Class X Session 2025-26
Subject - Mathematics (Basic)
Sample Question Paper - 03

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.

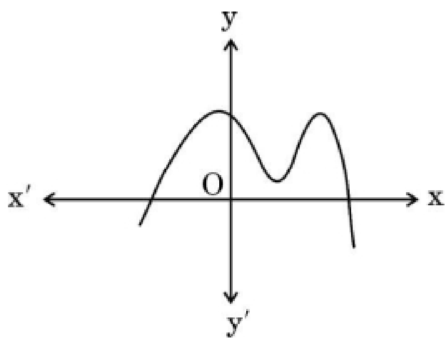
Section A

1. If the product of two co-prime numbers is 553, then their HCF is: **[1]**

   a) 7 b) 79

   c) 553 d) 1

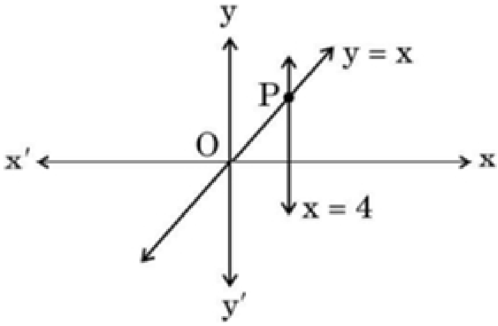
2. Graph of a polynomial p(x) is given in the figure. The number of zeroes of p(x) is: **[1]**



a) 2 b) 5

c) 3 d) 4

3. The lines represented by the linear equations y = x and x = 4 intersect at P. The coordinates of the point P are: **[1]**



a) (4, 4) b) (-4, 4)

c) (4, 0) d) (0, 4)

4. The roots of the quadratic equation $ax^2 + bx + c = 0$ are real and distinct, if: **[1]**

a) $b^2 - 4ac = 0$ b) $b^2 - 4ac > 0$

c) $b^2 - 4ac \geq 0$ d) $b^2 - 4ac < 0$

5. The 8^{th} term of an A.P. is 17 and its 14^{th} term is 29. The common difference of this A.P. is: **[1]**

a) 3 b) 2

c) 5 d) -2

6. Distance of the point $(a \cos \theta, a \sin \theta)$ from origin is: **[1]**

a) a^2 b) $\pm a$

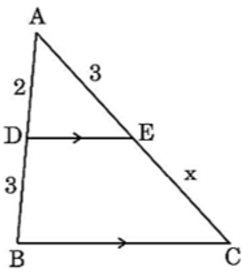
c) a d) 1

7. The midpoint of the line segment joining the points (-6, -4) and (0, 4) is: **[1]**

a) (-3, 0) b) (-6, 4)

c) (-6, 8) d) (-6, 0)

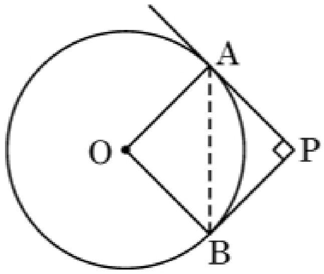
8. In the given figure, DE || BC. If AD = 2 units, DB = AE = 3 units and EC = x units, then the value of x is: **[1]**



a) 2 b) 5

c) $\frac{9}{2}$ d) 3

9. In the given figure, tangents PA and PB to the circle centred at O, from point P are perpendicular to each other. If PA = 5 cm, then length of AB is equal to **[1]**



a) 5 cm

b) $5\sqrt{2}$ cm

c) $2\sqrt{5}$ cm

d) 10 cm

10. Maximum number of common tangents that can be drawn to two circles intersecting at two distinct points is: **[1]**

a) 1

b) 4

c) 2

d) 3

11. $\left(\frac{2}{3}\sin 0^\circ - \frac{4}{5}\cos 0^\circ\right)$ is equal to: **[1]**

a) 30^o

b) 90^o

c) 60^o

d) 45^o

12. If sin A = $\frac{2}{3}$, then value of cot A is: **[1]**

a) $\frac{3}{2}$

b) $\frac{\sqrt{5}}{2}$

c) $\frac{2}{3}$

d) $\frac{5}{4}$

13. A kite is flying at a height of 30 m from the ground. The length of string from the kite to the ground is 60 m. Assuming that there is no slack in the string, the angle of elevation of the kite at the ground is **[1]**

a) 60°

b) 45°

c) 90°

d) 30°

14. The area of a sector of a circle of radius 16 cm cut off by an arc, which is 18.5 cm long, is: **[1]**

a) 148 cm^2

b) 154 cm^2

c) 176 cm^2

d) 168 cm^2

15. Pankaj has a motorcycle with wheels of diameter 91 cm. There are 22 spokes in the wheel. Find the length of arc between two adjoining spokes. **[1]**

a) 13 cm

b) 15 cm

c) 26 cm

d) 18 cm

16. In a family of two children, the probability of having at least one girl is: **[1]**

a) $\frac{1}{4}$

b) $\frac{2}{5}$

c) $\frac{3}{4}$

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

17. The probability of an impossible event is **[1]**

a) not defined

b) $\frac{1}{2}$

c) 1

d) 0

18. If the mean and the mode of a distribution are 17 and 20 respectively, then the median of the distribution, using empirical formula, is: **[1]**

a) $\frac{31}{3}$

b) 17

c) 20

d) 18

19. **Assrtion (A):** A toy is in the form of a cone mounted on a hemisphere with the same radius. The radius of the conical portion is 4 cm and its height is 3 cm. the surface area of the toy is 163.28 cm^2 . [Take π = 3.14] **[1]**

Reason (R): Volume of hemisphere is $\frac{2}{3}\pi r^2$

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):** Three consecutive terms 2k + 1, 3k + 3 and 5k - 1 form an AP than k is equal to 6. **[1]**

Reason (R): In an AP a, a + d, a + 2d, ... the sum to n terms of the AP be S_n = $\frac{n}{2}(2a+(n-1)d)$

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.

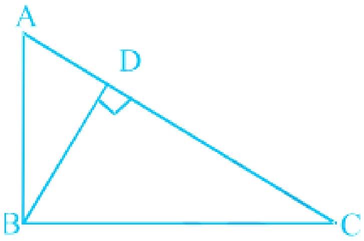
c) A is true but R is false.

d) A is false but R is true.

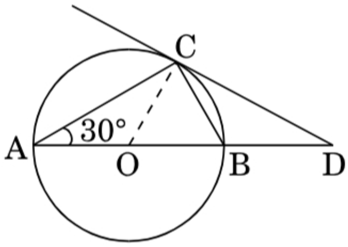
Section B

21. An electronic device makes a beep after every 60 seconds. Another device makes a beep after every 62 seconds. They beeped together at 10 a.m. At what time will they beep together at the earliest? **[2]**

22. In the given figure, ABC is a triangle, right angled at B and BD $\perp$ AC. If AD = 4 cm and CD = 5 cm, find BD and AB. **[2]**



23. In Figure, AB is the diameter of a circle with centre O and AC is its chord such that $\angle$BAC = 30^o. If the tangent drawn at C intersects extended AB at D, then show that BC = BD. **[2]**



24. If acosθ - bsinθ = c, prove that (asinθ + bcosθ) = $\pm\sqrt{a^2+b^2-c^2}$ **[2]**

OR

Prove that : $\frac{1}{cosec\theta-\cot\theta}-\frac{1}{\sin\theta}=\frac{1}{\sin\theta}-\frac{1}{cosec\theta+\cot\theta}$

25. The length of the minute hand of a clock is 14 cm. Find the area swept by the minute hand between 8:00 am and 8:05 am. **[2]**

OR

Find the length of the arc of a circle of diameter 42 cm which subtends an angle of 60° at the centre.

Section C

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

27. Find the zeroes of the quadratic polynomial $6x^2$ - 3 - 7x and verify the relationship between the zeroes and the **[3]**

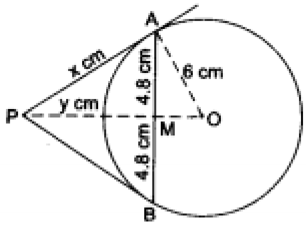
coefficients of the polynomial.

28. A sum of ₹ 700 is to be used to give seven cash prizes to students of a school for their overall academic performance. If, each prize is ₹ 20 less than its preceding term, find the value of each of the prizes. **[3]**

OR

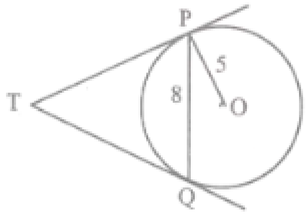
Find the sum of all 3-digit natural numbers, which are multiples of 11.

29. In the given figure, AB is a chord of length 9.6 cm of a circle with centre O and radius 6 cm. The tangents at A and B intersect at P. Find the length of PA. **[3]**



OR

In the given figure, PQ is a chord of length 8 cm of a circle of radius 5 cm and centre O. The tangents at TP and TQ intersect at point T. Find the length of TP.



30. If tan A = n tanB and sin A = m sinB, then prove that $\cos^2 A = \frac{m^2-1}{n^2-1}$ **[3]**

31. For what value of x, is the median of the following frequency distribution 34.5? **[3]**

Class	Frequency
0 - 10	3
10 - 20	5
20 - 30	11
30 - 40	10
40 - 50	x
50 - 60	3
60 - 70	2

Section D

32. A train travels at a certain average speed for a distance 63 km and then travels a distance of 72 km at an average speed of 6 km/hr more than the original speed. If it takes 3 hours to complete total journey, what is its original average speed? **[5]**

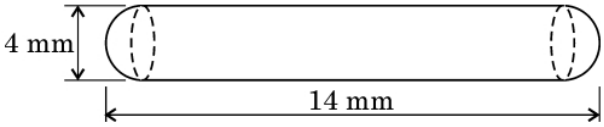
OR

The sum of squares of two consecutive multiples of 7 is 637. Find the multiples.

33. From the top of tower, 100 m high, a man observes two cars on the opposite sides of the tower with the angles of depression 30^o and 45^o respectively. Find the distance between the two cars. (Use $\sqrt{3}$ = 1.73) **[5]**

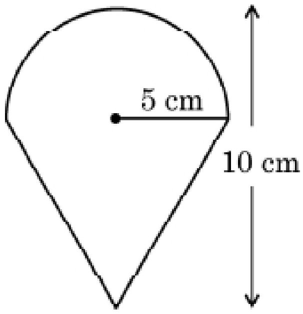
34. A medicine capsule is in the shape of a cylinder with two hemispheres stuck to each of its ends. The length of **[5]**

the entire capsule is 14 mm and the diameter of the capsule is 4 mm, find its surface area. Also, find its volume.



OR

An ice-cream filled cone having radius 5 cm and height 10 cm is as shown in the figure. Find the volume of the ice-cream in 7 such cones.



35. In a hospital, the ages of diabetic patients were recorded as follows. Find the median age. **[5]**

Age (in years)	0 - 15	15 - 30	30 - 45	45 - 60	60 - 75
Number of patients	5	20	40	50	25

Section E

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

A coaching institute of Mathematics conducts classes in two batches I and II and fees for rich and poor children are different. In batch I, there are 20 poor and 5 rich children, whereas in batch II, there are 5 poor and 25 rich children. The total monthly collection of fees from batch I is ₹ 9000 and from batch II is ₹ 26,000. Assume that each poor child pays ₹ x per month and each rich child pays ₹ y per month.

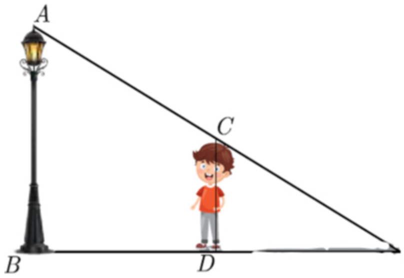
i. Represent the information given above in terms x and y. (1)
ii. Find the monthly fee paid by a poor child. (1)
iii. Find the difference in the monthly fee paid by a poor child and a rich child. (2)

OR

If there are 10 poor and 20 rich children in batch II, what is the total monthly collection of fees from batch II? (2)

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

Priyanshu is very intelligent in maths. He always try to relate the concept of maths in daily life. One day he is walking away from the base of a lamp post at a speed of 1 m/s. Lamp is 4.5 m above the ground.



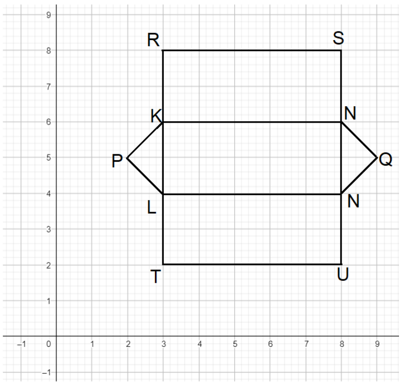
i. If after 2 second, length of shadow is 1 meter, what is the height of Priyanshu? (1)
ii. What is the minimum time after which his shadow will become larger than his original height? (1)
iii. What is the distance of Priyanshu from pole at this point? (2)

OR

What will be the length of his shadow after 4 seconds? (2)

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

The camping alpine tent is usually made using high-quality canvas and it is waterproof. These alpine tents are mostly used in hilly areas, as the snow will not settle on the tent and make it damp. It is easy to layout and one need not use a manual to set it up. One alpine tent is shown in the figure given below, which has two triangular faces and three rectangular faces. Also, the image of canvas on graph paper is shown in the adjacent figure.



i. What is the distance of point Q from y-axis? (1)
ii. What are the coordinates of U? (1)
iii. What is the distance between the points P and Q? (2)

OR

What is the Perimeter of image of a rectangular face? (2)

Solution

Section A

1.

(d) 1

Explanation:

Co prime number are number which have 1 as HCF.

2. **(a)** 2

Explanation:

Since, The graph of P(x) intersect the x-asix at two distinct point.

hence, two zeroes are possible.

3. **(a)** (4, 4)

Explanation:

(4, 4)

4.

(b) $b^2 - 4ac > 0$

Explanation:

A quadratic equation $ax^2 + bx + c = 0$ has real and distinct roots, if $b^2 - 4ac > 0$.

5.

(b) 2

Explanation:

$(T_{14} - T_8) = (29 - 17) = 12 \Rightarrow (a + 13d) - (a + 7d) \Rightarrow 6d = 12 \Rightarrow d = 2$

6.

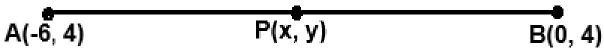
(c) a

Explanation:

a

7. **(a)** (-3, 0)

Explanation:



Coordinate of P

$p\left(\frac{-6+0}{2}, \frac{-4+4}{2}\right)$

p(-3, 0)

8.

(c) $\frac{9}{2}$

Explanation:

According to Basic Proportionality theorem.

$\frac{AD}{DB} = \frac{AE}{EC}$

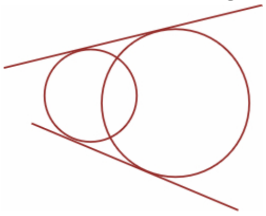
$\frac{2}{3} = \frac{3}{x}$

$x = \frac{9}{2}$

9.

(b) $5\sqrt{2}$ cm

Explanation:
Since PA⊥ PB
In quad. PAOB
$\angle P = \angle A = \angle B = 90^\circ$
PA = PB (Tangent's from same point)
Hence PAOB is a Square.
$AB = \sqrt{PA^2 + PB^2}$
$AB = \sqrt{5^2 + 5^2}$
AB = $5\sqrt{2}$ cm

10.
(c) 2
Explanation:
Given two intersecting circles.

Drawing the required figure with tangents,
Only two common tangents are possible because tangents touches a circle at only one point.
Thus, the number of tangents that can be drawn common to two intersecting circles is 2.

11. **(a)** 30^o
Explanation:
We know that
Tan A = $\frac{CB}{AB}$
Tan A = $\frac{15}{15\sqrt{3}}$
Tan A = $\frac{1}{\sqrt{3}}$
Tan A = Tan 30^o
on comparing the t-ratios
A = 30^o

12.
(b) $\frac{\sqrt{5}}{2}$
Explanation:
Sin $A = \frac{2}{3}$
We know
$\sin A = \frac{P}{H}$
here P = 2k, H = 3k
By Pyth. Theorem
$(3k)^2 = (2k)^2 + B^2$
$9k^2 - 4k^2 = B^2$
$B = k\sqrt{5}$
$\cot A = \frac{B}{P} = \frac{k\sqrt{5}}{2K}$
$\cot A = \frac{\sqrt{5}}{2}$

13.
(d) 30°
Explanation:

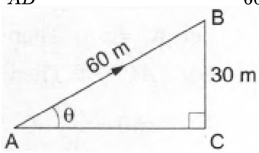
Let AB be the tower and B be the kite.

Let AC be the horizontal and let BC $\perp$ AC.

Let $\angle$CAB = θ.

BC = 30 m and AB = 60 m. Then,

$\frac{BC}{AB}$ = sin $\theta \Rightarrow$ sin θ = $\frac{30}{60} = \frac{1}{2} \Rightarrow$ sin θ = sin $30^{o} \Rightarrow \theta = 30^{o}$.



14. **(a)** 148 cm^2

Explanation:

$$Area\ of\ the\ sector = \frac{Arc\ length}{2\pi r} \times \pi r^2$$

$$= \frac{18.5}{2\pi(16)} \times [\pi 16^2]$$

$$\mathbf{= 148\ cm^2}$$

15. **(a)** 13 cm

Explanation:

Radius of wheel = $\frac{91}{2}$ cm

Angle between two adjoining spokes, $\theta = \frac{360^\circ}{22}$

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

= $\frac{360^\circ}{360^\circ \times 22} \times 2 \times \frac{22}{7} \times \frac{91}{2}$ = 13 cm

16.

(c) $\frac{3}{4}$

Explanation:

$\frac{3}{4}$

17.

(d) 0

Explanation:

An event which has no chance of occurrence is called an impossible event.

for example: The probability of getting more than 6 when a die is thrown is an impossible event because the highest number in a die is 6

The probability of an impossible event is always 0.

18.

(d) 18

Explanation:

18

19.

(c) A is true but R is false.

Explanation:

A is true but R is false.

20.

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

Explanation:

For 2k + 1, 3k + 3 and 5k - 1 to form an AP

(3k + 3) - (2k + 1) = (5k - 1) - (3k + 3) k + 2 = 2k - 4

2 + 4 = 2k - k = k

k = 6

So, both assertion and reason are correct but reason does not explain assertion.

Section B

21. L.C.M. of 60 and 62 seconds is 1860 seconds

$\frac{1860}{60} = 31$ minutes

They will beep together at 10:31 a.m.

22. Here $\triangle ADB \sim \triangle BDC$

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

$\Rightarrow \quad AD \times CD = BD \times BD$

$4 \times 5 = BD^2$

$\Rightarrow BD = 2\sqrt{5}$ cm

In right $\triangle BDA$

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

$\Rightarrow AB^2 = (2\sqrt{5})^2 + (4)^2$

$\Rightarrow AB^2 = 36 \Rightarrow AB = 6$ cm

23. OA = OC

$\Rightarrow \angle OCA = 30^o$

$\angle OCB = \angle ACB - \angle ACO$

$= 90^o - 30^o = 60^o$

$\angle BCD = 90^o - \angle OCB$

$= 90^o - 60^o = 30^o$ ...(i)

In $\triangle ACD$,

$\angle ACD + \angle CAD + \angle CDA = 180^o$

$90^o + 30^o + 30^o + \angle CDA = 180^o$

$\angle CDA = 30^o$ ...(ii)

From (i) and (ii)

$\angle BCD = \angle CDA$

$\Rightarrow BC = BD$ (In $\triangle CBD$)

24. Given, $a\cos\theta - b\sin\theta = c$ ..(i)

Now, $(a\cos\theta - b\sin\theta)^2 + (a\sin\theta + b\cos\theta)^2$

$= a^2(\cos^2\theta + \sin^2\theta) + b^2(\sin^2\theta + \cos^2\theta) = (a^2 + b^2)$.

Thus, $(a\cos\theta - b\sin\theta)^2 + (a\sin\theta + b\cos\theta)^2 = (a^2 + b^2)$

$\Rightarrow c^2 + (a\sin\theta + b\cos\theta)^2 = (a^2 + b^2)$

$\Rightarrow (a\sin\theta + b\cos\theta)^2 = (a^2 + b^2 - c^2)$

$\Rightarrow (a\sin\theta + b\cos\theta) = \pm\sqrt{a^2 + b^2 - c^2}$

Hence, $(a\sin\theta + b\cos\theta) = \pm \sqrt{a^2 + b^2 - c^2}$

OR

$\frac{1}{cosec\theta - \cot\theta} - \frac{1}{\sin\theta} = \frac{1}{\sin\theta} - \frac{1}{cosec\theta + \cot\theta}$

$\Rightarrow \frac{1}{cosec\theta - \cot\theta} + \frac{1}{cosec\theta + \cot\theta} = \frac{2}{\sin\theta}$ ...(i)

Now, LHS of (i)

$= \frac{1}{cosec\theta - \cot\theta} + \frac{1}{cosec\theta + \cot\theta}$

$= \frac{(cosec\theta + \cot\theta) + (cosec\theta - \cot\theta)}{(cosec\theta - \cot\theta)(cosec\theta + \cot\theta)} = \frac{2cosec\theta}{cosce^2\theta - \cot^2\theta}$

$= \frac{2\cos ec\theta}{1} \quad \because \cos ec^2\theta - \cot^2\theta = 1$

$= 2\cos ec\theta = \frac{2}{\sin\theta} =$ RHS of (i)

25. Angle swept by minute hand in 60 minutes = 360°

Angle swept by minute hand in 5 minutes =30°

r = 14 cm

Area swept = $\frac{\pi r^2\theta}{360^\circ} = \frac{30^\circ}{360^\circ} \times \frac{22}{7} \times 14 \times 14$

= $\frac{154}{3}$ cm^2 or 51.33 cm^2

OR

Diameter of a circle = 42 cm

$\Rightarrow$ Radius of a circle = r $= \frac{42}{2}$

= 21 cm

Central angle $= \theta = 60^\circ$

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

$= \frac{2\times\frac{22}{7}\times 21\times 60^\circ}{360^\circ}\text{cm}$

= 22 cm

Section C

26. Let us assume that 3 + 7$\sqrt{2}$ is a rational number. $\Rightarrow$

3 + 7$\sqrt{2}$ = $\frac{\text{p}}{\text{q}}$, p, q are integers and q $\neq$ 0

$\Rightarrow$ $\sqrt{2}$ = $\frac{p-3q}{7q}$

RHS is rational but LHS is irrational

$\therefore$ Our assumption was wrong

Hence, 3 + 7$\sqrt{2}$ is an irrational number

27. The given polynomial is

p(x) = 6x^2 -7x -3

Factorize the above quadratic polynomial, we have

6x^2 -7x -3 = 6x^2 -9x + 2x - 3

= 3x(2x - 3) + 1(2x - 3)

= (3x + 1)(2x - 3)

For p(x) = 0, either 3x + 1 = 0 or 2x - 3 = 0

$\Rightarrow \quad x = \frac{-1}{3}$ or $x = \frac{3}{2}$

Verification:we have a = 6, b = -7, c = -3

Sum of zeroes = $\frac{-1}{3} + \frac{3}{2} = \frac{7}{6}$

Also, $\frac{-b}{a} = \frac{-(-7)}{6} = \frac{7}{6}$

Now, product of zeroes= $\left(-\frac{1}{3}\right) \times \frac{3}{2} = \frac{-1}{2}$

Also, $\frac{c}{a} = \frac{-3}{6} = \frac{-1}{2}$

28. It is given that the sum of seven cash prizes is equal to ₹ 700.

And, each prize is ₹ 20 less than its preceding term.

Let the value of first prize = ₹ a

Let the value of second prize =₹ (a−20)

Let the value of third prize = ₹ (a−40)

So, we have a sequence of the form:

a, a−20, a−40, ...

It is an arithmetic progression because the difference between consecutive terms is constant.

First term = a, Common difference = d = (a − 20) − a= −20

n = 7 (Because there are total of seven prizes)

S_7 = ₹ 700 {given}

Applying formula, $S_n = \frac{n}{2}[2a + (n-1)d]$ to find sum of n terms of AP, we get

$S_7 = \frac{7}{2}[2a + (7-1)(-20)]$

$\Rightarrow 700 = \frac{7}{2}[2a - 120]$

⇒ 200 = 2a− 120

⇒ 320 = 2a

⇒ a =160

Therefore, value of first prize = ₹ 160

Value of second prize = 160 - 20= ₹ 140

Value of third prize = 140 - 20= ₹ 120

Value of fourth prize = 120 - 20 = ₹ 100

Value of fifth prize = 100 - 20 = ₹ 80

Value of sixth prize = 80 - 20 = ₹ 60

Value of seventh prize = 60 - 20 = ₹ 40

OR

Three digits numbers that are divisible by 11 are :-

110, 121, 132,.............., 990

Clearly ,above sequence is an A.P.

Here,

a (First term) = 110

d (common difference) = 11

a_n = 990

We know that, in A.P.

a_n = a + (n - 1)d

Or, 990 = 110 + (n - 1) $\times$ 11

Or, 990 = 110 + 11n - 11

Or, 990 = 99 + 11n

Or, 891 = 11n

Or, n = 81

Also,

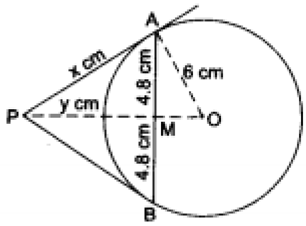
$S_n = \frac{n}{2}$ (a + a_n)

Or, $S_{81} = \frac{81}{2}(110 + 990)$

Or, S_{81} = 81 $\times$550

Or, S_{81} = 44550.

29. AB is a chord of length 9.6 cm of a circle with centre O and radius 6 cm.



The tangents at A and B intersect at P.

CONSTRUCTION : Join OP and OA. Let OP and AB intersect at M.

Let PA = x cm and PM = y cm.

Now, $PA = PB$

and OP is the bisector of $\angle APB$ [$\because$ two tangents to a circle from an external point are equally inclined to the line segment joining the centre to that point.

Also, $OP \perp AB$ and OP bisects AB at M [$\because$ OP is the right bisector of AB]

$\therefore$ AM = MB = $\frac{9.6}{2}$cm

$= 4.8cm.$

In right $\triangle AMO$, we have

$OA = 6cm$

and $AM = 4.8cm.$

$\therefore$ OM = $\sqrt{OA^2 - AM^2}$

$= \sqrt{6^2 - 4.8^2}$

$= \sqrt{12.96}$

$= 3.6\text{cm}.$

In right $\triangle PAO$, we have

$AP^2 = PM^2 + AM^2$

$\Rightarrow x^2 = y^2 + (4.8)^2$

$\Rightarrow \quad x^2 = y^2 + 23.04$ ...(i)

In right $\triangle PAO$, we have

$OP^2 = PA^2 + OA^2$ [Note $\angle PAO = 90^\circ$, since AO is the radius at the point of contact]

$\Rightarrow \quad (y + 3.6)^2$

$= x^2 + 6^2$

$\Rightarrow \quad y^2 + 7.2y + 12.96$

$= x^2 + 36$

$\Rightarrow 7.2y = 46.08$ [using (i)]

$\Rightarrow \quad y = 6.4\text{cm}$

and

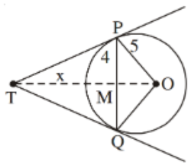
$x^2 = (6.4)^2 + 23.04$

$= 40.96 + 23.04 = 64$

$\Rightarrow x = \sqrt{64} = 8$

$\therefore PA = 8cm.$

OR



Join OT and OQ.

TP = TQ (As length of tangents from a point outside the circle is equal)

$\therefore$ TM $\perp$ PQ and bisects PQ

Hence PM = 4 cm

Therefore OM = $\sqrt{25-16}$ = $\sqrt{9}$ = 3 cm

Let TM = x

From $\triangle$PMT, $PT^2 = x^2 + 16$

From $\triangle$POT, $PT^2 = (x + 3)^2 - 25$

Hence $x^2 + 16 = x^2 + 9 + 6x - 25$

$\Rightarrow 6x = 32 \Rightarrow x = \frac{16}{3}$

Hence, $PT^2 = \frac{256}{9} + 16 = \frac{400}{9}$

$\therefore$ PT = $\frac{20}{3}$ cm = 6.667 cm

30. Given,

tan A = n tan B

$\Rightarrow$ tanB = $\frac{1}{n}$tan A

$\Rightarrow$ cotB = $\frac{n}{\tan A}$ ....(1)

Also given,

sin A = m sin B

$\Rightarrow$ sin B = $\frac{1}{m}$sin A

$\Rightarrow$ cosec B = $\frac{m}{\sin A}$ .....(2)

We know that, $\text{cosec}^2B - \cot^2B = 1$, hence from (1) & (2) :-

$$\frac{m^2}{\sin^2 A} - \frac{n^2}{\tan^2 A} = 1$$

$$\Rightarrow \quad \frac{m^2}{\sin^2 A} - \frac{n^2\cos^2 A}{\sin^2 A} = 1$$

$$\Rightarrow \quad \frac{m^2 - n^2\cos^2 A}{\sin^2 A} = 1$$

$\Rightarrow m^2 - n^2\cos^2A = \sin^2A$

$\Rightarrow m^2 - n^2\cos^2A = 1 - \cos^2A$

$\Rightarrow$ $m^2 - 1 = n^2\cos^2A - \cos^2A$

$\Rightarrow$ $m^2 - 1 = (n^2 - 1)\cos^2A$

$\Rightarrow \frac{m^2-1}{n^2-1} = \cos^2A$

31.

Class	**Frequency (f_i)**	C.F.
0 - 10	3	3
10 - 20	5	8
20 - 30	11	19
30 - 40	10	29
40 - 50	x	x + 29
50 - 60	3	x + 32
60 - 70	2	x + 34

Median = $30 + \frac{\left(\frac{34+x}{2} - 19\right)}{10} \times 10$

34.5 = $30 + \frac{34+x-38}{2}$

$\Rightarrow$ 34 + x - 38 = (34.5 - 30)2 = 9

$\Rightarrow$ x = 9 + 4 = 13

Section D

32. Let the original average speed of the train be x km/hr.

Time taken to cover 63 km $= \frac{63}{x}$ hours

Time taken to cover 72 km when the speed is increased by 6 km/hr $= \frac{72}{x+6}$ hours

By the question,we have,

$\frac{63}{x} + \frac{72}{x+6} = 3$

$\Rightarrow \frac{21}{x} + \frac{24}{x+6} = 1$

$\Rightarrow \frac{21x+126+24x}{x^2+6x} = 1$

$\Rightarrow$ $45x + 126 = x^2 + 6x$

$\Rightarrow$ $x^2 - 39x - 126 = 0$

$\Rightarrow$ $x^2 - 42x + 3x - 126 = 0$

$\Rightarrow$ x(x - 42) + 3(x - 42) = 0

$\Rightarrow$ (x - 42)(x + 3) = 0

$\Rightarrow$ x - 42 = 0 or x + 3 = 0

$\Rightarrow$ x = 42 or x = -3

Since the speed cannot be negative, $x \neq -3$.

Thus, the original average speed of the train is 42 km/hr.

OR

According to the question, let the consecutive multiples of 7 be 7x and 7x +7

$(7x)^2 + (7x+7)^2 = 637$

or, $49x^2 + 49x^2 + 49 + 98x = 637$

or, $98x^2 + 98x - 588 = 0$

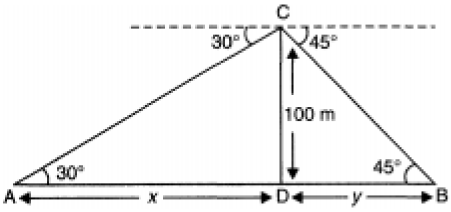
or, $x^2 + x - 6 = 0$

or, (x + 3)(x - 2) = 0

or, x = -3 ,2

Rejecting the value, x=2

Thus,the required multiples are, 14 and 21.

33.


In right △ADC,

$\tan 30^\circ = \frac{CD}{AD}$

$\Rightarrow \quad \frac{1}{\sqrt{3}} = \frac{100}{x}$

$\Rightarrow \quad x = 100\sqrt{3}$ ......(1)

In right △BCD

$\frac{CD}{DB} = \frac{100}{y} = \tan 45^\circ = 1$

So y = 100m ...... (2)

The distance between both the cars is

AB = AD + DB

= x + y

Substituting the value of x and y from (1) and (2) we get

$AB = 100\sqrt{3} + 100$

$= 100 \times 1.73 + 100$

= 173 + 100

= 273m

34. Radius of hemisphere = radius of cylinder = 2 mm

Length of cylindrical part = 14 - 4 = 10 mm.

Surface area of the capsule = CSA of cylinder + 2(CSA of hemisphere)

$= 2 \times \frac{22}{7} \times 2 \times 10 + 2 \times 2 \times \frac{22}{7} \times 2 \times 2$

= 176 mm^2

Volume of the capsule = volume of cylinder + 2(volume of hemisphere)

$= \frac{22}{7} \times 2 \times 2 \times 10 + 2 \times \frac{2}{3} \times \frac{22}{7} \times 2 \times 2 \times 2$

$= \frac{3344}{21}\ \text{mm}^3$ or $159.24\ \text{mm}^3$

OR

Given,

Radius of cone = Radius of hemisphere = r = 5 cm

Height of cone (h) = 10 cm

No. of cones = 7

Volume of ice cream in one cone = Volume of cone + Volume of hemisphere

= $\frac{1}{3}\pi r^2 h + \frac{2}{3}\pi r^3$

= $\frac{\pi}{3} r^2 (h + 2r)$

= $\frac{22}{7} \times \frac{1}{3} \times 5 \times 5(10 + 2 \times 7)$

= $\frac{22}{7} \times \frac{1}{3} \times 5 \times 5(10 + 10)$

= $\frac{22 \times 25 \times 20}{21}$

= 523.8 cm^3

Volume of ice cream in 7 cones

= 523.8 × 7 cm^3

= 3666.63 cm^3

= 3.67 litre

35. Calculation of median:

Class interval	Frequency(f_i)	Cumulative frequency
0 - 15	5	5
15 - 30	20	25
30 - 45	40	65

45 - 60	50	115
60 - 75	25	140

N = 140$\Rightarrow$ $\frac{N}{2}$= 70.

The median class is 45 -60.

$\therefore l = 45, h = 15, f = 50, c.f. = 65$

Median, M =$l + \left\{h \times \frac{\left(\frac{N}{2} - cf\right)}{f}\right\}$

$= 45 + \left\{15 \times \frac{(70-65)}{50}\right\}$

$= 45 + \left\{15 \times \frac{5}{50}\right\}$

$= 45 + 1.5 = 46.5$

Hence, the median age of diabetic patients is 46.5 years.

Section E

36. i. Since, each poor child pays ₹ x

and each rich child pays ₹ y

$\therefore$ In batch I, 20 poor and 5 rich children pays ₹ 9000 can be represented as 20x + 5y = 9000

and in batch II, 5 poor and 25 rich children pays ₹ 26,000 can be represented as 5x + 25y = 26,000

ii. As we have 20x + 5y = 9,000 ...(i)

and 5x + 25y = 26,000

or x + 5y = 5,200 ...(ii)

On subtracting (ii) from (i), we get

19x = 3,800

$\Rightarrow$ x = 200

$\therefore$ Monthly fee paid by a poor child = ₹ 200

iii. As we have,

20x + 5y = 9000 ...(i)

and 5x + 25y = 26000

x + 5y = 5200 ...(ii)

On subtracting equation (ii) from (i), we have

19x = 3800

x = $\frac{3800}{19}$

= 200

Put the value of x in equation (ii), we get

200 + 5y = 5200

5y = 5200 - 200

y = 1000

$\therefore$ y - x = 1000 - 200

= 800

Hence, difference in the monthly fee paid by a poor child and a rich child is ₹ 800.

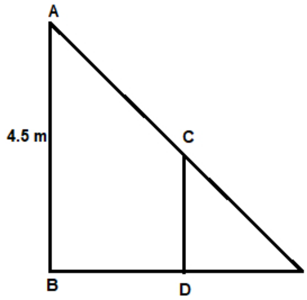
OR

Total monthly fee = 10x + 20y

= 10(200) + 20(1,000)

= 2,000 + 20,000

= ₹ 22,000

37. i. 

Distance covered in 2 sec = 2 m

length of shadow = 1 m

Total distance from base = 2 + 1 = 3m

$\frac{1}{3} = \frac{\text{height of Rohan}}{4.5}$

height of Rohan = 1.5 m

= 150 cm

ii. When x > 1.5 m

distance walked = d m

$\Rightarrow \frac{x}{d+x} = \frac{1.5}{4.5}$

$\Rightarrow \frac{x}{d+x} = \frac{1}{3}$

2x = d

d > 3

hence, the time must be 3 sec

$\therefore$ minimum time after which his shadow become larger than his original height = 3 s

iii. 3 metres

OR

After 4 and distance = 4 m

Shadow length = y m

$\frac{y}{4+y} = \frac{1.5}{4.5}$

3y = 4 + y

y = 2 m

$\therefore$ After 4 sec, the shadow length will be 2 m

38. i. Coordinates of Q are (9, 5).

$\therefore$ Distance of point Q from y-axis = 9 units

ii. Coordinates of point U are (8, 2).

iii. We have, P(2, 5) and Q (9, 5)

$\therefore$ PQ = $\sqrt{(2-9)^2 + (5-5)^2}$ = $\sqrt{49+0}$ = 7 units

OR

Length of TU = 5 units and of TL = 2 units

$\therefore$ Perimeter of image of a rectangular face = 2(5 + 2) = 14 units