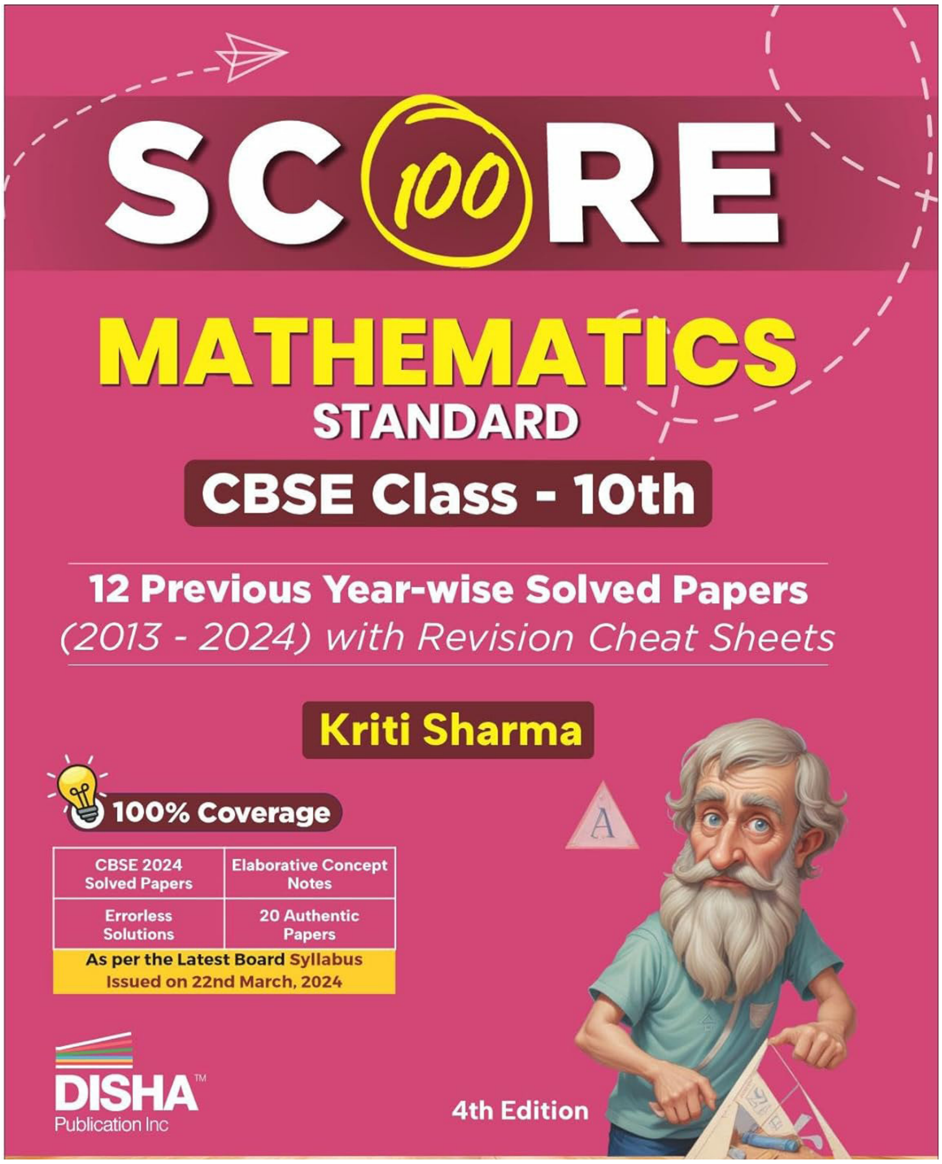
All India 2024 Solved Paper

This sample is taken from the **"Score 100 Mathematics (Standard) CBSE Class 10th 12 Previous Year-wise Solved Papers (2013 - 2024) with Revision Cheat Sheets 4th Edition"**



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All India 2024

CBSE Board Solved Paper

Time Allowed : 3 Hours *Maximum Marks : 80*

General Instructions:

Read the following instruction very carefully and strictly follow them:

(i) This question paper contains **38** questions. All questions are compulsory.

(ii) This question paper is divided into five sections – **A**, **B**, **C**, **D** and **E**.

(iii) In **Section A**, Question no. **1** to **18** are Multiple Choice Questions (MCQs) and questions number **19** and **20** are Assertion - Reason based questions of **1** mark each.

(iv) In **Section B**, Questions no. **21** to **25** are Very Short Answer (VSA) type questions, carrying **2** marks each.

(v) In **Section C**, Questions no. **26** to **31** are Short Answer (SA) type questions, carrying **3** marks each.

(vi) In **Section D**, Questions no. **32** to **35** are Long Answer (LA) type questions, carrying **5** marks each.

(vii) In **Section E**, Question no. **36** to **38** are Case Study Based questions, carrying **4** marks each. Internal choice is provided in **2** marks questions in each Case Study.

(viii) There is no overall choice. However, an internal choice has been provided in **2** questions in **Section B**, **2** questions in **Section C**, **2** questions in **Section D** and **3** questions in **Section E**.

(ix) Draw neat diagrams wherever required. Take $\pi = \frac{22}{7}$ wherever required, if not stated.

(x) Uses of calculator is **not** allowed.

SECTION - A

This section comprises Multiple Choice Questions (MCQs) of 1 mark each. 20 × 1 = 20

1. The next (4^{th}) term of the A.P. $\sqrt{18}, \sqrt{50}, \sqrt{98}, \ldots$ is:

(a) $\sqrt{128}$ (b) $\sqrt{140}$

(c) $\sqrt{162}$ (d) $\sqrt{200}$

2. If $\frac{x}{3} = 2\sin A, \frac{y}{3} = 2\cos A$, then the value of $x^2 + y^2$ is:

(a) 36 (b) 9

(c) 6 (d) 18

3. If $4 \sec \theta - 5 = 0$, then the value of $\cot \theta$ is:

(a) $\frac{3}{4}$ (b) $\frac{4}{5}$ (c) $\frac{5}{3}$ (d) $\frac{4}{3}$

4. Which out of the following type of straight lines will be represented by the system of equations $3x + 4y = 5$ and $6x + 8y = 7$?

(a) Parallel (b) Intersecting

(c) Coincident (d) Perpendicular to each other

5. The ratio of the sum and product of the roots of the quadratic equation $5x^2 - 6x + 21 = 0$ is:

(a) 5 : 21 (b) 2 : 7

(c) 21 : 5 (d) 7 : 2

6. For the data 2, 9, x + 6, 2x + 3, 5, 10, 5; if the mean is 7, then the value of x is:

(a) 9 (b) 6

(c) 5 (d) 3

7. One ticket is drawn at random from a bag containing tickets numbered 1 to 40. The probability that the selected ticket has a number which is a multiple of 7 is:

(a) $\frac{1}{7}$ (b) $\frac{1}{8}$

(c) $\frac{1}{5}$ (d) $\frac{7}{40}$

8. The perimeter of the sector of a circle of radius 21 cm which subtends an angle of 60° at the centre of circle, is:

(a) 22 cm (b) 43 cm

(c) 64 cm (d) 462 cm

9. The length of an arc of a circle with radius 12cm is 10π cm. The angle subtended by the arc at the centre of the circle, is:

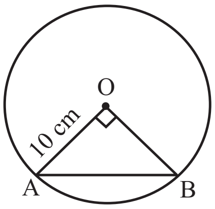
(a) 120° (b) 6°

(c) 75° (d) 150°

10. The greatest number which divides 281 and 1249, leaving remainder 5 and 7 respectively, is:
(a) 23 (b) 276
(c) 138 (d) 69

11. The number of terms in the A.P. 3, 6, 9, 12, ... , 111 is:
(a) 36 (b) 40
(c) 37 (d) 30

12. The chord of a circle of radius 10 cm subtends a right angle at its centre. The length of the chord (in cm) is:



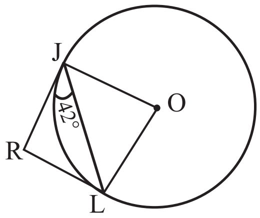
(a) $5\sqrt{2}$ (b) $10\sqrt{2}$
(c) $\frac{5}{\sqrt{2}}$ (d) 5

13. The LCM of three numbers 28, 44, 132 is:
(a) 258 (b) 231
(c) 462 (d) 924

14. If the product of two co-prime numbers is 553, then their HCF is:
(a) 1 (b) 553
(c) 7 (d) 79

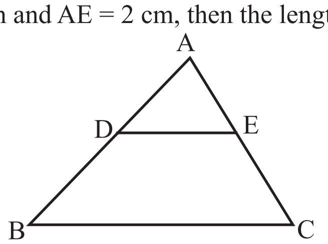
15. If α and β are the zeroes of the polynomial $p(x) = kx^2 - 30x + 45k$ and $\alpha + \beta = \alpha\beta$, then the value of k is:
(a) $-\frac{2}{3}$ (b) $-\frac{3}{2}$
(c) $\frac{3}{2}$ (d) $\frac{2}{3}$

16. In the given figure, RJ and RL are two tangents to the circle. If $\angle RJL = 42°$, then the measure of $\angle JOL$ is:



(a) 42° (b) 84°
(c) 96° (d) 138°

17. In the given figure, in Δ ABC, DE || BC. If AD = 2.4 cm, DB = 4 cm and AE = 2 cm, then the length of AC is:



(a) $\frac{10}{3}$ cm (b) $\frac{3}{10}$ cm
(c) $\frac{16}{3}$ cm (d) 1.2 cm

18. If a vertical pole of length 7.5 m casts a shadow 5m long on the ground and at the same time, a tower casts a shadow 24 m long, then the height of the tower is:
(a) 20 m (b) 40 m
(c) 60 m (d) 36 m

Questions number 19 and 20 are Assertion and Reason based questions .Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is correct explanation of Assertion (A).
(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true but Reason (R) is false.
(d) Assertion (A) is false but Reason (R) are true.

19. **Assertion (A) :** ABCD is a trapezium with DC || AB. E and F are points on AD and BC respectively, such that EF || AB. Then $\frac{AE}{ED} = \frac{BF}{FC}$.

Reason (R) : Any line parallel to parallel sides of trapezium divides the non-parallel sides proportionally.

20. **Assertion (A) :** Degree of a zero polynomial is not defined.

Reason (R) : Degree of a non-zero constant polynomial is 0.

SECTION - B

This section comprises Very Short Answer (VSA) type questions of 2 marks each. **5 × 2 = 10**

21. (a) If two tangents inclined at an angle of 60° are drawn to a circle of radius 3cm, then find the length of each tangent.

OR

(b) Prove that the tangents drawn at the ends of diameter of a circle are parallel.

22. Evaluate: $\frac{2\tan 30°.\sec 60°.\tan 45°}{1-\sin^2 60°}$

23. If α, β are zeroes of the polynomial $p(x) = 5x^2 - 6x + 1$, then find the value of $\alpha + \beta + \alpha\beta$.

24. (a) Find the ratio in which the point P(–4, 6) divides the line segment joining the points A(–6, 10) and B(3, –8).

OR

(b) Prove that the points (3, 0), (6, 4) and (–1, 3) are the vertices of an isosceles triangle.

25. A carton consists of 60 shirts of which 48 are good, 8 have major defects and 4 have minor defects. Nigam, a trader, will accept the shirts which are good but Anmol, another trader, will only reject the shirts which have major defects. One shirt is drawn at random from the carton. Find the probability that it is acceptable to Anmol.

SECTION - C

This section comprises Short Answer (SA) type questions of 3 marks each. **$6 \times 3 = 18$**

26. (a) Prove that $\sqrt{3}$ is an irrational number.

OR

(b) Prove that $\left(\sqrt{2}+\sqrt{3}\right)^2$ is an irrational number, given that $\sqrt{6}$ is an irrational number.

27. (a) If the sum of the first 14 terms of an A. P. is 1050 and the first term is 10, then find the 20^{th} term and the n^{th} term.

OR

(b) The first term of an A. P. is 5, the last term is 45 and the sum of all the terms is 400. Find the number of terms and the common difference of the A. P.

28. Prove that the parallelogram circumscribing a circle is a rhombus.

29. Prove that: $\dfrac{\tan A}{1-\cot A}+\dfrac{\cot A}{1-\tan A}=1+\sec A \operatorname{cosec} A$

30. Three unbiased coins are tossed simultaneously. Find the probability of getting:

(i) at least one head.

(ii) exactly one tail.

(iii) two heads and one tail.

31. An arc of a circle of radius 10 cm subtends a right angle at the centre of the circle. Find the area of the corresponding major sector. (Use $\pi = 3.14$)

SECTION - D

This section comprises Long Answer (LA) type questions of 5 marks each. **$4 \times 5 = 20$**

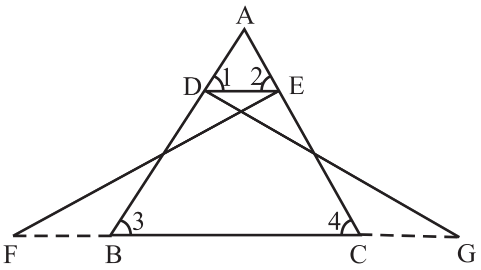
32. (a) Find the value of 'k' for which the quadratic equation $(k + 1)x^2 - 6(k + 1)x + 3(k + 9) = 0, k \neq -1$ has real and equal roots .

OR

(b) The age of a man is twice the square of the age of his son. Eight years hence, the age of the man will be 4 years more than three times the age of his son. Find their present ages.

33. From a point on a bridge across the river, the angles of depressions of the banks on opposite sides of the river are 30° and 60° respectively. If the bridges is at a height of 4 m from the banks, find the width of the river.

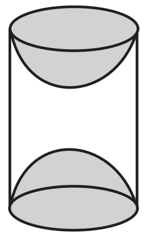
34. (a) In the given figure, $\Delta FEC \cong \Delta GDB$ and $\angle 1 = \angle 2$. Prove that $\Delta ADE \sim ABC$.



OR

(b) Sides AB and AC and median AD of a Δ ABC are respectively proportional to sides PQ and PR and median PM of another Δ PQR. Show that $\Delta ABC \sim \Delta PQR$.

35. A wooden article was made by scooping out a hemisphere from each end of a solid cylinder, as shown in the figure. If the height of the cylinder is 5.8 cm and its base is of radius 2.1 cm, find the total surface area of the article.



SECTION - E

This section comprises of 3 Case Study Based questions of 4 marks each. **$3 \times 4 = 12$**

Case Study – 1

36. Essel World is one of India's largest amusement parks that offers a diverse range of thrilling rides, water attractions and entertainment options for visitors of all ages. The park is known for its iconic "Water Kingdom" section, making it a popular destination for family outings and fun-filled adventure. The ticket charges for the park are ₹ 150 per child and ₹250 per adult.

On a day, the cashier of the park found that 300 tickets were sold and an amount of ₹55,000 was collected.

Based on the above, answer the following questions:

(i) If the number of children visited be x and the number of adults visited by y, then write the given situation algebraically . **1**

(ii) (a) How many children visited the amusement park that day? **2**

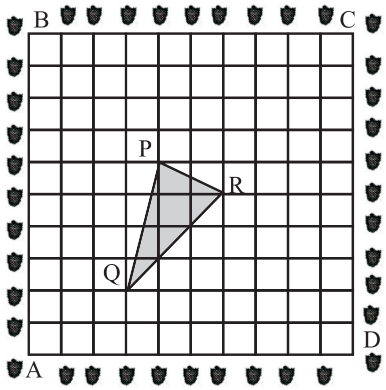
OR

(b) How many adults visited the amusement park that day? **2**

(iii) How much amount will be collected if 250 children and 100 adults visit the amusement park? **1**

Case Study – 2

37. A garden is in the shape of a square. The gardener grew saplings of Ashoka tree on the boundary of the garden at the distance of 1m from each other. He wants to decorate the garden with rose plants. He chose a triangular region inside the garden to grow rose plants. In the above situation, the gardener took help from the students of class 10. They made a chart for it which looks like the given figure.



Based on the above answer the following questions:

(i) If A is taken as origin, what are the coordinates of the vertices of ΔPQR? **1**

(ii) (a) Find distances PQ and QR. **2**

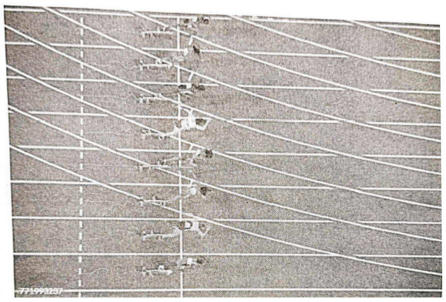
OR

(b) Find the coordinates of the point which divides the line segment joining point P and R in the ratio 2 : 1 internally. **2**

(iii) Find out if ΔPQR is an isosceles triangle **1**

Case Study – 3

38. Activities like running or cycling reduce stress and the risk of mental disorders like depression. Running helps build endurance. Children develop stronger bones and muscles and are less prone to gain weight. The physical education teacher of a school has decided to conduct an inter school running tournament in his school premises. The time taken by a group of students to run 100m, was notes as follows:



Time (in Second)	0–20	20–40	40–60	60–80	80–100
Number of students	8	10	13	6	3

Based on the above, answer the following questions:

(i) What is the median class of the above given data? **1**

(ii) (a) Find the mean time taken by the students to finish the race. **2**

OR

(b) Find the mode of the above given data. **2**

(iii) How many students given took time less than 60 seconds. **1**

Solutions

1. **(c)** A. P is $\sqrt{18}, \sqrt{50}, \sqrt{98} ----$

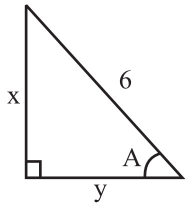
We can write as $3\sqrt{2}, 5\sqrt{2}, 7\sqrt{2} ----$

$d = a_2 - a_1 = a_3 - a_3 = 2\sqrt{2}$

$a_4 = a + 3d$

$= 3\sqrt{2} + 3 \times 2\sqrt{2} = 9\sqrt{2} = \sqrt{162}$ **[1 Mark]**

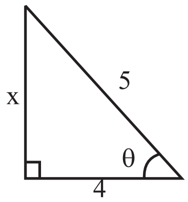
2. **(a)** $\sin A = \frac{x}{6}, \cos A = \frac{y}{6}$



$\therefore x^2 + y^2 = (6)^2 = 36$ **[1 Mark]**

3. **(d)** $4 \sec \theta - 5 = 0$

$\sec \theta = \frac{5}{4}$



By Pythagoras Theorem, $x = 3$

$\cot \theta = \frac{4}{3}$ **[1 Mark]**

4. **(a)** Given $3x + 4y = 5; 6x + 8y = 7$

$\frac{3}{6} = \frac{4}{8} \neq \frac{5}{7}$

$\Rightarrow \frac{1}{2} = \frac{1}{2} \neq \frac{5}{7}$

Parallel lines **[1 Mark]**

5. **(b)** $\frac{\text{Sum of roots}}{\text{Product of roots}} = \frac{\frac{-(-6)}{5}}{\frac{21}{5}} = \frac{6}{5} \times \frac{5}{21} = \frac{6}{21} = \frac{2}{7}$

[1 Mark]

6. **(d)** $\frac{\text{Sum of all numbers in data}}{\text{Total numbers in data}} = \text{Mean}$

$\Rightarrow \frac{2 + 9 + (x+6) + (2x+3) + 5 + 10 + 5}{7} = 7$

$\Rightarrow 3x + 40 = 49$

$\Rightarrow 3x = 49 - 40 = 9$

$\Rightarrow x = \frac{9}{3} = 3$ **[1 Mark]**

7. **(b)** We know that multiple of 7 between 1 to 40 is 7, 14, 21, 28, 35

Total number of outcomes $= 40$

Number of favourable outcomes which are multiple of 7 is $= 5$

Probability $\frac{5}{40} = \frac{1}{8}$ **[1 Mark]**

8. **(a)** Perimeter of sector of circle $= \frac{60°}{360°} \times 2\pi r$

$= \frac{60°}{360°} \times 2 \times \frac{22}{7} \times 21 = 22\text{cm}$ **[1 Mark]**

9. **(d)** Subtended angle $= \frac{\text{arc length}}{\text{radius}} = \frac{10\pi}{12} = \frac{10 \times 180°}{12}$

$= 150°$ **[1 Mark]**

10. **(c)** Since, the number divides 281 an 1249 and leaves the reminder 5 and 7 respectively. So, 281–5 = 276 and 1249 – 7 = 1242 is completely divided by the required number.

$\therefore$ The greatest such number = H.C.F (276, 1242) = 138.

[1 Mark]

11. **(c)** $a = 3, d = 6–3 = 3$

$T_n = 111$

$\Rightarrow a + (n-1)d = 111 \Rightarrow 3 + (n-1)3 = 111$

$\Rightarrow 1 + n - 1 = 37 \Rightarrow n = 37$ **[1 Mark]**

12. **(b)** $\theta = 90°$, radius r = 10 cm = OA = OB

$\because$ OAB is a right angle triangle.

$AO^2 + OB^2 = AB^2$

$\Rightarrow 10^2 + 10^2 = AB^2$

$\Rightarrow AB^2 = 200$

$\Rightarrow AB = 10\sqrt{2}$ **[1 Mark]**

13. **(d)** $28 = \boxed{2} \times \boxed{2} \times 7$

$44 = \boxed{2} \times \boxed{2} \times 11$

$132 = \boxed{2} \times \boxed{2} \times 3 \times 11$

$\therefore$ LCM (28, 44, 132) = 2 × 2 × 3 × 7 × 11 = 924

[1 Mark]

14. **(a)** Since, the numbers are co-prime. So, there will not be any common factor.

$\therefore$ HCF = 1 **[1 Mark]**

Note

HCF of prime number is 1.

15. **(d)** Given, $p(x) = kx^2 - 30x + 45k$

Sum of zeroes

$$= \alpha + \beta = \frac{-(-30)}{k} = \frac{30}{k}$$

and product of zeroes

$$= \alpha\beta = \frac{45k}{k} = 45$$

Since $\alpha + \beta = \alpha\beta$

$$\Rightarrow \frac{30}{k} = 45 \Rightarrow k = \frac{2}{3}$$ **[1 Mark]**

16. **(b)** Since RJ is a tangent to the circle

$\therefore \angle RJO = 90° \Rightarrow \angle RJL + \angle LJO = 90°$

$42° + \angle LJO = 90° \Rightarrow \angle LJO = 48°$

$\Rightarrow \angle JLO = \angle LJO = 48°$ [$\because$ OJ = OL]

In ΔOLJ, $\angle JLO + \angle LJO + \angle LOJ = 180°$

$\Rightarrow 48° + 48° + \angle LOJ = 180°$

$\Rightarrow \angle LOJ = 84°$ **[1 Mark]**

17. **(c)** $\because$ DE||BC $\Rightarrow \angle ADE = \angle ABC$

and $\angle AED = \angle ACB$

Also, $\angle A = \angle A$

So, $\Delta ADE \cong \Delta ABC$

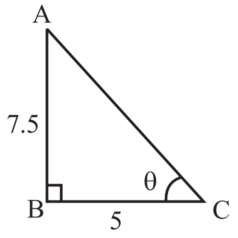
$$\therefore \frac{AD}{DB} = \frac{AE}{EC} \Rightarrow \frac{2.4}{4} = \frac{2}{EC}$$

$$\Rightarrow EC = \frac{10}{3}$$

Now, $AC = AE + EC = 2 + \frac{10}{3} = \frac{16}{3}$ cm **[1 Mark]**

18. **(d)** Let AB be the pole and BC is it shadow.

AB = 7.5 and BC = 5



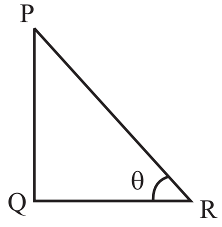
Let $\angle ACB = \theta$

$$\therefore \tan\theta = \frac{7.5}{5} = \frac{3}{2}$$

Now, Let PQ be the tower and QR be its shadow.

Since, we are measuring the shadow at the same time. So, $\angle ACB = \angle PRQ$

$\angle PRQ = \theta$



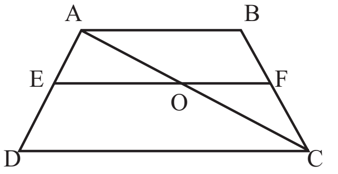
Now, $\tan\theta = \frac{PQ}{QR}$

$$\Rightarrow \frac{3}{2} = \frac{PQ}{24} \Rightarrow PQ = 36cm$$ **[1 Mark]**

Note

At same times Sun's altitude will be same.

19. **(a)**



$\because$ AB|| CD and AB||EF $\Rightarrow$ CD||EF

Draw a line which connects A to C.

In ΔADC, $\frac{AE}{ED} = \frac{OA}{OC}$ ...(i)

In ΔABC, $\frac{BF}{FC} = \frac{OA}{OC}$ ...(iii)

From (i) & (ii),

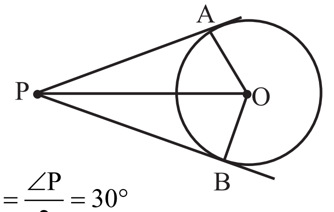
$$\frac{AE}{ED} = \frac{BF}{FC}$$ **[1 Mark]**

20. **(b)** Degree of a zero polynomial is not defined as it is of the form $0.x^n + 0.x^{n-1} + ...+ 0.x + 0$ where n can be any integer.

Degree of a non-zero constant polynomial is 0 as it can be written as

$p(x) = k = kx°, k \in R - \{0\}$ **[1 Mark]**

21. **(a)** Given: $\angle P = 60°$



$$\because \angle APQ = \frac{\angle P}{2} = 30°$$

r = OA = 3cm

Also, $\angle PAO = 90°$ **[½ Mark]**

In right angle triangle PAO,

$$\tan\angle APO = \frac{OB}{AP}$$ **[½ Mark]**

$$\Rightarrow \tan 30° = \frac{3}{AP}$$

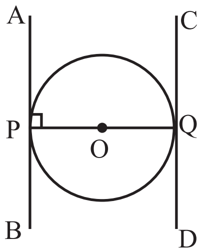
$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{3}{AP} \Rightarrow AP = 3\sqrt{3} \text{ cm.}$$

$\because PB = PA = 3\sqrt{3}$ cm

So, $AP = PB = 3\sqrt{3}$ cm **[1 Mark]**

(OR)

(b) Given O be the centre of the of circle and PQ be the diameter. AB and CQ are tangents of circle at point P and Q respectively.



Claim: AB||CD. **[1 Mark]**

Proof: $\because$ AB is tangent at P. $\Rightarrow$ AB $\perp$ PQ.

and CD is tangent at Q $\Rightarrow$ CD $\perp$ PQ

Now, AB and CD are perpendicular to PQ.

$\therefore$ AB||CD. **[1 Mark]**

22. $\dfrac{2\tan 30°.\sec 60°.\tan 45°}{1-\sin^2 60}$

$$=\frac{2\times\frac{1}{\sqrt{3}}\times 2\times 1}{1-\left(\frac{\sqrt{3}}{2}\right)^2}=\frac{\frac{4}{\sqrt{3}}}{1-\frac{3}{4}}=\frac{\frac{4}{\sqrt{3}}}{\frac{1}{4}}=\frac{16}{\sqrt{3}}$$

$=\dfrac{16\sqrt{3}}{3}$. **[2 Marks]**

23. Given: $p(x) = 5x^2 - 6x + 1$

Sum of zeroes $= \alpha + \beta = \dfrac{6}{5}$

Product of zeroes $= \alpha\beta = \dfrac{1}{5}$ **[1 Mark]**

Now, $\alpha + \beta + \alpha\beta + = \dfrac{6}{5}+\dfrac{1}{5}=\dfrac{7}{5}$ **[1 Mark]**

24. **(a)** Let (m : 1) is the required ratio.

$$\therefore \left(\frac{(-6)m+3\times 1}{m+1},\frac{10m+(-8)\times 1}{m+1}\right)=(-4,6)$$

$$\Rightarrow \left(\frac{-6m+3}{m+1},\frac{10m-8}{m+1}\right)=(-4,6)$$

Compare both sides, we get **[1 Mark]**

$\dfrac{-6m+3}{m+1}=-4$

$\Rightarrow$ $-6m + 3 = -4m - 4$

$\Rightarrow m=\dfrac{7}{2}$

and $\dfrac{10m-8}{m+1}=6$

$\Rightarrow$ $10m - 8 = 6m + 6$

$\Rightarrow m=\dfrac{7}{2}$

$\therefore$ The ratio is (m : 1)

$=\left(\dfrac{7}{2}:1\right)=(7:2)$ **[1 Mark]**

OR

(b) Let A ≡ (3, 0), B ≡ (6, 4) and C ≡ (–1, 3).

$AB=\sqrt{(6-3)^2+(4-0)^2}=\sqrt{9+16}=5$

$BC=\sqrt{(6+1)^2+(4-3)^2}=\sqrt{49+1}=\sqrt{50}$ **[1 Mark]**

$CA=\sqrt{(3+1)^2+(0-3)^2}=\sqrt{16+9}=5$

Since, only two sides of the triangle have the same length.

$\therefore$ The given vertices forms a isosceles triangle. **[1 Mark]**

25. n(S) = 60

$\because$ Anmol accepts good shirts and shirts with minor defects.

$\therefore$ n(E) = 48 + 4 = 52 **[1 Mark]**

Now, the required probability

$P=\dfrac{n(E)}{n(S)}=\dfrac{52}{60}=\dfrac{13}{15}$ **[1 Mark]**

26. **(a)** Suppose, if possible, $\sqrt{3}$ is a rational number. Then, there exist integers a and b such that $\dfrac{a}{b}=\sqrt{3}$, where a and b co-primes.

$\Rightarrow$ $a^2 = 3b^2$ ...(i) **[1 Mark]**

$\Rightarrow$ 3 divides a^2

$\Rightarrow$ 3 divides a, (3 is a prime number)

$\Rightarrow$ a = 3p for some integer p

from (i), $(3p)^2 = 3b^2$

$\Rightarrow$ $3p^2 = b^2$ **[1 Mark]**

$\Rightarrow$ 3 divides b^2 $\Rightarrow$ 3 divides b.

$\because$ 3 divides a and b both.

Which is a contradiction because a and b are co-primes

So, our supposition was not correct.

$\Rightarrow \sqrt{3}$ is an irrational number. **[1 Mark]**

OR

(b) $\left(\sqrt{2}+\sqrt{3}\right)^2=\left(\sqrt{2}\right)^2+\left(\sqrt{3}\right)^2+2\left(\sqrt{2}\right)\left(\sqrt{3}\right)$

[1 Mark]

$=2+3+2\sqrt{6}$

$=5+2\sqrt{6}$ **[1 Mark]**

$\because \sqrt{6}$ is an irrational number.

$\Rightarrow 5+2\sqrt{6}$ is an irrational number.

$\Rightarrow \left(\sqrt{2}+\sqrt{3}\right)^2$ is an irrational number. **[1 Mark]**

Note

Product of rational and irrational number is irrational.

27. **(a)** a = 10

$S_{14} = 1050 \Rightarrow \frac{14}{2}[2a + 13d] = 1050$ **[1 Mark]**

$\Rightarrow$ 20 + 13d = 150 $\Rightarrow$ 13d = 130

$\Rightarrow$ d = 10 **[1 Mark]**

T_{20} = a + 19d = 10 + 19 × 10 = 200

T_n = a + (n – 1)d = 10 + (n – 1) 10 = 10n. **[1 Mark]**

OR

(b) a = 5, l = 45

$S_n = 400 \Rightarrow \frac{n}{2}[a + l] = 400$

$\Rightarrow n[5 + 45] = 800 \Rightarrow n = 16$ **[1½ Marks]**

Since, l = 45 $\Rightarrow$ a + (n – 1)d = 45

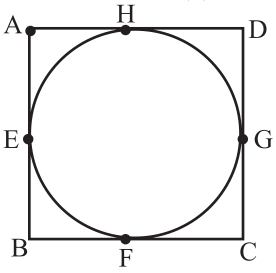
$\Rightarrow$ 5 + (16 – 1) d = 45

$\Rightarrow 15d = 40 \Rightarrow d = \frac{8}{3}$ **[1½ Marks]**

28. Let ABCD be the parallelogram circumscribing the circle.

$\Rightarrow$ AD||BC and AD = BC ...(1)

and AB||CD and AB = CD ...(2)



[1 Mark]

$\because$ AH and AE are tangent from A to the circle.

$\Rightarrow$ AE = AH ...(3)

Since, BE and BF are tangent from B to the circle

$\Rightarrow$ BE = BF ...(4)

Also, CF and CG are tangent from C to circle

$\Rightarrow$ CG = CF ...(5)

Also, DG and DH are tangent from D to circle

$\Rightarrow$ DG = DH ...(6)

Adding (3), (4), (5) and (6); **[1 Mark]**

AE + BE + CG + DG = AH + BF + CF + DH.

$\Rightarrow$ AB + CD = (AH + DH) + (BF + CF)

$\Rightarrow$ AB + AB = AD + BC

$\Rightarrow$ 2AB = AD + AD {AD = BC}

$\Rightarrow$ 2AB = 2AD $\Rightarrow$ AB = AD ...(7)

from equation (1), (2) and (7), we get:

AB = BC = AD = BC

$\Rightarrow$ ABCD is a rhombus **[1 Mark]**

29. L.H.S. $= \frac{\tan A}{1 - \cot A} + \frac{\cot A}{1 - \tan A}$

$= \frac{\frac{\sin A}{\cos A}}{1 - \frac{\cos A}{\sin A}} + \frac{\frac{\cos A}{\sin A}}{1 - \frac{\sin A}{\cos A}}$

$= \frac{\sin^2 A}{\cos A(\sin A - \cos A)} + \frac{\cos^2}{\sin A(\cos A - \sin A)}$ **[1 Mark]**

$= \frac{\sin^2 A}{\cos A(\sin A - \cos A)} + \frac{\cos^2 A}{\sin A(\cos A - \sin A)}$

$= \frac{\sin^3 A - \cos^3 A}{\sin A \cos A(\sin A - \cos A)}$ **[1 Mark]**

$= \frac{(\sin A - \cos A)(\sin^2 A + \cos^2 A + \cos A \sin A)}{\sin A \cos A(\sin A - \cos A)}$

$= \frac{1 + \cos A \sin A}{\sin A \cos A} = 1 + \text{cosec } A \sec A$

= R.H.S. **[1 Mark]**

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

(i) E_1 = {HHH, HHT, HTH, HTT; THH, THT, TTH}.

$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{7}{8}$ **[1 Mark]**

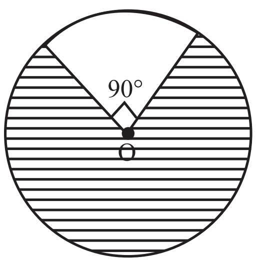
(ii) E_2 = {THH, HTH, HHT}

$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{3}{8}$ **[1 Mark]**

(iii) E_3 = {HHT; HTH, THH}

$P(E_3) = \frac{n(E_3)}{n(S)} = \frac{3}{8}$ **[1 Mark]**

31. r = 10 cm



[1 Mark]

The required area $= \frac{3}{4} \times \pi r^2$ **[½ Mark]**

$= \frac{3 \times \pi \times 100}{4} = 75\pi$

= 75 × 3.14

= 235.5 cm^2 **[1½ Marks]**

Note

Area of quadrant $= \frac{1}{4}\pi r^2$

32. **(a)** Given:

$(k + 1)x^2 – 6(k + 1) x + 3 (k + 9) = 0, k \neq –1$ ...(1)

Equation (1) has real and equal roots, so D = 0

$\Rightarrow$ $36(k + 1)^2 – 12(k + 9) (k + 1) = 0$ **[2 Marks]**

$\Rightarrow$ $12 (k + 1) [3k + 3 – k – 9] = 0$

$\Rightarrow$ $(k + 1) (2k – 6) = 0$ **[1 Mark]**

$\Rightarrow$ $k = –1, 3.$

$\because$ $k \neq –1$

$\therefore$ $k = 3$ **[2 Marks]**

OR

(b) Let the age of the son is x years.

$\therefore$ The age of the man = $2x^2$

Now, after 8 years.

Son's age = (x + 8) **[1 Mark]**

$\therefore$ Man's age = $2x^2 + 8$

$\Rightarrow$ $3(x + 8) + 4 = 2x^2 + 8$ (According to Question)

$\Rightarrow$ $2x^2 – 3x – 20 = 0$ **[2 Marks]**

$\Rightarrow$ $2x^2 – 8x + 5x – 20 = 0$

$\Rightarrow$ $(x – 4) (2x + 5) = 0$ **[1 Mark]**

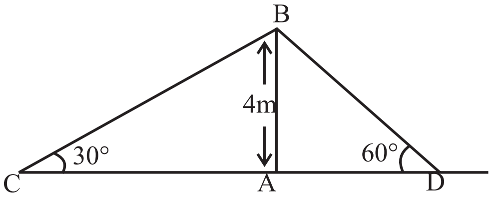
$\Rightarrow$ $x = 4, -\frac{2}{5}$

Age can't be negative.

So, x = 4

Now, age of the man = $2(4)^2$ = 32 years **[1 Mark]**

33.



Let AB be the height of the bridge and C and D are the two opposite sides of the river. **[1 Mark]**

AB = 4m.

In ΔABD; $\tan 60° = \frac{AB}{AD} \Rightarrow \sqrt{3} = \frac{4}{AD} \Rightarrow AD = \frac{4}{\sqrt{3}}$ m

[1 Mark]

In ΔABC; $\tan 30° = \frac{AB}{CA} \Rightarrow \frac{1}{\sqrt{3}} = \frac{4}{CA} \Rightarrow CA = 4\sqrt{3}$m.

[1 Mark]

$\therefore$ Width of river = CA + AD = $4\sqrt{3} + \frac{4}{\sqrt{3}} = \frac{16}{\sqrt{3}} = \frac{16\sqrt{3}}{3}$ cm

[2 Marks]

34. **(a)** $\because \angle 1 = \angle 2$

$\Rightarrow$ AE = AD ...(1)

Also, ΔFEC ≅ ΔGDB **[1 Mark]**

$\Rightarrow$ CE = BD ...(2) (By CPCT)

Equation (2)/(1): **[1 Mark]**

$\frac{CE}{AE} = \frac{BD}{AD}$ **[1 Mark]**

By the converse of the basic proportionality theorem, we have

$\Rightarrow$ BC||DE **[1 Mark]**

$\Rightarrow$ $\angle 1 = \angle 3$ & $\angle 2 = \angle 4$ (corresponding angle)

and $\angle A = \angle A$ (common angle)

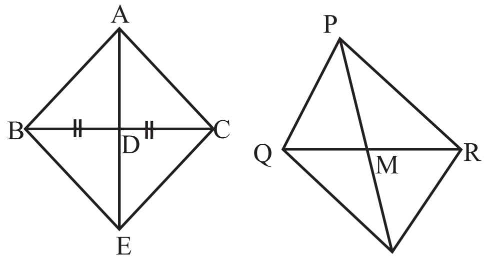
$\therefore$ ΔADE ~ ΔABC **[1 Mark]**

OR

(b) Given: In ΔABC and ΔPQR, AD is the median of ΔABC and PM is median of ΔPQR.

Also,

$\frac{AB}{PQ} = \frac{AC}{PR} = \frac{AD}{PM}$ ...(1)



Let us extend AD and PM to point E & M respectively such that **[½ Mark]**

AD =DE & PM = ML ...(2)

Now, join B and C to E and Q and R to L.

Also, BD = DC and AD = DE **[½ Mark]**

$\because$ In □ABEC, diagonals AE and BC bisect each other at D

$\therefore$□ABEC is a parallelogram.

$\Rightarrow$ AC = BE and AB = CE ...(3)

Similarly, we can prove that □PQLR is a parallelogram

PQ = QL and PQ = LR ...(4)

From equation (1), (3) & (4), we get:

$\frac{AB}{PQ} = \frac{BE}{QL} = \frac{AD}{PM}$ **[1 Mark]**

$\Rightarrow \frac{AB}{PQ} = \frac{BE}{QL} = \frac{2AD}{2PM}$

$\Rightarrow \frac{AB}{PQ} = \frac{BE}{QL} = \frac{AE}{PL}$

$\therefore$ ΔABE ~ ΔPQL (By SSS similarity criterion)

$\Rightarrow$ $\angle BAE = \angle QPL$ ...(5) **[1 Mark]**

Similarly, we can prove that ΔAEC ~ ΔPLR

$\Rightarrow$ $\angle CAE = \angle RPL$ ...(6)

From equation (5) & (6):

$\angle BAE + \angle CAE = \angle QPL + \angle RPL$

$\Rightarrow \angle CAB = \angle RPQ$ ...(7) **[1 Mark]**

In ΔABC & ΔPQR

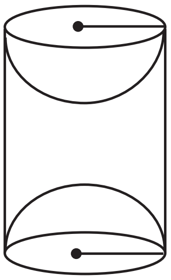
$\Rightarrow \frac{AB}{PQ} = \frac{AC}{PR}$ (From (1))

& $\angle CAB = \angle RPQ$ (from (7))

By SAS similarity criterion,

$\Delta ABC \sim \Delta PQR$ **[1 Mark]**

35. r = 2.1 cm, h = 5.8 cm



Total surface area = surface area of cylinder + 2 × surface area of semi circle.

$= 2\pi rh + 2(2\pi r^2)$ **[2 Marks]**

$= 2\pi\,(2.1) \times 5.8 + 2 \times 2\,\pi(2.1)^2$ **[1 Mark]**

$= 42\pi = 42 \times \frac{22}{7} = 132\ cm^2$. **[2 Marks]**

Note

T.S.A. = C.S.A. + Area of bases

36. **(i)** $150x + 250y = 55000$ ...(1) **[1 Mark]**

$x + y = 300$ ...(2)

(ii) Now, Equation (1) –150 Equations (2), we get

$250y - 150y = 55000 - 45000$ **[1 Mark]**

Note : T.S.A = C.S.A + Area of buses.

$\Rightarrow 100y = 10000 \Rightarrow y = 100$

From Equation (2): $x + 100 = 300$

$\Rightarrow x + 100 = 300$

$\Rightarrow x = 200$

(a) 200 childrens has visited the amusement park. **[2 Marks]**

OR

(b) 100 adults visited the amusement part. **[2 Marks]**

(iii) Amount collected = 250 × 150 + 100 × 250

= 37500 + 25000

= 62500

∴ Rs 62500 will be collected **[1 Mark]**

37. **(i)** Co-ordinate of the vertices are,

P(4, 6), Q(3, 2) and R(6, 5). **[1 Mark]**

(ii) **(a)** $PQ = \sqrt{(4-3)^2 + (6-2)^2} = \sqrt{1+16} = \sqrt{17}m$

$QR = \sqrt{(6-3)^2 + (5-2)^2} = \sqrt{9+9} = \sqrt{18} = 3\sqrt{2}m$

[2 Marks]

OR

(b) Let S be the required point.

$S = \left(\frac{4\times2+6\times1}{2+1}, \frac{6\times2+5\times1}{2+1}\right) = \left(\frac{14}{3}, \frac{17}{3}\right)$ **[2 Marks]**

(iii) $\because PQ = \sqrt{17}m$, $QR = 3\sqrt{2}$ m

and $PR = \sqrt{(6-4)^2 + (5-6)^2} = \sqrt{4+1} = \sqrt{5}$ m

Since, $PQ \neq QR \neq PR$ **[1 Mark]**

∴ ΔPQR is not an isosceles triangle

Note

If any two sides of a triangle are equal then triangle is isosceles triangle. So equalateral triangle is also called iscosceles.

38.

Time (in seconds)	No. of Students (f)	Cummulative frequency (cf)	x_i	$x_i f_i$
0-20	8	8	10	80
20-40	10	18	30	300
40-60	13	31	50	650
60-80	6	37	70	420
80-100	3	40	90	270
Total	40			1720

$n = \sum f_i = 40 \Rightarrow \frac{n}{2} = 20$

(i) Since 40-60 is the class whose cumulative frequency 31 is greater than (and nearest to) $\frac{n}{2} = 20$ **[1 Mark]**

So, Median class is 40-60.

(ii) (a) $\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{1720}{40} = 43$ **[2 Marks]**

OR

(b) Since, the maximum number of students are in the internal 40-60 So, Model class is 40-60.

$l = 40$, h = 20

$f_1 = 13$

$f_0 = 10$

$f_2 = 6$

Mode

$= l + \left(\frac{f_i - f_0}{2f_1 - f_0 - f_2}\right) \times h = 40 + \left(\frac{13-10}{2\times13-10-6}\right) \times 20$

$= 40 + \frac{3}{10} \times 20 = 46$ **[2 Marks]**

(iii) Number of students taking time less than 60 second

= 8 + 10 + 13 = 31 **[1 Mark]**