then $\quad x + y = 20 \quad$ ....(i)

and $\quad 4x + 2y = 56$

[∵ Car has 4 wheels and motorcycle has 2 wheels]

$2x + y = 28 \quad$ ....(ii)

Subtracting equation (i) from equation (ii), we get, $\quad x = 8$

∴ Number of cars = x = 8

35. A man goes 15m due west and then 8m due north. How far is he from the starting point?

(a) 7m **(b) 10m**

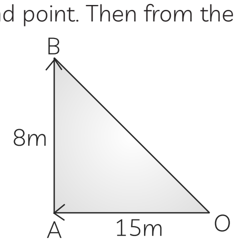
(c) 17m **(d) 23m** 1

Ans. *(c)* $H^2 = P^2 + B^2$

$H^2 = 15^2 + 8^2$

$H = 17m$

Explanation: Let O be his starting point and B be his end point. Then from the figure,



$$OB^2 = OA^2 + AB^2$$

[By pythagoras theorem]

$$= (15)^2 + (8)^2$$
$$= 225 + 64$$
$$= 289 = (17)^2$$

$\Rightarrow$ $OB = 17m$

36. What is the length of an altitude of an equilateral triangle of side 8cm?

(a) $2\sqrt{3}$ cm **(b) $3\sqrt{3}$ cm**

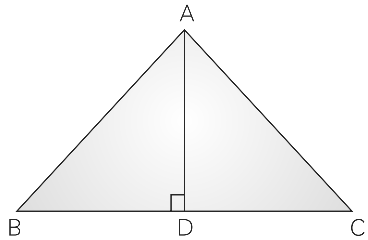
(c) $4\sqrt{3}$ cm **(d) $5\sqrt{3}$ cm** 1

Ans. *(c)* $(\text{altitude})^2 = (\text{side})^2 - \left(\frac{\text{side}}{2}\right)^2$

$= 8^2 - 4^2 = 64 - 16 = 48$

Altitude $= 4\sqrt{3}$ cm.

Explanation: Let AD be the altitude of equilateral triangle ABC of side 8 cm also. Altitude of an equilateral triangle also bisect the base.



$\therefore$ $BD = DC = \frac{1}{2} \times 8 = 4cm$

Now, in ΔABD,

$$AD^2 = AB^2 - BD^2$$
$$= (8)^2 - (4)^2$$
$$= 64 - 16$$
$$= 48$$
$$AD = \sqrt{48} = 4\sqrt{3}$$

37. If the letters of the word RAMANUJAN are put in a box and one letter is drawn at random. The probability that the letter is A is:

(a) $\frac{3}{5}$ **(b) $\frac{1}{2}$**

(c) $\frac{3}{7}$ **(d) $\frac{1}{3}$** 1

Ans. *(d)* $P = \frac{3}{9} = \frac{1}{3}$

Explanation: Total number of letters is the word RAMANUJAN = 9

and number of A in this word = 3

$\therefore$P (getting letter A) = $\frac{3}{9} = \frac{1}{3}$

38. Area of a sector of a circle is $\frac{1}{6}$ to the area of circle. Find the degree measure of its minor arc.

(a) 90° **(b) 60°**

(c) 45° **(d) 30°** 1

Ans. *(b)* $\frac{\theta}{360°} \times \pi r^2 = \frac{1}{6} \times \pi r^2$

$\theta = 60°$

Explanation: Let θ be the central angle of the sector.

Now, area of sector = $\frac{1}{6}$ × Area of circle

$\Rightarrow$ $\frac{\theta}{360} \times \pi r^2 = \frac{1}{6} \times \pi r^2$

$\Rightarrow$ $\theta = 60$

39. A vertical stick 20m long casts a shadow 10m long on the ground. At the same time a tower casts a shadow 50m long. What is the height of the tower?

(a) 30m **(b) 50m**

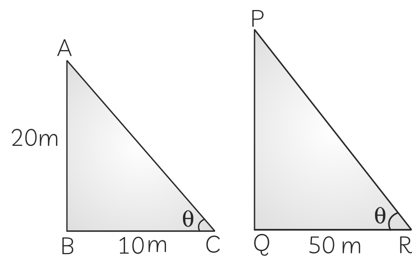
(c) 80m **(d) 100m** 1

Ans. *(d) Height of vertical stick/Shadow of vertical stick = height of tower/shadow of tower*

$\frac{20}{10} = \frac{\text{Height of tower}}{50}$

Height of tower = 100 m.

Explanation: Let AB be the stick and BC be its shadow. Also, let PQ be the tower and QR be its shadow.



At the same time of day, the angle of elevation will be same *i.e.*, $\angle ACB = \angle PRQ = \theta$ and $\angle ABC = \angle PQR = 90°$

Then, $\Delta ABC \sim \Delta PQR$

$\therefore$ $\frac{AB}{BC} = \frac{PQ}{QR}$

$\Rightarrow$ $\frac{20}{10} = \frac{PQ}{50}$

$\Rightarrow$ $PQ = 100m$

40. What is the solution of the pair of linear equations $37x + 43y = 123$, $43x + 37y = 117$?

(a) $x = 2, y = 1$ **(b) $x = -1, y = 2$**

(c) $x = -2, y = 1$ **(d) $x = 1, y = 2$** 1

Ans. (d) $37x + 43y = 123$ ... (i)

$43x+37y = 117$ ...(ii)

Adding (i) and (ii)

$x + y = 3$ (iii)

Subtracting (iii) from (i)

$-x + y = 1$ ...(iv)

Adding (iii) and (iv),

$2y = 4$

$y = 2$

$\Rightarrow$ $x = 1$

$\therefore$ *Solution is $x = 1$ and $y = 2$*

Explanation: On adding the given equation, we get

$$80x + 80y = 240$$

$$\Rightarrow \quad 80(x + y) = 240$$

$$\Rightarrow \quad x + y = 3 \quad ....(i)$$

On subtracting the given equations, we get,

$$-6x + 6y = 6$$

$$\Rightarrow \quad -x + y = 1 \quad ....(ii)$$

Adding equation (i) and (ii), we get

$$2y = 4 \text{ s } y = 2$$

$\therefore$ From (i), $x = 3 - y = 3 - 2 = 1$

$\therefore$ $x = 1, y = 2$

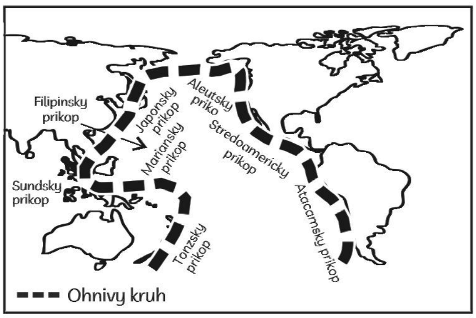
SECTION C **8 marks**

Case Study Based Questions.

(Section C consists of 10 questions of 1 mark each. Any 8 questions are to be attempted.)

Case Study -1
Pacific Ring of Fire

The Pacific Ring of Fire is a major area in the basin of the Pacific Ocean where many earthquakes and volcanic eruptions occur. In a large horseshoe shape, it is associated with a nearly continuous series of oceanic trenches, volcanic arcs, and volcanic belts and plate movements.



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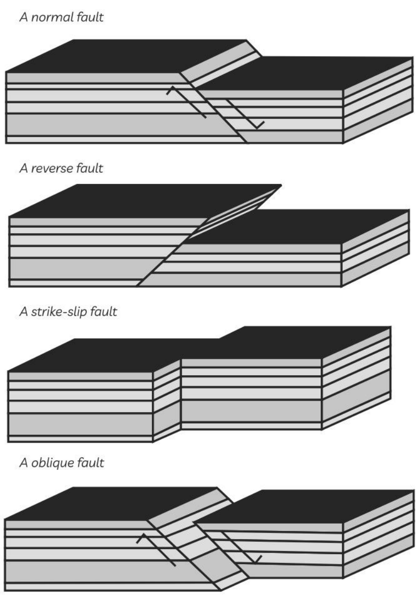
Fault Lines



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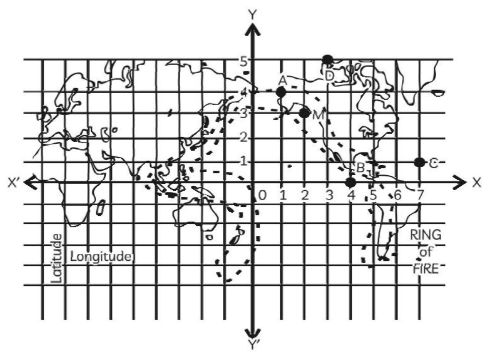
Large faults within the Earth's crust result from the action of plate tectonic forces, with the largest forming the boundaries between the plates.

Energy release associated with rapid movement on active faults is the cause of most earthquakes.

Positions of some countries in the Pacific ring of fire is shown in the square grid below :



Based on the given information, answer the questions NO. 41-45

41. **The distance between the point Country A and Country B is:**

(a) 4 units **(b) 5 units**

(c) 6 units **(d) 7 units** 1

Ans. (b) $AB = \sqrt{\{(4-1)^2+(0-4)^2\}}$

$= \sqrt{3^2+4^2}$

AB = 5 units.

Explanation: From the graph,

Coordinates of country A = (1, 4)

Coordinates of country B = (4, 0)

$\therefore$ Required distance = AB

$$= \sqrt{(4-1)^2 + (0-4)^2}$$

[Using distance formula]

$$= \sqrt{9+16}$$

$$= \sqrt{25} = 5$$

42. Find a relation between x and y such that the point (*x, y*) is equidistant from the Country C and Country D:

(a) $x - y = 2$ **(b) $x + y = 2$**

(c) $2x - y = 0$ **(d) $2x + y = 2$** 1

Ans. *(a) $(x-7)^2 + (y-1)^2 = (x-3)^2 + (y-5)^2$*

$x^2 + 49 - 14x + y^2 + 1 - 2y = x^2 + 9 - 6x + y^2 + 25 - 10y$

Simplifying

$x - y = 2$.

Explanation: From the graph, coordinates are C = (7, 1) and D = (3, 5).

Let the required point be X(x, y), then

$Cx = Dx$ [Given]

are $Cx^2 = Dx^2$

$\Rightarrow \quad (x-7)^2 + (y-1)^2 = (x-3)^2 + (y-5)^2$

[Using distance formula]

$\Rightarrow x^2 - 14x + 49 + y^2 - 2y + 1$

$= x^2 - 6x + 9 + y^2 - 10y + 25$

$\Rightarrow -14x - 2y + 50 = -6x - 10y + 34$

$\Rightarrow -8x + 8y + 16 = 0$

$\Rightarrow \quad x - y - 2 = 0$

or $\quad x - y = 2$

43. The fault line 3x + y – 9 = 0 divides the line joining the Country P(1, 3) and Country Q(2, 7) internally in the ratio :

(a) 3 : 4 **(b) 3 : 2**

(c) 2 : 3 **(d) 4 : 3** 1

Ans. *(a) $3x + y - 9 = 0$*

Let R divide the line in ratio k : 1

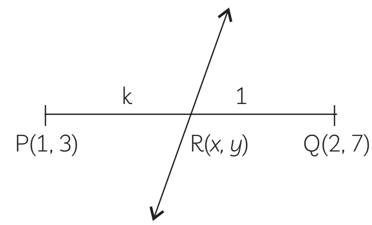
$$R\left(\frac{2k+1}{k+1}\right),\left(\frac{7k+3}{k+1}\right)$$

$$3\left(\frac{2k+1}{k+1}\right)+\left(\frac{7k+3}{k+1}\right)-9=0$$

$$4k - 3 = 0,$$

$$K = \frac{3}{4}$$

Explanation: Let the point R(*x, y*) be the line $3x + y - 9$ which divide the line joining P and Q in the ratio k : 1.



$3x + y - 9 = 0$

Then, using section formula,

$$R(x, y) = \left(\frac{k\times2+1\times1}{k+1}, \frac{k\times7+1\times3}{k+1}\right)$$

$$= \left(\frac{2k+1}{k+1}, \frac{7k+3}{k+1}\right)$$

Since, point R lies on the line $3x + y - 9 = 0$

$$\therefore\ 3\left(\frac{2k+1}{k+1}\right)+\left(\frac{7k+3}{k+1}\right)-9 = 0$$

$\Rightarrow 3(2k + 1) + (7k + 3) - 9(k + 1) = 0$

$\Rightarrow 6k + 3 + 7k + 3 - 9k - 9 = 0$

$\Rightarrow 4k - 3 = 0 \Rightarrow k = \frac{3}{4}$

$\therefore$ Required ratio $= k : 1 = \frac{3}{4} : 1 = 3 : 4$

44. The distance of the Country M from the x-axis is :

(a) 1 units **(b) 2 units**

(c) 3 units **(d) 5 units** 1

Ans. *(c) Distance of M from X-axis $= \sqrt{(2-2)^2} + (0-3)^2 = \sqrt{9} = 3$ units.*

Explanation: $\because$ Coordinates of M = (2, 3)

Distance of M from x-axis = y-coordinate of M = 3

45. What are the co-ordinates of the Country lying on the mid-point of Country A and Country D?

(a) (1, 3) **(b) $\left(2, \frac{a}{2}\right)$**

(c) $\left(4, \frac{5}{2}\right)$ **(d) $\left(\frac{9}{2}, 2\right)$** 1

Ans. *(b) $\left(\frac{1+3}{2}\right),\left(\frac{4+5}{2}\right) = \left(\frac{4}{2}, \frac{9}{2}\right)\left(2, \frac{9}{2}\right)$*

Explanation: Since, A = (1, 4) and D = (3, 5)

$$\therefore \text{ Mid-point of AD} = \left(\frac{1+3}{2}, \frac{4+5}{2}\right)$$

$$= \left(\frac{4}{2}, \frac{9}{2}\right)$$

$$= \left(2, \frac{9}{2}\right)$$

Case Study -2

ROLLER COASTER POLYNOMIALS

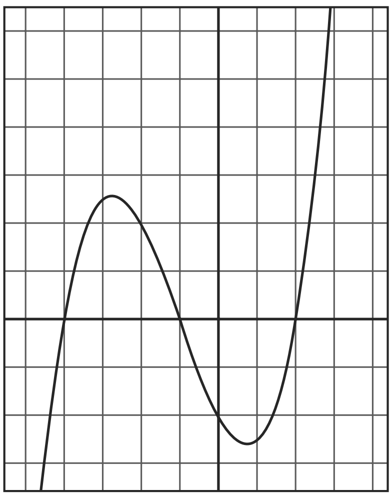
Polynomials are everywhere. They play a key role in the study of algebra, in analysis and on the whole many mathematical problems involving them.

Since, polynomials are used to describe curves of various types engineers use polynomials to graph the curves of roller coasters.

https://images.app.goo.gl/WfcM1aRTHjjqtyT27

Based on the given information, answer the questions NO. 46-50.

46. If the Roller Coaster is represented by the following graph y = p(x) , then name the type of the polynomial it traces.



(a) Linear **(b) Quadratic**

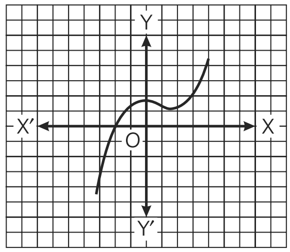
(c) Cubic **(d) Bi-quadratic** 1

Ans. *(c) Cubic*

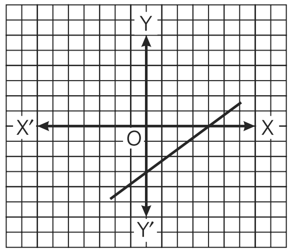
Explanation: Since, the curve of polynomial $p(x)$ intersect x-axis at three points. So, polynomial $p(x)$ has three zeroes. Therefore, it is a cubic polynomial.

47. The Roller Coasters are represented by the following graphs y=p(x). Which Roller Coaster has more than three distinct zeroes?

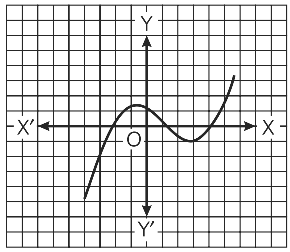
(a)



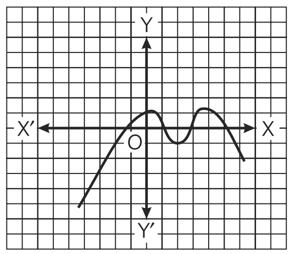
(b)



(c)



(d)



1

Ans. *(d) Four Zeroes as the curve intersects the x-axis at 4 points.*

Explanation: In the curve (d), the curve of the polynomial $p(x)$ intersect x-axis at four points. So the polynomial $p(x)$ has four zeros i.e., more than three zeroes.

48. If the Roller Coaster is represented by the cubic polynomial $t(x) = px^3 + qx^2 + rx + s$, then which of the following is always true:

(a) $s \neq 0$ **(b) $r \neq 0$**

(c) $q \neq 0$ **(d) $p \neq 0$** 1

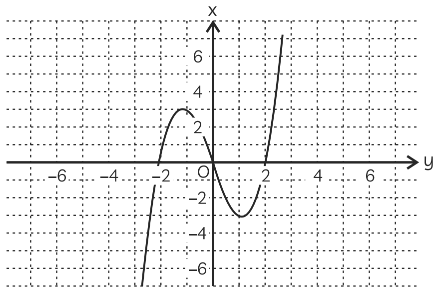
Ans. *(d) $p \neq 0$*

Explanation: The coefficient of highest power of variable of the polynomial should not be zero.

Here, highest power of x is 3, whose coefficient is p.

$\therefore \quad p \neq 0$

49.



If the path traced by the Roller Coaster is represented by the above graph *y* = *p*(*x*), find the number of zeroes?

(a) 0 **(b) 1**

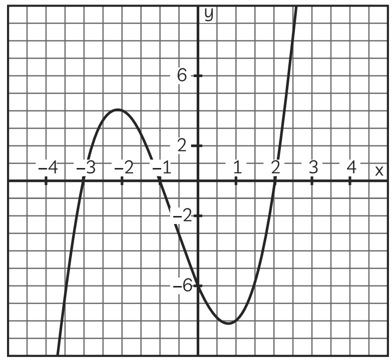
(c) 2 **(d) 3** 1

Ans. *(d) 3 Zeroes as the curve intersects the x-axis at 3 points.*

Explanation: The graph of $p(x)$ intersect x-axis at three points.

$\therefore$ Number of zeros of $p(x)$ = 3

50.



If the path traced by the Roller Coaster is represented by the above graph *y* = *p*(*x*), find its zeroes?

(a) –3, –6, –1 **(b) 2, –6, –1**

(c) –3, –1, 2 **(d) 3, 1, –2** 1

Ans. *(c) –3, –1, 2*

Explanation: The points at which curve of $p(x)$ intersect the x-axis, are its zeroes.

Here, curve of $p(x)$ intersect x-axis at points –3, –1 and 2

$\therefore$ Zeroes of $p(x)$ = –3, –1, 2