Next Toppers

Abhay 2025, Class 10th

Sample Question Paper-2

Time Allowed: 3 hours **Maximum Marks: 80**

General Instructions:

Read the following instructions carefully and follow them:

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

(ii) *Question paper is divided into FIVE sections - Section **A, B, C, D** and **E**.*

(iii) *In section A, question number **1** to **18** are multiple choice questions (MCQs) and question number **19** and **20** are Assertion-Reason based questions of **1** mark each.*

(iv) *In section **B**, question number **21** to **25** are very short answer (VSA) type questions of **2** marks each.*

(v) *In section **C**, question number **26** to **31** are short answer (SA) type questions carrying **3** marks each.*

(vi) *In section **D**, question number **32** to **35** are long answer (LA) type questions carrying **5** marks each.*

(vii) *In section **E**, question number **36** to **38** are case based integrated units of assessment questions carrying **4** marks each. Internal choice is provided in **2** marks question 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 figures wherever required. Take $\pi = 22/7$ wherever required if not stated.*

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

Section-A

Section A Consists of Multiple Choice Type questions of 1 mark each

1. If n is a natural number, then $2(5^n + 6^n)$ always ends with

(A) 1 **(B)** 4 **(C)** 3 **(D)** 2

2. How many zero(es) does the polynomial $293x^2 - 293x$ have?

(A) 0 **(B)** 1 **(C)** 2 **(D)** 3

3. If the system of equations $3x + y = 1$ and $(2k - 1)x + (k - 1)y = 2k + 1$ is inconsistent, then $k =$

(A) -1 **(B)** 0 **(C)** 1 **(D)** 2

4. The value(s) of k for which the quadratic equation $2x^2 + kx + 2 = 0$ has equal roots, is

(A) 4 **(B)** ± 4 **(C)** -4 **(D)** 0

5. The next term of the A.P.: $\sqrt{6}, \sqrt{24}, \sqrt{54}$ is:

(A) $\sqrt{60}$ **(B)** $\sqrt{96}$ **(C)** $\sqrt{72}$ **(D)** $\sqrt{216}$

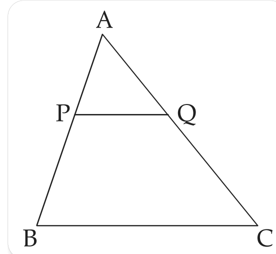
6. The coordinates of the point where the line $2y = 4x + 5$ crosses x-axis is

(A) $\left(0, \frac{-5}{4}\right)$ **(B)** $\left(0, \frac{5}{2}\right)$ **(C)** $\left(\frac{-5}{4}, 0\right)$ **(D)** $\left(\frac{-5}{2}, 0\right)$

7. The distance between the points $(m, -n)$ and $(-m, n)$ is:

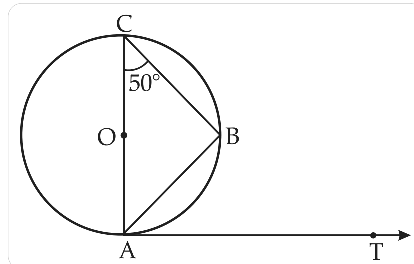
(A) $\sqrt{m^2 + n^2}$ units **(B)** $m + n$ units **(C)** $2\sqrt{m^2 + n^2}$ units **(D)** $\sqrt{2m^2 + 2n^2}$ units

8. In ΔABC, $PQ \parallel BC$. If $PB = 6$ cm, $AP = 4$ cm, $AQ = 8$ cm, find the length of AC.



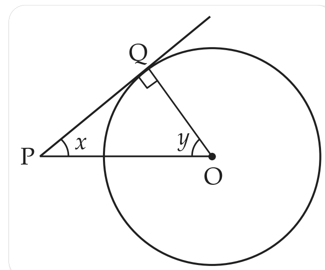
(A) 12 cm
(B) 20 cm
(C) 6 cm
(D) 14 cm

9. In the given figure, AB is a chord of the circle and AOC is its diameter, such that $\angle ACB = 50°$. If AT is the tangent to the circle at the point A, then $\angle BAT$ is equal to:



(A) 65°
(B) 60°
(C) 50°
(D) 40°

10. In the given figure, PQ is a tangent to the circle with centre O. If $\angle OPQ = x$, $\angle POQ = y$, then $x + y$ is:



(A) 45°
(B) 90°
(C) 60°
(D) 180°

11. The value of $\dfrac{1}{\tan\theta + \cot\theta} =$

(A) $\cos\theta \sin\theta$
(B) $\sec\theta \sin\theta$
(C) $\tan\theta \cot\theta$
(D) $\sec\theta \operatorname{cosec}\theta$

12. $(\sec^2\theta - 1)(\operatorname{cosec}^2\theta - 1)$ is equal to:

(A) –1 **(B)** 1 **(C)** 0 **(D)** 2

13. The length of a string between a kite and a point on the ground is 85 m. If the string makes an angle θ with the ground level such that $\tan\theta = \dfrac{15}{8}$, then height of the kite from the ground is:

(A) 75 m **(B)** 79.41 m **(C)** 80 m **(D)** 72.5 m

14. The length of tangent drawn to a circle of radius 7 cm from a point 25 cm from the centre is:

(A) 24 cm **(B)** 20 cm **(C)** 25 cm **(D)** 26 cm

15. Two circles touch each other externally at P. AB is a common tangent to the circles touching them at A and B. The value of $\angle APB$ is:

(A) 30° **(B)** 45° **(C)** 60° **(D)** 90°

16. A bag contains 5 red balls and n green balls. If the probability of drawing a green balls is three times that of a red ball, then the value of n is:

(A) 18 **(B)** 15 **(C)** 10 **(D)** 20

17. Two identical fiar dice have numbers 1 to 6 written on their faces. Both are tossed simultaneously. What is the probability that the product of the numbers that turn up is 12?

(A) $\dfrac{1}{36}$ **(B)** $\dfrac{1}{9}$ **(C)** $\dfrac{1}{6}$ **(D)** $\dfrac{1}{3}$

18. For the following distribution:

Marks Below	10	20	30	40	50	60
Number of students	3	12	27	57	75	80

The modal class is:

(A) 10 – 20 **(B)** 20 – 30 **(C)** 30 – 40 **(D)** 50 – 60

DIRECTIONS: Two statements are given below - one labelled Assertion (A) and the other labelled Reason (R). Read the statements carefully and choose the option that correctly describes statements (A) and (R).

(A) Both (A) and (R) are true and (R) is the correct explanation of the (A).

(B) Both (A) and (R) are true but (R) is not the correct explanation of the (A).

(C) (A) is true but (R) is false.

(D) (A) is false but (R) is true.

19. **Assertion (A):** Rampal decided to donate canvas for 10 tents conical in shape with base diameter 14 m and height 24 m to a centre for handicapped person's welfare. The slant height of the conical tent is 25.

Reason (R): According to assertion, the surface area of 10 tents is 5500 m^2.

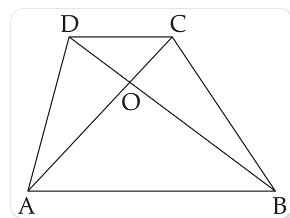
20. **Assertion (A):** The value of k for which the quadratic polynomial $kx^2 + x + k$ has equal zeroes are $\pm\frac{1}{2}$.

Reason (R): If all the three zeroes of a cubic polynomial $x^3 + ax^2 - bx + c$ are positive, then at least one of a, b and c is non-negative.

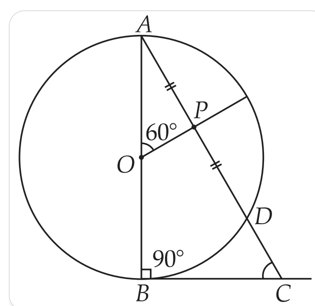
Section-B

Section B consists of 5 questions of 2 marks each.

21. Write whether $\dfrac{2\sqrt{45}+3\sqrt{20}}{2\sqrt{5}}$ on simplification gives an irrational or a rational number.



22. Diagonals AC and BD of trapezium ABCD with AB||DC intersect each other at point O. Show that $\dfrac{OA}{OC}=\dfrac{OB}{OD}$.



23. In Fig. AB is diameter of a circle centered at O. BC is tangent to the circle at B. If OP bisects the chord AD and $\angle AOP = 60°$, then find $\angle C$.

24.(A) Evaluate: $\dfrac{5}{\cot^2 30°}+\dfrac{1}{\sin^2 60°}-\cot^2 45°+2\sin^2 90°$

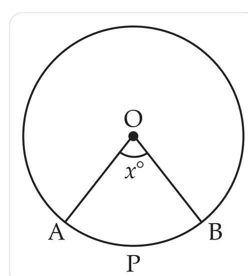
OR

(B) If θ is an acute angle and $\sin\theta = \cos\theta$, find the value of $\tan^2\theta + \cot^2\theta - 2$.

25. **(A)** In given figure, O is the centre of a circle. If the area of the sector $OAPB$ is $\frac{5}{36}$ times the area of the circle, then find the value of x.

OR

(B) Find the area of the sector of a circle of radius 6 cm whose central angle is 30° (take $\pi = 3.14$).



Section-C

Section C Consists of 6 questions of 3 marks each

26. A dining hall has a length of 8.25 m, breadth of 6.75 m, and height of 4.50 m. What is the length of the longest unmarked ruler that can exactly measure the three dimensions of the hall ? Show your steps and give valid reasons.

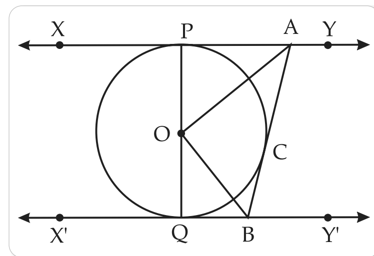
27. Write the discriminant of the quadratic equation $(x + 4)^2 = 3(7x - 4)$.

28. **(A)** Places A and B are 80 km apart from each other on a highway. A car starts from A and another from B at the same time. If they move in same direction they meet in 8 hours and if they move towards each other they meet in 1 hour 20 minutes. Find the speed of cars.

OR

(B) A train covered a certain distance at a uniform speed. If the train would have been 6 km/h faster, it would have taken 4 hours less than the scheduled time. And, if the train were slower by 6 km/h ; it would have taken 6 hours more than the scheduled time. Find the length of the journey.

29. **(A)** In the figure XY and X'Y' are two parallel tangents to a circle with centre O and another tangent AB with point of contact C interesting XY at A and X'Y' at B, what is the measure of $\angle AOB$.



OR

(B) Two concentric circles are of radii 5 cm and 3 cm. Find the length of the chord of the larger circle which touches the smaller circle.

30. Prove that sec A (1 – sin A) (sec A + tan A) = 1.

31. A class teacher has the following absentee record of 40 students of a class for the whole term. Find the mean number of days a student was absent.

Number of days	0 – 6	6 – 12	12 – 18	18 – 24	24 – 30	30 – 36	36 – 42
Number of students	10	11	7	4	4	3	1

Section-D

Section D consists of 4 questions of 5 marks each.

32. **(A)** A straight highway leads to the foot of a tower. A man standing on the top of the 75 m high tower observes two cars at angles of depression of 30° and 60°, which are approaching the foot of the tower. If one car is exactly behind the other on the same side of the tower, find the distance between the two cars. (Use $\sqrt{3} = 1.73$)

OR

(B) From the top of a 7 m high building, the angle of elevation of the top of a cable tower is 60° and the angle of depression of its foot is 30°. Determine the height of the tower.

33. Find the ratio in which the Y-axis divides the line segment joining the points (–1, –4) and (5, –6). Also find the co-ordinates of the point of intersection.

34. **(A)** Two arithmetic progressions have the same first term. The common difference of one progression is 4 more than the other progression. 124^{th} term of the first arithmetic progression is the same as 42^{nd} term of the second.

Find one set of possible values of the common differences. Show your work.

OR

(B) Huner said, "The value of the 20^{th} term of ANY arithmetic progression is double that of the 10^{th} term."

Is Huner's statement correct? Justify your answer.

35. The King, Queen and Jack of clubs are removed from a pack of 52 cards and then the remaining cards are well shuffled. A card is selected from the remaining cards. Find the probability of getting a card:

(i) of spade

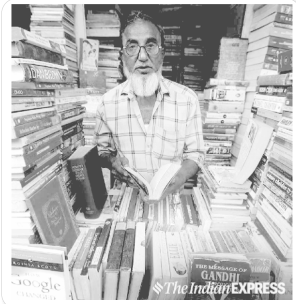
(ii) of black king

(iii) of club

(iv) of jack

Section-E

Case study based questions are compulsory.



36. A book store shopkeeper gives books on rent for reading. He has variety of books in his store related to fiction, stories and quizzes etc. He takes a fixed charge for the first two days and an additional charge for subsequent days. Amruta paid ₹22 for a book and kept for 6 days; while Radhika paid ₹16 for keeping the book for 4 days.

(i) Form the algebraic expression for amount paid by Radhika. **[1]**

(ii) Form the algebraic expression for amount paid by Amruta. **[1]**

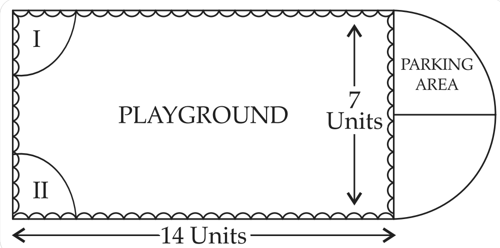
(iii) What are the additional charges for each subsequent day for a book? **[2]**

OR

Which is the total amount paid by both, if both of them have kept the book for 2 more days?

37. Governing council of a local public development authority of Dehradun decided to build an adventurous playground on the top of a hill, which will have adequate space for parking.

After survey, it was decided to build rectangular playground, with a semi-circular are allotted for parking at one end of the playground. The length and breadth of the rectangular playground are 14 units and 7 units, respectively. There are two quadrants of radius 2 units on one side for special seats.



Based on the above information, answer the following questions:

(i) What is the total perimeter of the parking area? **[1]**

(ii) What is the total area of parking and the two quadrants? **[2]**

OR

What is the ratio of area of playground to the area of parking area?

(iii) Find the cost of fencing the playground and parking area at the rate of ₹ 2 per unit. **[1]**

38. Some concrete water towers have been built to supply water to the localities nearby. They are usually mounted with a cylindrical tank. A water tower for a locality is 40 m high.

(i) The water tower cast a shadow of 25 m. At the same time, a tree near it casts a shadow of 5 m. What is the height of the tree? **[1]**

(ii) A scale model of the water tower of 100 cm height is created. The height of its pillars is 75 cm each. What is the height of a pillar (in m) in the actual water tower? **[2]**

OR

Dharmendra made a scale model of a water tower for another locality. The radius of the reservoir in the model is 6 cm and its volume is 216 cm^3. The radius of the actual water reservoir is 2.5 m. What is its volume?

(iii) The water tower casts a shadow of 30 m. At the same time, a tree of height 4 m also casts a shadow. What is the shadow of a tree? **[1]**

Abhay 2025, Class 10th

Sample Question Paper-2

SOLUTIONS

Section-A

1. Option (D) is correct.

Explanation: Let us take an example of different powers of 5.

As, $5^1 = 5$

$5^2 = 25$

$5^3 = 125$

$5^4 = 625$ …….

It is clear from above example that 5^n will always end with 5.

Similarly, 6^n will always end with 6.

So, $5^n + 6^n$ will always end with $5 + 6 = 11$

Also, $2(5^n + 6^n)$ will always end with $2 \times 11 = 22$

i.e., it will always end with 2.

[CBSE Marking Scheme, 2021]

2. Option (C) is correct.

Explanation: Given polynomial is $293x^2 - 293x$

$\Rightarrow 293x(x-1)$

For the property of zeroes,

$$293x(x-1) = 0$$

Either, $293x = 0 \Rightarrow x = 0$

or, $x - 1 = 0 \Rightarrow x = 1$

Hence, it has two zeroes.

Commonly Made Error

- Students often make mistakes in analysing the zeroes as they get confused with the different terms.

Answering Tip

- Understand the different cases for zeroes.

3. Option (D) is correct.

Explanation: $3x + y = 1$ ...(i)

and $(2k-1)x + (k-1)y = 2k + 1$ ...(ii)

Comparing eq. (i) with $a_1x + b_1y + c_1 = 0$ and eq. (ii) with $a_2x + b_2y + c_2 = 0$, we get

$a_1 = 3$, $a_2 = 2k - 1$, $b_1 = 1$, $b_2 = k - 1$, $c_1 = -1$ and $c_2 = -(2k+1)$

Since, system is inconsistent, then

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$$

$$\Rightarrow \frac{3}{2k-1} = \frac{1}{k-1} \neq \frac{-1}{-(2k+1)}$$

Either $\frac{3}{2k-1} = \frac{1}{k-1}$ or $\frac{1}{k-1} \neq \frac{1}{2k+1}$

$\Rightarrow$ $3k - 3 = 2k - 1$ or $2k + 1 \neq k - 1$

$\Rightarrow$ $k = 2$ or $k \neq -2$

Hence, the value of k is 2.

4. Option (B) is correct.

Explanation:

Given: $2x^2 + kx + 2 = 0$

Comparing above equation with $ax^2 + bx + c = 0$,

$a = 2$, $b = k$ and $c = 2$

Condition for equal roots is:

$$D = 0$$

i.e., $b^2 - 4ac = 0$

Substituting the values of a, b and c, we get

$$k^2 - 4 \times 2 \times 2 = 0$$

$\Rightarrow$ $k^2 - 16 = 0$

$\Rightarrow$ $[(k)^2 - (4)^2] = 0$

$\Rightarrow$ $(k+4)(k-4) = 0$

$\Rightarrow$ $k = 4$ or -4.

5. Option (B) is correct

Explanation: First term, $a_1 = \sqrt{6}$

Second term, $a_2 = \sqrt{24} = 2\sqrt{6}$

Common difference $= 2\sqrt{6} - \sqrt{6}$

$= \sqrt{6}(2-1) = \sqrt{6}$

Next term of A.P. is = Third term + common difference

$= \sqrt{54} + \sqrt{6}$

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

$= 4\sqrt{6} = \sqrt{96}$

6. Option (C) is correct

Explanation: Given $2y = 4x + 5$

Any point where the line intersects with x-axis is of the form $(x, 0)$ i.e., at that point 'y' coordinate is 0.

Put $y = 0$ in given equation

$$2 \times 0 = 4x + 5$$

$$-5 = 4x$$

$$x = \frac{-5}{4}$$

$\therefore$ Required coordinates are $\left(-\frac{5}{4}, 0\right)$.

7. **Option (C) is correct.**

Topper Answer, 2020

Sol. A (m, −n)
B (−m, n)

AB = $\sqrt{(m+m)^2 + (-n-n)^2}$
AB = $\sqrt{4m^2+4n^2}$

AB = $2\sqrt{m^2+n^2}$

Ans - (c) $2\sqrt{m^2+n^2}$

[CBSE Marking Scheme, 2020]

8. **Option (B) is correct**

Explanation: As PQ || BC by using basic proportionality theorem,

$$\frac{AP}{PB} = \frac{AQ}{QC}$$

$$\Rightarrow \quad \frac{4}{6} = \frac{8}{QC}$$

$$\Rightarrow \quad QC = \frac{8 \times 6}{4}$$

$$\Rightarrow \quad QC = 12 \text{ cm}$$

Now, $AC = AQ + QC$
$= 8 + 12 = 20$ cm

9. **Option (C) is correct.**

Explanation: Since, the angle between chord and tangent is equal to the angle subtended by the same chord in alternate segment of circle.

$\Rightarrow \quad \angle BAT = 50°$

10. **Option (B) is correct**

Explanation:

Here, $\angle OQP = 90°$ (angle between radius and tangent)

Now, in ΔOQP,

$$\angle OQP + \angle QOP + \angle OPQ = 180°$$
$$90° + y + x = 180°$$
$$\Rightarrow \quad x + y = 90°$$

11. **Option (A) is correct.**

Explanation:

$$\frac{1}{\tan\theta + \cot\theta} = \frac{1}{\frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta}}$$

$$= \frac{1}{\frac{\sin^2\theta + \cos^2\theta}{\cos\theta\sin\theta}}$$

$$= \frac{\cos\theta\sin\theta}{\sin^2\theta + \cos^2\theta}$$

$$= \cos\theta\sin\theta$$

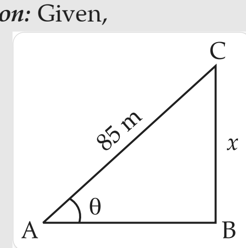
$[\sin^2\theta + \cos^2\theta = 1]$

12. **Option (B) is correct**

Explanation: $(\sec^2\theta - 1)(\text{cosec}^2\theta - 1)$
$= (\tan^2\theta)(\cot^2\theta)$
$[\because \sec^2\theta - \tan^2\theta = 1 \text{ and } \text{cosec}^2\theta - \cot^2\theta = 1]$
$$= \tan^2\theta \times \frac{1}{\tan^2\theta}$$
$= 1$

13. **Option (A) is correct.**

Explanation: Given,



$$\tan\theta = \frac{15}{8}$$

$$\sin\theta = \frac{15}{17} \qquad \text{...(i)}$$

$\therefore$ Let height of the kite,

$BC = x$ m

Now, $\sin\theta = \frac{x}{85}$ ...(ii)

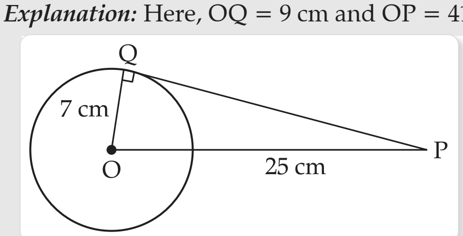
From equation, (i) and (ii),

$$\frac{15}{17} = \frac{x}{85}$$

$x = 75$ m

14. **Option (A) is correct**

Explanation: Here, OQ = 9 cm and OP = 41 cm

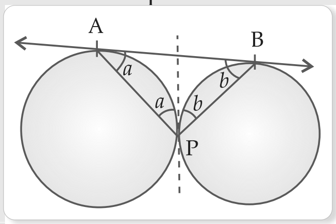


In ΔPQO,

$$OP^2 = OQ^2 + PQ^2$$
$$(25)^2 = (7)^2 + PQ^2$$
$$625 = 49 + PQ^2$$
$$PQ^2 = 625 - 49$$
$$PQ^2 = 576$$
$$PQ = 24 \text{ cm}$$

15. Option (D) is correct.

Explanation: Let ∠BAP be a and ∠ABP be b and tangent at a contact point P cut AB at D.



and $\angle APB = a + b$

In ΔAPB,

$$\angle BAP + \angle APB + \angle PBA = 180°$$

(Angle sum property of a triangle)

$$a + (a + b) + b = 180°$$

$$2(a + b) = 180° \Rightarrow a + b = 90°$$

So, $\angle APB = 90°$

16. Option (B) is correct

Explanation: Total balls $= 5 + n$

Probability of drawing red ball, $P(R) = \dfrac{5}{5+n}$

Probability of drawing green ball, $P(a) = \dfrac{n}{5+n}$

Given, $P(G) = 3P(R)$

$\therefore$ $\dfrac{n}{5+n} = 3\times\dfrac{5}{5+n}$

or, $n = 15$

17. Option (B) is correct

Explanation: Total number of outcomes = 6 × 6 = 36

Number of favourable outcome are (2, 6); (3, 4); (4, 3); (6, 2) = 4

$\therefore$ Probability $= \dfrac{4}{36} = \dfrac{1}{9}$

18. Option (C) is correct

Explanation:

Marks	No. of students	f_i
0 – 10	3 – 0 = 3	3
10 – 20	12 – 3 = 9	9
20 – 30	27 – 12 = 15	15
30 – 40	57 – 27 = 30	30
40 – 50	75 – 57 = 18	18
50 – 60	80 – 75 = 5	5

Modal class has maximum frequency (30) in class 30 – 40.

19. Option (A) is correct.

Explanation: For assertion,

$$\text{Radius of tent } (r) = \frac{\text{Diameter}}{2} = 7 \text{ m}$$

and height $(h) = 24$ m

$\therefore$ slant height of the tent $= \sqrt{h^2 + r^2}$

$$= \sqrt{(24)^2 + (7)^2}$$

$$= \sqrt{576 + 49} = 25 \text{ m.}$$

So, assertion is true.

For reason:

Surface area of 10 tents $= \pi rl \times 10$

$$= \frac{22}{7} \times 7 \times 25 \times 10$$

(Proved above, $l = 25$ m)

$= 5500 \text{ m}^2$.

So, reason is also true.

Both A and R are true and R is the correct explanation of A.

20. Option (C) is correct.

Explanation: In case of assertion:

$$f(x) = kx^2 + x + k$$

[here, $a = k, b = 1, c = k$]

For equal roots $b^2 - 4ac = 0$

$\Rightarrow$ $(1)^2 - 4(k)(k) = 0$

$\Rightarrow$ $4k^2 = 1$

$\Rightarrow$ $k^2 = \dfrac{1}{4}$

$\Rightarrow$ $k = \pm\dfrac{1}{2}$

So, there are $+\dfrac{1}{2}$ and $-\dfrac{1}{2}$ values of k so that the given equation has equal roots.

$\therefore$ Assertion is true.

In case of reason:

All the zeroes of cubic polynomial are positive only when all the constants a, b, and c are negative.

$\therefore$ Reason is false.

Thus, assertion is true but reason is false.

Section-B

21. $$\frac{2\sqrt{45} + 3\sqrt{20}}{2\sqrt{5}} = \frac{2\sqrt{9\times5} + 3\sqrt{4\times5}}{2\sqrt{5}}$$

$$\Rightarrow \quad = \frac{2\times3\sqrt{5} + 3\times2\sqrt{5}}{2\sqrt{5}}$$

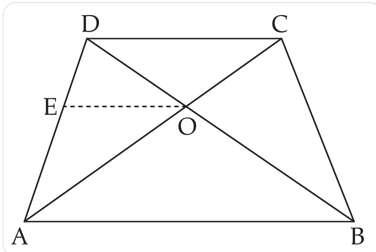
$$\Rightarrow \quad = \frac{6\sqrt{5} + 6\sqrt{5}}{2\sqrt{5}}$$

$$\Rightarrow \quad = \frac{(6+6)\sqrt{5}}{2\sqrt{5}}$$

$\Rightarrow \qquad = \dfrac{12\sqrt{5}}{2\sqrt{5}} = 6$

which is a rational number. **2**

22. **Given:** $ABCD$ is a trapezium, $AB \parallel DC$.



Diagonals AC and BD intersect at O.

To Prove: $\dfrac{OA}{OC} = \dfrac{OB}{OD}$

Construction: Draw $OE \parallel AB$, through O, meeting AD at E.

Proof: In ΔADC,

$EO \parallel DC \qquad (\because EO \parallel AB \parallel DC)$

$\therefore \quad \dfrac{AE}{ED} = \dfrac{OA}{OC}$ (By Thales Theorem (i))

In ΔDAB, $\quad EO \parallel AB$ (By constructions) **1**

$\therefore \quad \dfrac{AE}{ED} = \dfrac{OB}{OD}$ (By Thales Theorem)

...(ii)

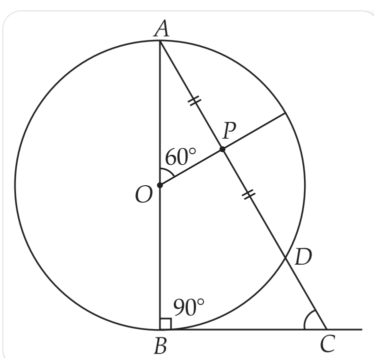
From (i) and (ii) **1**

$\dfrac{OA}{OC} = \dfrac{OB}{OD}$ **Hence Proved.**

23. Given, OP bisect the chord AD.

$\therefore \quad OP \perp AD$

So, $\quad \angle OPC = 90°$ and $\angle B = 90°$



$\angle BOP = 180° - 60° = 120°$ **1**

Now, in quad. $BOPC$, applying angle sum property

$\angle P + \angle B + \angle O + \angle C = 360°$

or, $\quad 90° + 90° + 120° + \angle C = 360°$

or, $\quad \angle C = 360° - 300° = 60°$ **1**

24. **(A)** We have, $\dfrac{5}{\cot^2 30°} + \dfrac{1}{\sin^2 60°} - \cot^2 45° + 2\sin^2 90°$

$= \dfrac{5}{(\sqrt{3})^2} + \dfrac{1}{\left(\dfrac{\sqrt{3}}{2}\right)^2} - (1)^2 + 2(1)^2$ **1**

$= \dfrac{5}{3} + \dfrac{4}{3} - 1 + 2 = \dfrac{9}{3} + 1$

$= 3 + 1$

$= 4$ **1**

OR

(B) Given, $\quad \sin\theta = \cos\theta$

$\therefore \quad \dfrac{\sin\theta}{\cos\theta} = 1$

$\Rightarrow \quad \tan\theta = 1$

$\Rightarrow \quad \tan\theta = \tan 45°$

$\Rightarrow \quad \theta = 45°$ **1**

Now, $\tan^2\theta + \cot^2\theta - 2$

$= \tan^2 45° + \cot^2 45° - 2$

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

$= 1 + 1 - 2$

$= 0$ **1**

25. **(A)** Area of sector $OAPB = \dfrac{5}{36}$ times the area of circle

$\therefore \quad \pi r^2 \times \dfrac{x}{360°} = \dfrac{5}{36}\pi r^2$

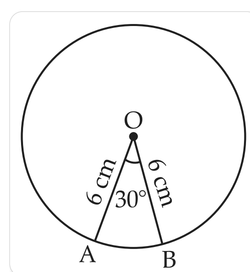
or, $\quad \dfrac{x}{360°} = \dfrac{5}{36}$

or, $\quad x = 50°$ **2**

[CBSE Marking Scheme, 2012]

OR

(B)



Given, radius of a circle,

$OA = OB = 6$ cm

(assuming in figure) **1**

and $\quad$ central angle $\theta = \angle AOB = 30°$

By using formula,

Area of the sector of a circle

$= \dfrac{\theta}{360°} \times \pi r^2$

$= \dfrac{30°}{360°} \times 3.14 \times 6 \times 6$

$= 9.42 \text{ cm}^2$ **1**

Commonly Made Error

- Some students used incorrect formula for area of sector and some made mistakes in calculations.

Answering Tip

- Remember the formula of area of sector and the concept of angle subtended at the centre.

Section-C

26. Length of longest unmarked ruler = HCF of Length, Breadth and Height of Dining Hall **1**

Prime Factorisation of 825 = $3 \times 5^2 \times 11$

Prime Factorisation of 675 = $3^3 \times 5^2$ **1**

Prime Factorisation of 450 = $2 \times 3^2 \times 5^2$

Highest common Factor (HCF) = 3×5^2 = 75 cm

Hence, Longest Unmarked Ruler Length = 75 cm or 0.75 m **1**

27. Given, $(x + 4)^2 = 3(7x - 4)$

$\Rightarrow \quad x^2 + 16 + 8x = 21x - 12$

$\Rightarrow \quad x^2 - 13x + 28 = 0$ **1**

Comparing with $ax^2 + bx + c = 0$, we get

$a = 1, b = -13$ and $c = 28$ **1**

Discriminant $= b^2 - 4ac$

$= (-13)^2 - 4 \times 1 \times 28$

$= 169 - 112 = 57$ **1**

28. **(A)** Let the speed of the car 1 from A be x km/h and speed of the car 2 from B be y km/h. **1**

Same direction:

Distance covered by car 1 = 80 + (distance covered by car 2)

$\Rightarrow \quad 8x = 80 + 8y$

$\Rightarrow \quad 8x - 8y = 80$

$\Rightarrow \quad x - y = 10$ ...(i)

Opposite direction:

Distance covered by car 1 + distance covered by car 2 = 80 km

$$\frac{4}{3}x + \frac{4}{3}y = 80$$

$\Rightarrow \quad x + y = 60$ ...(ii)

Adding eq. (i) and (ii), we get

$2x = 70$

$x = 35$

Substituting $x = 35$ in eq. (i),

$y = 25$

$\therefore$ Speed of the car 1 from A = 35 km/h **1**

and speed of the car 2 from B = 25 km/h **1**

OR

(B) Let the actual speed of the train be x km/h and the actual time taken be y hours.

Distance covered is xy km.

If the speed is increased by 6 km/h, then time of journey is reduced by 4 hours i.e., when speed is $(x + 6)$ km/h, time of journey is $(y - 4)$ hours. ½

$\therefore$ Distance covered $= (x + 6)(y - 4)$

$\Rightarrow \quad xy = (x + 6)(y - 4)$

$\Rightarrow \quad -4x + 6y - 24 = 0$

$\Rightarrow \quad -2x + 3y - 12 = 0$ …(i) ½

Similarly, $xy = (x - 6)(y + 6)$

$\Rightarrow \quad 6x - 6y - 36 = 0$

$\Rightarrow \quad x - y - 6 = 0$ …(ii) ½

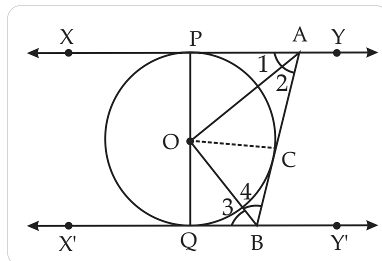
Solving (i) and (ii) we get $x = 30$ and $y = 24$ **1**

Putting the values of x and y in equation (i), we obtain

Distance = (30 × 24) km = 720 km

Hence, the length of the journey is 720 km. ½

29. **(A)**



Join OC.

In ΔOPA and ΔOCA,

$OP = OC$ (radii of same circle)

$PA = CA$ **1**

(length of two tangents from an external point)

$AO = AO$ (Common)

Therefore, $\Delta OPA \cong \Delta OCA$ ½

(By SSS congruency criterion)

Hence, $\angle 1 = \angle 2$ (CPCT) ½

Similarly $\angle 3 = \angle 4$

$\angle PAB + \angle QBA = 180°$ ½

(co-interior angles are supplementary as XY || X'Y')

$2\angle 2 + 2\angle 4 = 180°$

$\angle 2 + \angle 4 = 90°$ …(1) ½

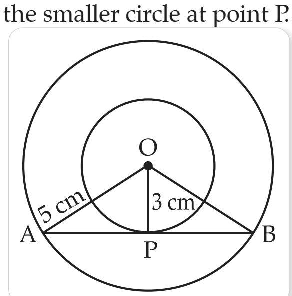
$\angle 2 + \angle 4 + \angle AOB = 180°$ (Angle sum property)

Using (1), we get, $\angle AOB = 90°$.

OR

(B) Let the two concentric circles with centres O.

Let AB be the chord of the larger circle which touches the smaller circle at point P.



Therefore, AB is tangent to the smaller circle to the point P.

$\therefore$ OP $\perp$ AB

In ΔOPA, $AO^2 = OP^2 + AP^2$

$(5)^2 = (3)^2 + AP^2$

$AP^2 = 25 - 9$

$\therefore$ $AP = 4$ cm **1**

Now, in ΔOPB,

$OP \perp AB$

$\therefore$ $AP = PB$ **1**

(Perpendicular form the centre of the circle bisects the chord)

Thus, $AB = 2AP$

$= 2 \times 4$

$= 8$ cm **1**

Hence, length of the chord of the larger circle is 8 cm.

30. LHS $= \sec A(1 - \sin A)(\sec A + \tan A)$

$= \left(\sec A - \dfrac{\sin A}{\cos A}\right)(\sec A + \tan A)$

$\left[\because \sec A = \dfrac{1}{\cos A}\right]$ **1**

$= (\sec A - \tan A)(\sec A + \tan A)$

$= \sec^2 A - \tan^2 A$ **1**

$= (1 + \tan^2 A) - \tan^2 A$

$= 1$ **1**

$=$ RHS **Hence Proved**

31.

Topper Answer, 2019

Calculating mean using stepdeviation method.

15.

No. of days (Class interval)	No. of students (f_i)	x_i $\left(\frac{\text{Upper+lower limit}}{2}\right)$	$u_i = \frac{x_i - A}{h}$	$f_i \times u_i$
0-6	10	3	$\frac{3-21}{6} = -3$	$10 \times -3 = -30$
6-12	11	9	$\frac{9-21}{6} = -2$	$11 \times -2 = -22$
12-18	7	15	$\frac{15-21}{6} = -1$	$7 \times -1 = -7$
18-24	4	A 21	$\frac{21-21}{6} = 0$	$4 \times 0 = 0$
24-30	4	27	$\frac{27-21}{6} = 1$	$4 \times 1 = 4$
30-36	3	33	$\frac{33-21}{6} = 2$	$3 \times 2 = 6$
36-42	1	39	$\frac{39-21}{6} = 3$	$1 \times 3 = 3$
Total :	$\Sigma f_i = 40$			$\Sigma f_i u_i = -46$

Class size $(h) = 6 - 0 = 6$

Assumed mean $(A) = 21$

Mean $= A + \dfrac{\Sigma f_i u_i}{\Sigma f_i} \times h$

$\Rightarrow$ Mean $= 21 + \left(\dfrac{-46}{40}\right) \times 6$

$= 21 - \dfrac{23}{\cancel{20}\,10} \times \cancel{6}\,3$

$= 21 - 6.9$

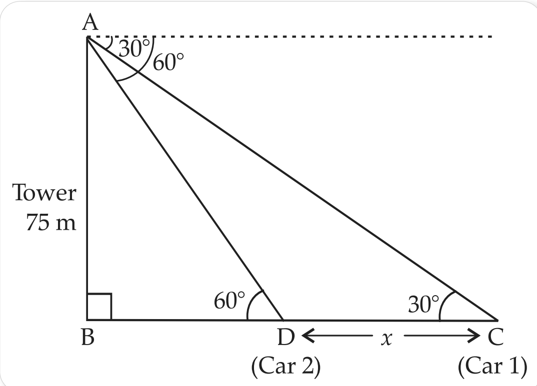
$= 14.1$ days

Mean of no. of days student remains absent $= 14.1$ days

Section-D

32. **(A)** Let AB be the tower C is the position of first car and D is the position of second car.

CD is the distance between two cars. 1



In right ΔABC,

$$\tan 30° = \frac{AB}{BC}$$

$$\frac{1}{\sqrt{3}} = \frac{75}{BD + x}$$

$$\therefore \quad BD + x = 75\sqrt{3} \qquad \text{...(i)} \ \mathbf{1}$$

In right ΔABD,

$$\tan 60° = \frac{AB}{BD}$$

$$\sqrt{3} = \frac{75}{BD}$$

$$BD = \frac{75}{\sqrt{3}} \qquad \text{...(ii)} \ \mathbf{1}$$

From eqs. (i) and (ii), we get

$$\frac{75}{\sqrt{3}} + x = 75\sqrt{3}$$

$$\Rightarrow \quad x = 75\sqrt{3} - \frac{75}{\sqrt{3}}$$

$$\Rightarrow \quad x = 75\sqrt{3} - \frac{75\sqrt{3}}{3}$$

$$\Rightarrow \quad x = 75\sqrt{3}\left(1 - \frac{1}{3}\right)$$

$$\Rightarrow \quad x = 75\sqrt{3} \times \frac{2}{3}$$

$$\Rightarrow \quad x = \frac{150}{\sqrt{3}}$$

$$\Rightarrow \quad x = \frac{150}{1.73}$$

$$\Rightarrow \quad x = 86.705$$

$$\Rightarrow \quad x = 86.71 \text{ m} \qquad \mathbf{2}$$

OR

(B) Let AB be the building of height 7 m and EC be the height of the tower.

A is the point from where elevation of tower is 60° and the angle of depression of its foot is 30°.

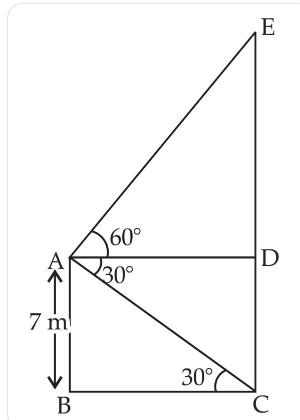
$$EC = DE + CD$$

Also, $CD = AB = 7$ m and $BC = AD$ **1**

In right ΔABC,

$$\tan 30° = \frac{AB}{BC}$$

$$\frac{1}{\sqrt{3}} = \frac{7}{BC}$$



$$BC = 7\sqrt{3} \qquad \mathbf{1}$$

Since, $BC = AD$

So, $AD = 7\sqrt{3}$ m

In right ΔADE,

$$\tan 60° = \frac{DE}{AD}$$

$$\sqrt{3} = \frac{DE}{7\sqrt{3}}$$

$$\therefore \quad DE = 21 \text{ cm} \qquad \mathbf{1}$$

Hence, $EC = CD + ED$

$= 7 + 21$

$= 28$ cm **2**

Thus, height of the tower is 28 m.

Commonly Made Error

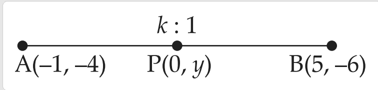
- Sometimes students get confused with the concepts of angle of elevation and depression.

Answering Tip

- Understand the difference between angle of elevation and depression. Do practice more problems of length and distance to avoid mistakes in drawing the figure.

33. Any point on Y-axis is P(0,y). **1**

Let P divides AB in $k:1$ **1**



$$\Rightarrow \quad 0 = \frac{5k-1}{k+1}$$

$$\Rightarrow \quad k = \frac{1}{5} \text{ i.e., } 1:5 \qquad \mathbf{1}$$

$$\Rightarrow \quad y = \frac{-6k-4}{k+1} = \frac{-\frac{6}{5}-4}{\frac{1}{5}+1} = \frac{-26}{6} = \frac{-13}{3} \qquad \mathbf{1}$$

$$\Rightarrow \text{P is } \left(0, \frac{-13}{3}\right). \qquad \mathbf{1}$$

[CBSE Marking Scheme, 2019]

34. **(A)** Let first term of two A.P. $= a$

Common difference $= d_1$ and d_2

Then, $d_1 = d_2 + 4$ (given)

$T_{124} = a + 123d_1$ ...(i)

$T_{42} = a + 41d_2$ ...(ii)

Equating (i) and (ii) we get

$a + 123d_1 = a + 41d_2$ **1**

$a + 123(d_2 + 4) = a + 41d_2$(From above)

$a + 123d_2 + 492 = a + 41d_2$

$123d_2 - 41d_2 = -492$

$82d_2 = -492$

$d_2 = -6$ ½

Subsitute d_2 in $d_1 = d_2 + 4$ we get

$d_1 = -6 + 4$

$d_1 = -2$ **1½**

Thus set of possible values of common difference is $d_1 = -2$ and $d_2 = -6$.

OR

(B) $T_n = a + (n-1)d$

$\therefore$ $T_{20} = a + (20-1)d$

$= a + 19d$ ...(i) **1**

$T_{10} = a + (10-1)d$

$= a + 9d$ ...(ii) **1**

According to Huner statement

$T_{20} = 2(T_{10})$ **1**

$a + 19d = 2(a + 9d)$

$a + 19d = 2a + 18d$

$19d - 18d = 2a - a$

$d = a$ **1**

So, Huner's statement is correct only when $a = d$ but not for Any A.P. **1**

35. Total number of cards $= 52 - 3 = 49$ **1**

(i) Number of spade cards $= 13$

$\therefore$ $P(\text{getting a spade}) = \frac{13}{49}$ **1**

(ii) Number of black king $= 2 - 1 = 1$

$\therefore$ $P(\text{getting a black king}) = \frac{1}{49}$ **1**

(iii) Number of club cards $= 13 - 3 = 10$

$\therefore$ $P(\text{getting a club card}) = \frac{10}{49}$ **1**

(iv) Number of jacks $= 4 - 1 = 3$

$\therefore$ $P(\text{getting a jack}) = \frac{3}{49}$ **1**

Section-E

36. **(i)** Let the fixed charge for two days be ₹x and additional charge be ₹y per day.

As Radhika has taken book for 4 days.

It means that Radhika will pay fixed charge for first two days and pays additional charges for next two days.

$x + 2y = 16.$ **1**

(ii) Let the fixed charge for two days be ₹x and additional charge be ₹y per day.

It means that Amruta will pay fixed charge for first two days and pays additional charges for next four days.

$x + 4y = 22.$ **1**

(iii) From solutions of (i) and (ii),

$x + 2y = 16$ ...(i)

$x + 4y = 22$ ...(ii)

Subtracting (ii) from (i), we get

$y = 3$ and put this value of x in (i), we get $x = 10$.

Therefore, fixed charge $x =$ ₹10. **2**

OR

From above solution, we get

$y = 3$

Therefore, additional charges, $y =$ ₹3. **2**

37. **(i)** Radius of semi-circle $(r) = \frac{7}{2} = 3.5$ units

Circumference of semi-circle $= \pi r$

$= \frac{22}{7} \times 3.5$

$= 11$ units

$\therefore$ Perimeter of parking area

= circumference of semi-circle + diameter of semi-circle

$= 11 + 7$

$= 18$ units **1**

(ii) Area of parking $= \dfrac{\pi r^2}{2}$

$= \dfrac{22}{7} \times \dfrac{1}{2} \times (3.5)^2$

$= 11 \times 0.5 \times 3.5$

$= 19.25$ unit^2

Area of quadrants $= 2 \times$ area of one quadrant

$= 2 \times \dfrac{\pi r_1^2}{4}$

$= 2 \times \dfrac{22}{7} \times \dfrac{1}{4} \times (2)^2$

[$\because r_1 = 2$ units]

$= 6.285$ unit^2

Thus, Total area $= 19.25 + 6.285$

$= 25.535$ unit^2 **2**

OR

Area of playground = length × breadth

= 14 × 7

= 98 unit^2

Area of parking = 19.25 unit^2

[from part (ii) a]

∴ Ratio of playground : Ratio of parking area

= 98 : 19.25

$= \dfrac{9800}{1925}$

$= \dfrac{56}{11}$

Thus, required ratio is 56 : 11. **2**

(iii) We know that,

Perimeter of parking area = 18 units

Also, Perimeter of playground $= 2(l + b)$

= 2(14 + 7)

= 2 × 21

= 42 units

Thus, total perimeter of parking area and playground

= 18 + 42 – 7

= 53 units

Hence, Total cost = ₹ 2 × 53 = ₹ 106 **1**

38. (i) Let the height of the tree be x m, then

$$\frac{\text{Height of the water tower}}{\text{Height of the tree}} = \frac{\text{Shadow of water tower}}{\text{Shadow of the tree}}$$

$\Rightarrow \quad \dfrac{40}{x} = \dfrac{25}{5}$

$\Rightarrow \quad 25x = 200$

$\Rightarrow \quad x = 8$ m **1**

(ii) By using scale factor method,

Height of pillar in the actual water tower

$= \dfrac{40}{100} \times 75$

= 30 m **2**

OR

By using scale factor method,

The ratio of two corresponding sides in similar figures is called the scale factor.

∴ If the side of the actual water reservoir = 2.5 then its volume

$= 2.5 \times 2.5 \times 2.5$ m^3

$= 15.625$ m^3 **2**

(iii) Let the shadow of a tree = x m, then

$$\frac{\text{Height of the water tower}}{\text{Height of the tree}} = \frac{\text{Shadow of water tower}}{\text{Shadow of the tree}}$$

$\dfrac{40}{3} = \dfrac{30}{x}$

$x = \dfrac{30 \times 4}{40}$

$x = 3$ m

Thus shadow of a tree = 3m **1**