Class X Session 2026-27
Subject - Mathematics (Standard)
Sample Question Paper - 1

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

General Instructions:

Read the following instructions carefully and follow them:

1. This question paper contains 38 questions.
2. This Question Paper is divided into 5 Sections A, B, C, D and E.
3. In Section A, Questions no. 1-18 are multiple choice questions (MCQs) and questions no. 19 and 20 are Assertion- Reason based questions of 1 mark each.
4. In Section B, Questions no. 21-25 are very short answer (VSA) type questions, carrying 02 marks each.
5. In Section C, Questions no. 26-31 are short answer (SA) type questions, carrying 03 marks each.
6. In Section D, Questions no. 32-35 are long answer (LA) type questions, carrying 05 marks each.
7. In Section E, Questions no. 36-38 are case study-based questions carrying 4 marks each with sub-parts of the values of 1,1 and 2 marks each respectively.
8. All Questions are compulsory. However, an internal choice in 2 Questions of Section B, 2 Questions of Section C and 2 Questions of Section D has been provided. An internal choice has been provided in all the 2 marks questions of Section E.
9. Draw neat and clean figures wherever required.
10. Take $\pi = 22/7$ wherever required if not stated.
11. Use of calculators is not allowed.

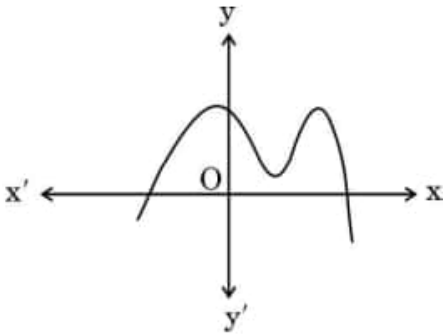
Section A

1. What is the largest number that divides each one of 1152 and 1664 exactly? **[1]**

   a) 64 b) 128

   c) 32 d) 256

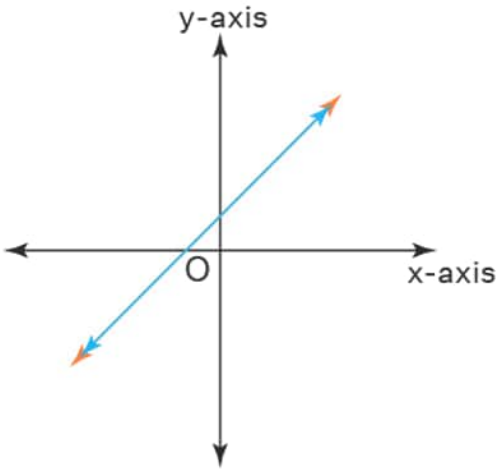
2. Graph of a polynomial p(x) is given in the figure. The number of zeroes of p(x) is: **[1]**



a) 2 b) 5

c) 3 d) 4

3. A system of linear equations is said to be consistent, if it has **[1]**



a) exactly one solution b) one or many solutions

c) no solution d) two solutions

4. The discriminant of the quadratic equation $bx^2 + ax + c = 0; b \neq 0$ is given by: **[1]**

a) $\sqrt{a^2 - 4bc}$ b) $a^2 - 4bc$

c) $b^2 - 4ac$ d) $\sqrt{b^2 - 4ac}$

5. The next term of the A.P.: $\sqrt{6}, \sqrt{24}, \sqrt{54}$ is: **[1]**

a) $\sqrt{60}$ b) $\sqrt{96}$

c) $\sqrt{216}$ d) $\sqrt{72}$

6. XOYZ is a rectangle with vertices X(-3, 0), O(0, 0), Y(0, 4) and Z(x, y). The length of its each diagonal is **[1]**

a) 5 units b) 4 units

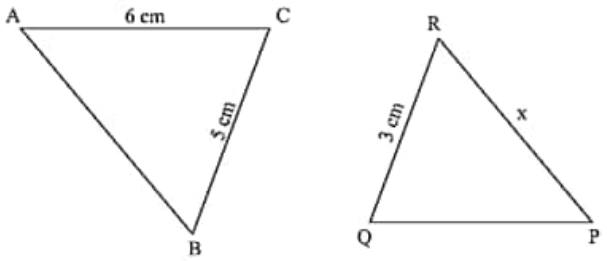
c) $x^2 + y^2$ units d) X

7. A line segment joining the points $P(-5, 11)$ and Q is divided internally by the point $M(2, -3)$ such that $PM : MQ = 7 : 2$. The coordinates of Q are: **[1]**

a) $(-7, 4)$ b) $\left(\frac{4}{9}, \frac{1}{9}\right)$

c) $(4, -7)$ d) $(27.5, -52)$

[1]

8. 

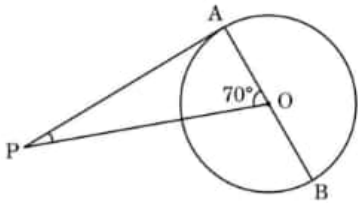
In the given figure, $\triangle ABC \sim \triangle QPR$. If AC = 6 cm, BC = 5 cm, QR = 3 cm and PR = x; then the value of x is:

a) 3.6 cm b) 2.5 cm

c) 3.2 cm d) 10 cm

9. In the given figure, PA is a tangent from an external point P to a circle with centre O. **[1]**

If $\angle AOP = 70^o$, then the measure of $\angle APO$ is:



a) 90° b) 110°

c) 20° d) 70°

10. How many tangents can be drawn to a circle from a point on it? **[1]**

a) Infinite b) One

c) Two d) Zero

11. $2\cos^2\theta(1 + \tan^2\theta)$ is equal to: **[1]**

a) 2 b) 3

c) 0 d) 1

12. If $x = a\sin\theta$ and $y = b\cos\theta$, then $b^2x^2 + a^2y^2$ is equal to: **[1]**

a) $a^2 + b^2$ b) a^2b^2

c) $\frac{a^2+b^2}{a^2b^2}$ d) 1

13. The top of a broken tree has its top end touching the ground at a distance 15 m from the bottom, the angle made by the broken end with the ground is 30°. Then length of broken part is **[1]**

a) $5\sqrt{3}$ m b) $\sqrt{3}$ m

c) $10\sqrt{3}$ m d) 10 m

14. If a sector of a circle has an area of 40π sq. units and a central angle of 72°, the radius of the circle is: **[1]**

a) 100 units b) $10\sqrt{2}$ units

c) 200 units d) 20 units

15. The angle of the major sector and the corresponding minor sector of a circle are **[1]**

a) Complementary Angles
b) Reflex Angles
c) Supplementary Angles
d) Conjugate Angles

16. Cards bearing numbers 3 to 20 are placed in a bag and mixed thoroughly. A card is taken out of the bag at random. What is the probability that the number on the card taken out is an even number? **[1]**

a) $\frac{9}{17}$
b) $\frac{5}{9}$
c) $\frac{1}{2}$
d) $\frac{7}{18}$

17. A dice is thrown once. The probability of getting an odd number is **[1]**

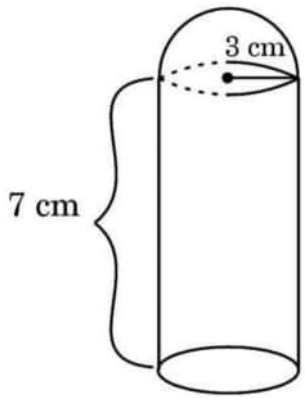
a) $\frac{2}{6}$
b) $\frac{4}{6}$
c) 1
d) $\frac{1}{2}$

18. Find the value of p, if the mean of the following data is 20. **[1]**

x_i	15	17	19	20 + p	23
f_i	2	3	4	5p	6

a) 2
b) 10
c) 1
d) 4

19. **Assertion (A):** In the given figure, a toy is in the form of a cylinder surmounted by a hemisphere of the same radius. If the radius of the cylinder is 3 cm and its height is 7 cm, then the volume of toy is $81\pi\ cm^3$. **[1]**



Reason (R): Volume of the given solid is the sum of the volume of the cylinder and the volume of the hemisphere.

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

20. **Assertion (A):** The sum of the first n terms of an AP is given by $S_n = 3n^2 - 4n$. Then its nth term $a_n = 6n - 7$ **[1]**

Reason (R): nth term of an AP, whose sum to n terms is S_n, is given by $a_n = S_n - S_{n-1}$

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false. d) A is false but R is true.

Section B

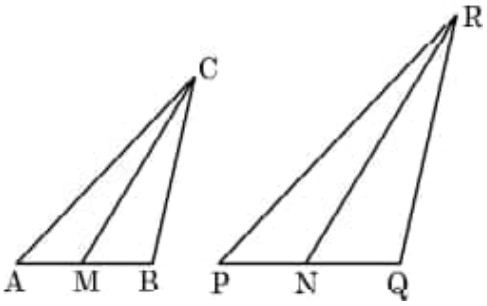
21. Evaluate: $\frac{5\cos^2 60^\circ + 4\sec^2 30^\circ - \tan^2 45^\circ}{\sin^2 30^\circ + \cos^2 30^\circ}$ **[2]**

OR

Prove that: $\frac{\sin\theta - \cos\theta + 1}{\cos\theta + \sin\theta - 1} = \frac{1}{\sec\theta - \tan\theta}$

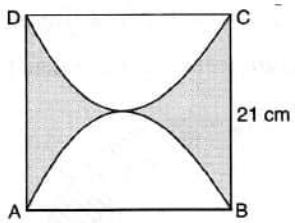
22. Prove that $2 + 3\sqrt{3}$ is an irrational number. It is given that $\sqrt{3}$ is an irrational number. **[2]**

23. **[2]**



In the given figure, CM and RN are respectively the medians of △ABC and △PQR. If △ABC ∼ △PQR, then prove that △AMC ∼ △PNR.

24. Find the perimeter of the shaded region if ABCD is a square of side 21 cm and APB and CPD are semicircles. $\left(\pi = \frac{22}{7}\right)$ **[2]**



OR

A horse is tethered to one corner of a rectangular field of dimensions 70 m × 52 m, by a rope of length 21 m. How much area of the field can it graze?

25. If the angle between two tangents drawn from an external point P to a circle of radius a and centre O, is 60° then find the length of OP. **[2]**

Section C

26. Prove that $7\sqrt{2}$ is an irrational number, given that $\sqrt{2}$ is an irrational number. **[3]**

27. If α and β are the zeroes of the polynomial $p(x) = x^2 - (k+5)x + (5k+1)$ such that, $\alpha + \beta = \frac{\alpha\beta}{3}$, then find the value of k. **[3]**

28. Prove that: $\frac{1}{\text{cosec}A - \cot A} - \frac{1}{\sin A} = \frac{1}{\sin A} - \frac{1}{\text{cosec}A + \cot A}$. **[3]**

29. A sum of ₹2,000 is invested at 7% per annum simple interest. Calculate the interests at the end of 1st , 2nd and 3rd year. Do these interests form an AP? If so, find the interest at the end of the 27th year. **[3]**

OR

If S_n denotes, the sum of the first n terms of an A.P. prove that $S_{12} = 3(S_8 - S_4)$.

30. 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 **[3]**

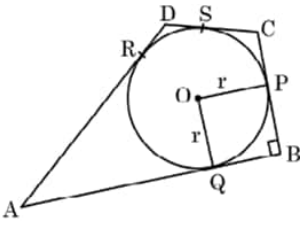
Number of Days	0-6	6-12	12-18	18-24	24-30	30-36	36-42

Number of students	10	11	7	4	4	3	1

31. Prove that a rectangle circumscribing a circle is a square. **[3]**

OR

In the given figure, a circle is inscribed in a quadrilateral ABCD in which $\angle B = 90^o$. If AD = 17 cm, AB = 20 cm and DS = 3 cm, then find the radius of the circle.



Section D

32. The shadow of a tower standing on a level ground is found to be 40 m longer when the Sun's altitude is 30° than when it was 60°. Find the height of the tower and the length of original shadow. (use $\sqrt{3}$ = 1.73) **[5]**

33. Find the mean and the median of the following data: **[5]**

Marks	Number of Students
0 - 10	3
10 - 20	5
20 - 30	16
30 - 40	12
40 - 50	13
50 - 60	20
60 - 70	6
70 - 80	5

34. A motor boat whose speed is 18 km/h in still water takes 1 hour more to go 24 km upstream, than to return to the same point. Find the speed of the stream and total time of the journey. **[5]**

OR

If the difference between the radii of the smaller circle and the larger circle is 7 cm and the difference between the areas of the two circles is 1078 sq. cm. Find the radius of the smaller circle.

35. A bat manufacturing company made a huge bat for charity and got it signed by world cup winning team. **[5]**

The dimensions of the bat which is in the form of a cuboid with a cylindrical handle at the top are as follows:

length $= 2\ m$, width $= 0.5\ m$, thickness $= 0.1\ m$

diameter of cylindrical part $= 0.1\ m$

height of cylindrical part $= 0.7\ m$

Find the volume of wood used in the bat. Also, find the total surface area of the wooden bat.

OR

From one of the faces of a solid wooden cube of side 14 cm, maximum number of hemispheres of diameter 1.4 cm are scooped out. Find the total number of hemispheres that can be scooped out. Also, find the total surface area of the remaining solid.

Section E

36. A school is organizing a grand cultural event to show the talent of its students. To accommodate the guests, the school plans to rent chairs and tables from a local supplier. It finds that rent for each chair is ₹ 50 and for each table is ₹ 200. The school spends ₹ 30,000 for renting the chairs and tables. Also, the total number of items (chairs and tables) rented are 300. **[4]**



If the school rents 'x' chairs and 'y' tables, answer the following questions:

i. Write down the pair of linear equations representing the given information. **(1)**

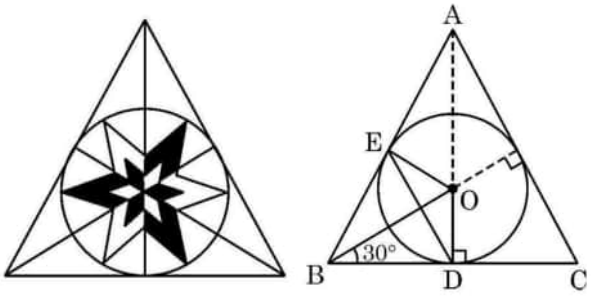
ii. a. Find the number of chairs and number of tables rented by the school. **(2)**

OR

b. If the school wants to spend a maximum of ₹ 27,000 on 300 items (tables and chairs), then find the number of chairs and tables it can rent. **(2)**

iii. What is maximum number of tables that can be rented in ₹ 30,000 if no chairs are rented? **(1)**

37. **[4]**



In a Fine Arts class, students were asked to design triangular tiles in geometric

pattern.

Neelima made a circular design inside an equilateral triangle ABC. The radius of the circle is 4 cm. Observe the diagram and answer the following questions:

i. Determine the length OB. **(1)**

ii. Is $DE \| CA$? Give reason for your answer. **(1)**

iii. a. Write all angles of quadrilateral OEBD and show that it is a cyclic quadrilateral. **(2)**

OR

b. Find the perimeter of $\triangle ABC$. (Use $\sqrt{3} = 1.73$) **(2)**

38. **Read the following text carefully and answer the questions that follow:** **[4]**

In an examination hall, students are seated at a distance of 2 m from each other, to maintain the social distance due to CORONA virus pandemic. Let three students sit at points A, B and C whose coordinates are (4, -3), (7, 3) and (8, 5) respectively.



i. What is the distance between A and C? (1)

ii. If an invigilator at point 7, lying on the straight line joining B and C such that it divides the distance between them in the ratio of 1 : 2. Then what are the coordinates of I(invigilator)? (1)

iii. What is the mid-point of the line segment joining A and C? (2)

OR

What is the ratio in which B divides the line segment joining A and C? (2)

Solution

Section A

1. **(b)** 128
Explanation:
Largest number that divides each one of 1152 and 1664 = HCF (1152, 1664)
We know, 1152 = $2^7 \times 3^2$
1164 = $2^7 \times 13$
$\therefore$ HCF = 2^7 = 128

2. **(a)** 2
Explanation:
Since, The graph of P(x) intersect the x-asix at two distinct point.
hence, two zeroes are possible.

3. **(b)** one or many solutions
Explanation:
A system of linear equations is said to be consistent if it has at least one solution or can have many solutions. If a consistent system has an infinite number of solutions, it is dependent. When you graph the equations, both equations represent the same line. If a system has no solution, it is said to be inconsistent. The graphs of the lines do not intersect, so the graphs are parallel and there is no solution.

4. **(b)** $a^2 - 4bc$
Explanation:
$a^2 - 4bc$

5. **(b)** $\sqrt{96}$
Explanation:
$\sqrt{6}, \sqrt{24}, \sqrt{54}$ are in AP
$\sqrt{6}, \sqrt{4 \times 6}, \sqrt{9 \times 6}$
$\sqrt{6}, 2\sqrt{6}, 3\sqrt{6}$
common difference is 1
So, next term of AP = $4\sqrt{6}$
= $\sqrt{16 \times 6}$
= $\sqrt{96}$

6. **(a)** 5 units
Explanation:
X(-3, 0), O(0, 0), Y(0, 4), Z(x, y).
XOYZ is a rectangle,
So, diagonal xy = diagonal OZ
$xy = \sqrt{(-3-0)^2 + (0-4)^2}$
$= \sqrt{9+16}$

$= \sqrt{25}$

xy = 5 units

7.

(c) $(4, -7)$

Explanation:

$(4, -7)$

8.

(b) 2.5 cm

Explanation:

Given $\triangle$ABC $\sim \triangle$QPR

Ac = 6 cm, BC = 5 cm, QR = 3 cm and PR = x

Since, triangles are similar

$\therefore \frac{AC}{QR} = \frac{BC}{PR}$ ...(By proportionality theorem)

$\Rightarrow \frac{6}{3} = \frac{5}{x}$

$\Rightarrow x = \frac{5 \times 3}{6}$

$= \frac{5}{2}$

= 2.5 cm

9.

(c) 20°

Explanation:

We know that,

Radius is $\perp$ to the tangent at point of contact, So

$\angle PAO = 90^\circ$

And $\angle AOP = 70^\circ$ (given)

Now,

In $\triangle APO$,

$\angle PAO + \angle AOP + \angle APO = 180^\circ$

$\Rightarrow 90 + 70 + \angle APO = 180^\circ$

$\Rightarrow 160^\circ + \angle APO = 180^\circ$

$\Rightarrow \angle APO = 180 - 160^o$

$\Rightarrow \angle APO = 20^o$

10.

(b) One

Explanation:

From a point **on** a circle, you can draw **exactly one tangent** to the circle at that point — it's the line perpendicular to the radius at that point. Points **outside** the circle allow two tangents, while points **inside** allow none.

11. **(a)** 2

Explanation:

2

12.

(b) a^2b^2

Explanation:

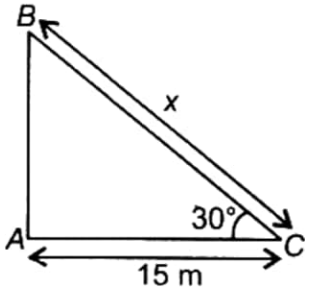
a^2b^2

13.

(c) $10\sqrt{3}$ m

Explanation:

Let the length of broken part (BC) = x



In $\triangle$ABC,

$\cos 30^{o} = \frac{15}{x}$

$\Rightarrow x \times \frac{\sqrt{3}}{2} = 15$

$\Rightarrow x = 5\sqrt{3} \times 2 = 10\sqrt{3}$ m

14.

(b) $10\sqrt{2}$ units

Explanation:

$10\sqrt{2}$ units

15.

(d) Conjugate Angles

Explanation:

Conjugate Angles

16.

(c) $\frac{1}{2}$

Explanation:

Total number of card = 18

n(s) = 18

A = Even numbers from 3 to 20

(A) = 4, 6, 8, 10, 12, 14, 16, 18, 20

n(A) = 9

Required probability P(A) = $\frac{n(A)}{n(S)} = \frac{9}{18}$

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

17.

(d) $\frac{1}{2}$

Explanation:

$\frac{1}{2}$

18.

(c) 1

Explanation:

$\mathbf{x_i}$	$\mathbf{f_i}$	$\mathbf{f_i x_i}$

15	2	30
17	3	51
19	4	76
20 + p	5 p	$100\ p + 5p^2$
23	6	138
Total	Σf_i **= 15 + 5 p**	$\Sigma f_i x_i$ **= 295 + 100 p + 5 p^2**

Mean = $\frac{\Sigma f_i x_i}{\Sigma f_i} \Rightarrow 20 = \frac{295+100p+5p^2}{15+5p}$

$\Rightarrow 20(15 + 5\ p) = 295 + 100\ p + 5p^2$

$\Rightarrow 300 + 100\ p = 295 + 100\ p + 5p^2 \Rightarrow 5p^2 = 5$

$\Rightarrow p^2 = 1 \Rightarrow p = 1$ ($\because p \neq -1$)

19. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation:
Both A and R are true and R is the correct explanation of A.

20. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation:
nth term of an AP be $a_n = S_n - S_{n-1}$

$a_n = 3n^2 - 4n - 3(n - 1)^2 + 4(n - 1)$

$a_n = 6n - 7$

So, both A and R are true and R is the correct explanation of A.

Section B

21. Given: $\frac{5\cos^2 60^\circ + 4\sec^2 30^\circ - \tan^2 45^\circ}{\sin^2 30^\circ + \cos^2 30^\circ}$

$= \frac{5\left(\frac{1}{2}\right)^2 + 4\left(\frac{2}{\sqrt{3}}\right)^2 - (1)^2}{\left(\frac{1}{2}\right)^2 + \left(\frac{\sqrt{3}}{2}\right)^2}$

$= \frac{5\times\frac{1}{4} + 4\times\frac{4}{3} - 1}{\frac{1}{4} + \frac{3}{4}}$

$= \frac{\frac{5}{4} + \frac{16}{3} - 1}{\frac{1+3}{4}}$

$= \frac{\frac{15+64-12}{12}}{\frac{4}{4}}$

$= \frac{\frac{67}{12}}{1}$

$= \frac{67}{12}$

OR

We have to prove that, $\frac{\sin\theta - \cos\theta + 1}{\sin\theta + \cos\theta - 1} = \frac{1}{\sec\theta - \tan\theta}$

Taking L.H.S. = $\frac{\sin\theta - \cos\theta + 1}{\sin\theta + \cos\theta - 1}$

$= \frac{\tan\theta - 1 + \sec\theta}{\tan\theta + 1 - \sec\theta}$ [dividing the numerator and denominator by $\cos\theta$]

$= \frac{(\tan\theta + \sec\theta) - 1}{(\tan\theta - \sec\theta) + 1}$

$= \frac{\{(\tan\theta + \sec\theta) - 1\}(tan\theta - \sec\theta)}{\{(\tan\theta - \sec\theta) + 1\}(\tan\theta - \sec\theta)}$ [Multiplying and dividing by $(\tan\theta - \sec\theta)$]

$= \frac{(\tan^2\theta - \sec^2\theta) - (tan\theta - \sec\theta)}{\{(\tan\theta - \sec\theta) + 1\}(\tan\theta - \sec\theta)}$ [$\because$ (a – b)(a + b) = a^2 – b^2]

$= \frac{-1-\tan\theta+\sec\theta}{(\tan\theta-\sec\theta+1)(\tan\theta-\sec\theta)}$ [$\because \tan^2\theta - \sec^2\theta = -1$]

$= \frac{-(\tan\theta-\sec\theta+1)}{(\tan\theta-\sec\theta+1)(\tan\theta-\sec\theta)}$

$= \frac{-1}{\tan\theta-\sec\theta}$

$= \frac{1}{\sec\theta-\tan\theta}$

= R.H.S.

Hence Proved.

22. Let us assume that $2 + 3\sqrt{3}$ is a rational number

$2 + 3\sqrt{3} = \frac{p}{q}$; p, q are integers and $q \neq 0$

$\Rightarrow \sqrt{3} = \frac{p-2q}{3q}$

RHS is rational but LHS is irrational

$\therefore$ Our assumption is wrong. Hence $2 + 3\sqrt{3}$ is an irrational number.

23. Given: $\triangle$ABC $\sim$ $\triangle$PQR

and CM and RN are medians of $\triangle$ABC and $\triangle$PQR respectively.

To Prove: $\triangle$AMC $\sim$ $\triangle$PNR

Proof: $\triangle$ABC $\sim$ $\triangle$PQR ...(Given)

$\therefore \angle A = \angle P$,

and $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR}$

$\frac{AB}{PQ} = \frac{AC}{PR}$

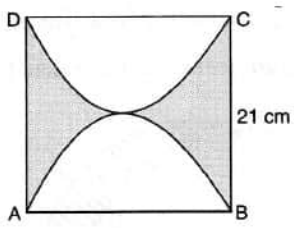
$\frac{2AM}{2PN} = \frac{AC}{PR}$

$\frac{AM}{PN} = \frac{AC}{PR}$

and $\angle A = \angle P$

$\therefore$ $\triangle$AMC $\sim$ $\triangle$PQR ...(SAS Test)

Hence Proved.

24. 

$r = \frac{21}{2}$ cm

Perimeter of the shaded region = AD + BC + lengths of the arcs of semi circles APB and CPD

= AD + BC + {tex}2\;\left[\frac12(2\mathrm{πr})\right]{/tex}

= AD + BC + {tex}2 (\mathrm{πr}){/tex}

$= 21 + 21 + 2\left(\frac{22}{7} \times \frac{21}{2}\right)$

$= 42 + 2(11 \times 3)$

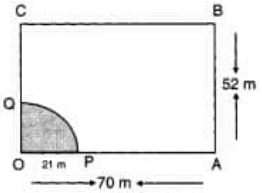
= 42 + 66

= 108 cm.

Thus, Perimeter of the shaded region is 108 cm.

OR

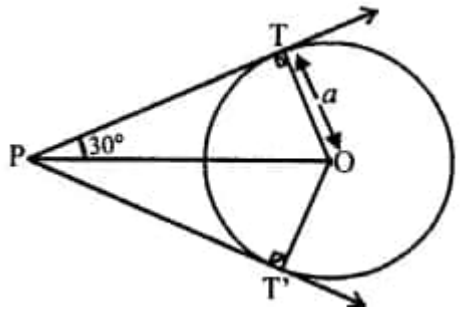
Shaded portion indicates the area which the horse can graze. Clearly, shaded area is the area of a quadrant of a circle of radius r - 21 m.



$\therefore$Required Area = $\frac{1}{4}\pi r^2$

$\therefore$Required Area = $\left\{\frac{1}{4} \times \frac{22}{7} \times (21)^2\right\}$ cm^2 = $\frac{693}{2}$cm^2 = 346.5 cm^2

25. Since, tangents drawn from an external point are equally inclined to the line joining centre to that point.



$\therefore \angle TPT = 60^\circ \quad \Rightarrow \angle TPO = 30^\circ$

Also, OT $\perp$ TP

Now, in $\triangle$TPO $\sin 30^\circ = \frac{OT}{OP}$

$\Rightarrow \frac{1}{2} = \frac{a}{OP} \quad \Rightarrow OP = 2a$

Section C

26. $\because$ Given that $\sqrt{2}$ is an irrational number.

Let us assume that $7\sqrt{2}$ is a rational number.

Then, $7\sqrt{2} = \frac{a}{b}$, where a and b have no common factors other than 1.

$(7\sqrt{2})$ b = a

$\sqrt{2} = \frac{a}{7b}$

Since, a, 7, and b are integers, so, $\frac{a}{7b}$ is a rational number. This means $\sqrt{2}$ is rational. But this contradicts the fact that $\sqrt{2}$ is irrational.

So, our assumption was wrong. Therefore, $7\sqrt{2}$ is an irrational number.

27. Here, $\alpha + \beta = (k+5)$ and $\alpha\beta = (5k+1)$

Given, $\alpha + \beta = \frac{\alpha\beta}{3}$

$\Rightarrow k + 5 = \frac{5k+1}{3}$

$\Rightarrow k = 7$

28. We have,

$\Rightarrow \frac{1}{\text{cosec}A - \cot A} - \frac{1}{\sin A} = \frac{1}{\sin A} - \frac{1}{\text{cosec}A + \cot A}$

$\Rightarrow \frac{1}{\text{cosec}A - \cot A} + \frac{1}{\text{cosec}A + \cot A} = \frac{1}{\sin A} + \frac{1}{\sin A}$

$\Rightarrow \frac{1}{\text{cosec}A - \cot A} + \frac{1}{\text{cosec}A + \cot A} = \frac{2}{\sin A}$

LHS = $\frac{1}{\text{cosec}A - \cot A} + \frac{1}{\text{cosec}A + \cot A}$

$\Rightarrow \frac{\text{cosec}A + \cot A + \text{cosec}A - \cot A}{(\text{cosec}A - \cot A)(\text{cosec}A + \cot A)}$

$\Rightarrow \frac{2\text{cosec}A}{\text{cosec}^2 A - \cot^2 A}$

$\Rightarrow \frac{\frac{2}{\sin A}}{1} = \frac{2}{\sin A}$ = RHS.

Hence Proved.

29. Interest at the end of 1st year $= \frac{2000 \times 7 \times 1}{100} = ₹140$

Interest at the end of 2nd year $= \frac{2000 \times 7 \times 2}{100} = ₹280$

Interest at the end of 3rd year $= \frac{2000\times7\times3}{100} = ₹420$

140, 280, 420, ...

Yes, Interests form an AP with first term $= 140$ and common difference $= 140$

Interest at the end of 27th year $= 140 + 26 \times 140$

$= ₹\ 3780$

OR

Let a be the first term and the common difference be d.

$S_n = \frac{n}{2}[2a + (n - 1)d]$

$S_{12} = \frac{12}{2}[2a + (12 - 1)d]$

$= 6[2a + 11d]$

$= 12a + 66d$

$S_8 = \frac{8}{2}[2a + (8 - 1)d]$

$= 4[2a + 7d]$

$= 8a + 28d$

$S_4 = \frac{4}{2}[2a + (4- 1)d]$

$= 2[2a + 3d]$

$= 4a + 6d$

$3(S_8 - S_4) = 3[(8a + 28d) - (4a + 6d)]$

$= 3[8a + 28d - 4a - 6d]$

$= 3[4a + 22d]$

$= 12a + 66d$

$= S_{12}$

30. Calculation of mean:

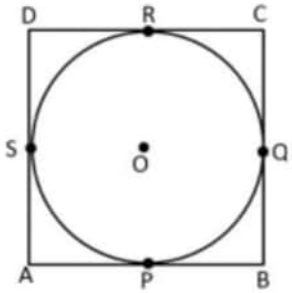
Number of Days	**Number of students (f_i)**	x_i	f_ix_i
0-6	10	3	30
6-12	11	9	99
12-18	7	15	105
18-24	4	21	84
24-30	4	27	108
30-36	3	33	99
36-42	1	39	39
	$\Sigma f_i = 40$		Σf_ix_i **= 564**

We know that, Mean $= \frac{\Sigma f_i x_i}{\Sigma f_i}$

$= \frac{564}{40}$

$= 14.1$

Therefore, mean number of days a student was absent is 14.1

31. 

As the length of tangents from an external point to a circle are equal

Thus,

$AP = AS$

$BP = BQ$

$DR = DS$

$CR = CQ$

Adding the above equations,

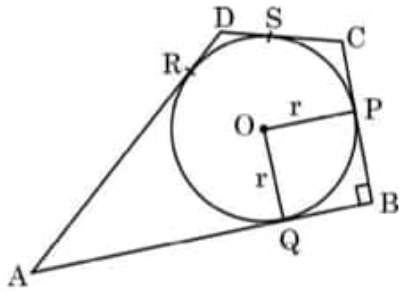
$AB + CD = BC + AD$

As $AB = CD \& BC = AD$ (opp. sides of rectangle)

$\Rightarrow AB = AD$

$\therefore ABCD$ is a square

OR



DR = DS = 3 cm

$\therefore$ AR = AD - DR = 17 - 3 = 14 cm

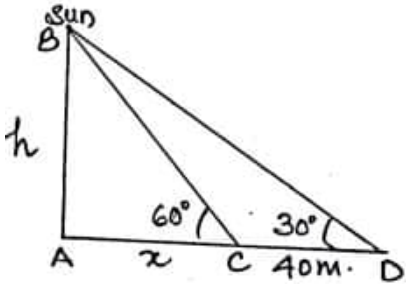
$\Rightarrow$ AQ = AR = 14 cm

$\therefore$ QB = AB - AQ = 20 - 14 = 6 cm

Since QB = OP = r $\therefore$ radius = 6 cm

Section D

32. Let AB be the tower and AC and AD are shadows.



In $\triangle BAD, \tan 30^\circ = \frac{h}{x+40} \Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x+40}$

$\Rightarrow x + 40 = h\sqrt{3}$ ...(i)

In$\triangle$BAC, $\tan 60^\circ = \frac{\text{h}}{\text{x}} \Rightarrow \sqrt{3} = \frac{\text{h}}{\text{x}} \Rightarrow \text{h} = \text{x}\sqrt{3}$ ...(ii)

From (i) and (ii) $\text{h} = 20\sqrt{3} = 34.6$ m

And $\text{x} = 20$

length of original shadow $= 20$ m, height $= 34.6$ m.

33.

Marks	**x**	**f**	**u** = $\frac{x-35}{10}$	**fu**	**cf**
0-10	5	3	-3	-9	3
10-20	15	5	-2	-10	8
20-30	25	16	-1	-16	24
30-40	35	12	0	0	36
40-50	45	13	1	13	49
50-60	55	20	2	40	69

60-70	65	6	3	18	75
70-80	75	5	4	20	80
		80		56	

Mean = $35 + \left(10 \times \frac{56}{80}\right) = 42$

Median class: 40 - 50

Median = $40 + \frac{10}{13}(40 - 36) = 43$

34. Given:-

Speed of boat =18 km/hr

Distance = 24 km

Let x be the speed of stream.

Let t_1 and t_2 be the time for upstream and downstream As we know that,

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

$$\Rightarrow \text{time} = \frac{\text{distance}}{\text{speed}}$$

For upstream, Speed = (18 - x) km/hr

Distance =24 km

Time = t_1

Therefore,

$t_1 = \frac{24}{18-x}$

For downstream,

Speed = (18 + x) km/hr

Distance = 24 km

Time = t_2

Therefore,

$t_2 = \frac{24}{18+x}$

Now according to the question-

$t_1 = t_2 + 1$

$\frac{24}{18-x} = \frac{24}{18+x} + 1$

$\Rightarrow \frac{1}{18-x} - \frac{1}{18+x} = \frac{1}{24}$

$\Rightarrow \frac{(18+x)-(18-x)}{(18-x)(18+x)} = \frac{1}{24}$

$\Rightarrow 48x = (18 - x)(18 + x)$

$\Rightarrow 48x = 324 + 18x - 18x - x^2$

$\Rightarrow x^2 + 48x - 324 = 0$

$\Rightarrow x^2 + 54x - 6x - 324 = 0$

$\Rightarrow x(x + 54) - 6(x + 54) = 0$

$\Rightarrow (x + 54)(x - 6) = 0$

$\Rightarrow x = -54$ or $x = 6$

Since speed cannot be negative.

$\Rightarrow x \neq -54$

$\therefore x = 6$

Thus the speed of stream is 6 km/hr.

Total time of Journey = $t_1 + t_2$

$= \frac{24}{18-x} + \frac{24}{18+x}$

$= \frac{24}{12} + \frac{24}{24} = 2 + 1 = 3$ hrs.

OR

Let the lengths of the radii of the smaller and larger circles be r cm and R cm respectively.

It is given that,R - r = 7.....(i).

It is also given that the difference between the areas of two circles is 1078 cm^2

$\therefore \quad \pi R^2 - \pi r^2 = 1078$

$\Rightarrow \quad \pi\left(R^2 - r^2\right) = 1078$

$\Rightarrow \quad \frac{22}{7}(R+r)(R-r) = 1078$

$\Rightarrow \quad \frac{22}{7}(R+r) \times 7 = 1078$

$\Rightarrow$ R + r = 49 .....(ii)

Subtracting (i) from (ii), we get

2r = 42$\Rightarrow$r = 21

Hence, the radius of the smaller circle is of length 21 cm.

35. Radius of cylindrical part $= \frac{0.1}{2}\ m$ or $\frac{1}{20}\ m$

Volume of wood = Volume of cuboid + volume of cylinder

$= 2 \times 0.5 \times 0.1 + \frac{22}{7} \times \frac{0.1}{2} \times \frac{0.1}{2} \times 0.7$

$= \frac{211}{2000}$ or $0.1055m^3$

Total surface area of bat = TSA of cuboid + CSA of cylinder

$= 2(2 \times 0.5 + 0.5 \times 0.1 + 0.1 \times 2) + \ 2 \times \frac{22}{7} \times \frac{0.1}{2} \times 0.7$

$= \frac{5}{2} + \frac{11}{50} = \frac{68}{25}$ or $2.72m^2$

OR

Total number of hemispheres $= \frac{14 \times 14}{1.4 \times 1.4}$

$= 100$

Total Surface Area of remaining solid = Surface Area of Cube + Curved Surface Area of 100 hemispheres - Area of 100 circles

$= 6 \times 14 \times 14 + 100 \times 2 \times \frac{22}{7} \times 0.7 \times 0.7 \quad -100 \times \frac{22}{7} \times 0.7 \times 0.7$

$= 1330$

$\therefore$ Total surface area of remaining solid is $1330\ cm^2$.

Section E

36. i. $x + y = 300$

and $50x + 200y = 30000$ or $x + 4y = 600$

ii. a. $x + y = 300$ and $x + 4y = 600$

Solving the equations, we get

$x = 200$ and $y = 100$

$\therefore$ Number of chairs and tables rented by the school are 200 and 100 respectively.

OR

b. $x + y = 300$ and $50x + 200y = 27000$ or $x + 4y = 540$

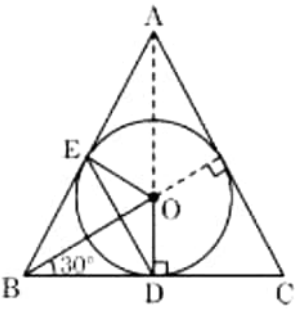
Solving the equations, we get

$x = 220$ and $y = 80$

$\therefore$ Number of chairs and tables rented by the school are 220 and 80 respectively.

iii. Number of tables $= \frac{30000}{200} = 150$

$\therefore$ Maximum number of tables that can be rented is 150 if no chairs are rented.

37. 

i. In $\triangle ODB, \sin 30^\circ = \frac{4}{OB} \Rightarrow OB = 8\ cm$

ii. Yes, $DE \| CA$

$\triangle ABC$ is an equilateral triangle and $AD \perp BC$

$\Rightarrow D$ is the mid point of BC

Similarly, E is the mid point of AB, so $DE \| CA$

iii. a. $\angle EBD = 60^\circ \Rightarrow \angle EOD = 120^\circ$

$\angle OEB = \angle ODB = 90^\circ$

(radius is perpendicular to the tangent through the point of contact)

$\angle OEB + \angle ODB = 90^\circ + 90^\circ = 180^\circ$

$\therefore$ quad. OEBD is a cyclic quad.

OR

b. In $\triangle OBD, \cos 30^\circ = \frac{BD}{8} \Rightarrow BD = 6.92$ cm

$BC = 2BD = 13.84\ cm$

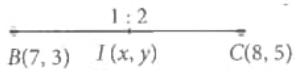
$\therefore$ Perimeter of $\triangle ABC = 41.52\ cm$

38. i. The distance between A and C

$= \sqrt{(8-4)^2 + (5+3)^2} = \sqrt{4^2 + 8^2}$

$= \sqrt{16 + 64} = \sqrt{80} = 4\sqrt{5}$ units

ii. Let the coordinates of I be (x, y)



Then, by section formula,

x = $\frac{1\times8+2\times7}{1+2} = \frac{8+14}{3} = \frac{22}{3}$

and y = $\frac{1\times5+2\times3}{1+2} = \frac{5+6}{3} = \frac{11}{3}$

Thus, the coordinates of I is $\left(\frac{22}{3}, \frac{11}{3}\right)$

iii. The mid-point of A and C

$= \left(\frac{8+4}{2}, \frac{5-3}{2}\right) = (6, 1)$

OR

Let B divides the line segment joining A and C in the ratio k : 1. Then, the coordinates of B will be $\left(\frac{8k+4}{k+1}, \frac{5k-3}{k+1}\right)$.

Thus, we have $\left(\frac{8k+4}{k+1}, \frac{5k-3}{k+1}\right) = (7, 3)$

$\Rightarrow \frac{8k+4}{k+1} = 7$ and $\frac{5k-3}{k+1} = 3$

Consider, $\frac{8k+4}{k+1} = 7 \Rightarrow 8k + 4 = 7k + 7 \Rightarrow k = 3$

Hence, the required ratio is 3 : 1.