Class X Session 2026-27
Subject - Mathematics (Standard)
Sample Question Paper - 7

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.

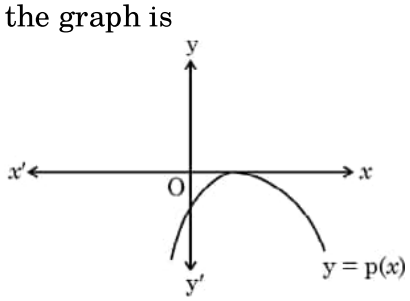
Section A

1. If n is a natural number, then 8^n cannot end with digit **[1]**

   a) 0 b) 4

   c) 6 d) 2

2. The graph of y = p(x) is given, for a polynomial p(x). The number of zeroes of p(x) from the graph is **[1]**



a) 0

b) 1

c) 3

d) 2

3. The pair of linear equations y = 0 and y = - 6 has: **[1]**



a) no solution

b) only solution (0, 0)

c) a unique solution

d) infinitely many solutions

4. Which of the following equations is a quadratic equation? **[1]**

a) $x^3 = (x+1)^3$

b) $x^2 + 1 = \frac{1}{x}$

c) $x^2 = \sqrt{x}$

d) $x^3 = (x-1)^3 + 3x^2$

5. If the first term of an AP is -3 and common difference -2, then the seventh term is **[1]**

a) 9

b) -17

c) -9

d) -15

6. AOBC is a rectangle whose three vertices are $A(0, 2), O(0, 0)$ and $B(4, 0)$. The square of the length of its diagonal is equal to: **[1]**

a) 20

b) 36

c) 4

d) 16

7. The distance of the point (5, 4) from the origin is **[1]**

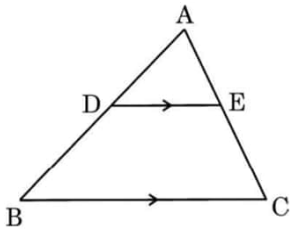
a) $\sqrt{41}$

b) 9

c) 41

d) 3

8. In $\triangle$ABC, DE || BC. If AD : DB = 2 : 3, then DE : BC is equal to: **[1]**



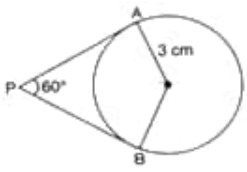
a) 2 : 5

b) 3 : 5

c) 3 : 2

d) 2 : 3

9. If two tangents inclined at 60° are drawn to circle of radius 3 cm, then length of each tangent is equal to **[1]**



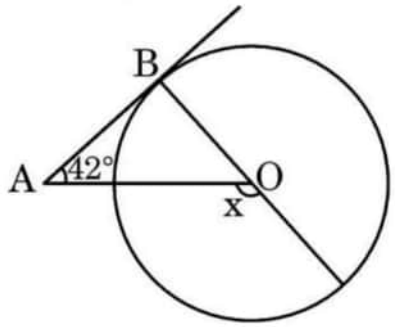
a) $3\sqrt{3}$

b) 3 cm

c) $3\sqrt{2}$ cm

d) $2\sqrt{3}$ cm

10. In the given figure, AB is a tangent to the circle with centre O. If $\angle BAO = 42^\circ$, then the value of x is: **[1]**



a) 42°

b) 132°

c) 48°

d) 38°

11. $\left(\frac{2\tan 30^\circ}{1+\tan^2 30^\circ}\right)$ is equal to: **[1]**

a) sin 30°

b) cos 60°

c) sin 60°

d) tan 60°

12. If $\cos\theta = \frac{\sqrt{3}}{2}$ and $\sin\phi = \frac{1}{2}$, then $\tan(\theta+\phi)$ is: **[1]**

a) $\frac{1}{\sqrt{3}}$

b) 1

c) not defined

d) $\sqrt{3}$

13. The angle of elevation of the top of a 30 m high tower at a point 30 m away from the base of the tower is: **[1]**

a) 45°

b) 90°

c) 30°

d) 60°

14. The area of a sector of a circle with radius 7 cm, when the angle of the sector is 60°, is: **[1]**

a) $\frac{44}{7} sqcm$

b) $\frac{22}{3} sqcm$

c) $\frac{77}{3} sqcm$

d) $\frac{132}{7} sq\ cm$

15. Area of a sector of angle θ (in degrees) of a circle with radius r is: **[1]**

a) $\frac{\theta}{180} \times \pi r^2$

b) $\frac{\theta}{180} \times 2\pi r$

c) $\frac{\theta}{360} \times 2\pi r$

d) $\frac{\theta}{720} \times 2\pi r^2$

16. Which of the following **cannot** be the probability of an event? **[1]**

a) $\frac{1}{3}$

b) 3%

c) 0.1

d) $\frac{5}{3}$

17. A card is drawn at random from a well-shuffled deck of 52 playing cards. The probability of getting an ace of spade is: **[1]**

a) $\frac{1}{52}$

b) $\frac{3}{52}$

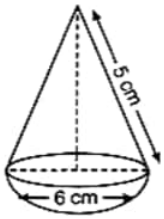
c) $\frac{1}{26}$ d) $\frac{1}{13}$

18. If the mean and mode of a frequency distribution are 28 and 16 respectively, then its median is: **[1]**

a) 24.5 b) 23.5

c) 24 d) 22

19. **Assertion (A):** The given figure represents a hemisphere surmounted by a conical block of wood. The diameter of their bases is 6 cm each and the slant height of the cone is 5 cm. The volume of the solid is 196 cm^3 **[1]**



Reason (R): The volume hemisphere is given by $\frac{2}{3}\pi r^3$

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):** If S_n is the sum of the first n terms of an A.P., then its nth term a_n is given by $a_n = S_n - S_{n-1}$ **[1]**

Reason (R): The 10th term of the A.P. 5, 8, 11, 14, ... is 35.

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

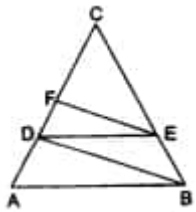
21. Prove that $\frac{1+\sec\theta-\tan\theta}{1+\sec\theta+\tan\theta} = \frac{1-\sin\theta}{\cos\theta}$. **[2]**

OR

Prove that: (cosec A – sin A) (sec A – cos A) = $\frac{1}{\tan A+\cot A}$

22. Prove that $\sqrt{5}$ is an irrational number. **[2]**

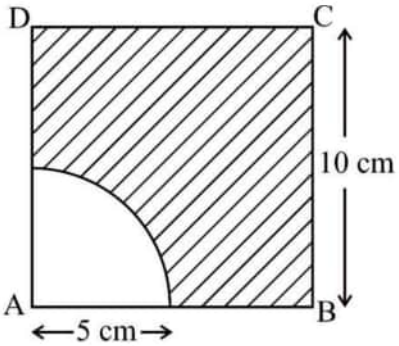
23. In the given figure, $AB \| DE$ and $BD \| EF$ Prove that $DC^2 = CF \times AC$. **[2]**



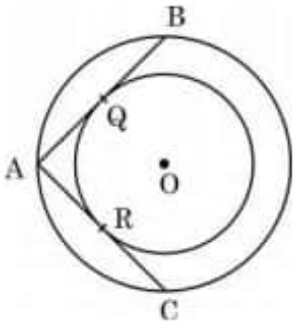
24. In a circle of radius 21 cm, an arc subtends an angle of 60° at the centre. Find the area of the sector formed by the arc. Also, find the length of the arc. **[2]**

OR

In the given figure, ABCD is a square of side 10 cm. A sector of radius 5 cm is cut out from one of the corners. Find the area of the shaded region. (Take $\pi = 3.14$)



25. In Fig., there are two concentric circles with centre O. If ARC and AQB are tangents to the smaller circle from the point A lying on the larger circle, find the length of AC, if AQ = 5 cm. **[2]**



Section C

26. Three sets of Physics, Chemistry and Mathematics books have to be stacked in such a way that all the books are stored subject-wise and the height of each stack is the same. The number of Physics books is 144, the number of Chemistry books is 180 and the number of Mathematics books is 192. Assuming that the books are of same thickness, determine the number of stacks of Physics, Chemistry and Mathematics books. **[3]**

27. If α and β are zeroes of the quadratic polynomial $4x^2 + 4x + 1$, then form a quadratic polynomial whose zeroes are 2α and 2β. **[3]**

28. Prove that $\frac{\tan\theta}{1-\tan\theta} - \frac{\cot\theta}{1-\cot\theta} = \frac{\cos\theta+\sin\theta}{\cos\theta-\sin\theta}$. **[3]**

29. If m times the mth term of an Arithmetic Progression is equal to n times its nth term and $m \neq n$, show that the $(m + n)^{th}$ term of the A.P. is zero. **[3]**

OR

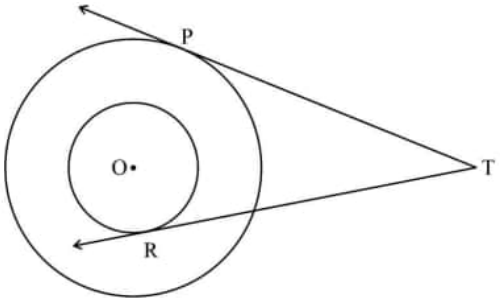
Resham wanted to save at least ₹6500 for sending her daughter to school next year (after 12 months). She saved ₹450 in the first month and raised her savings by ₹20 every next month. How much will she be able to save in next 12 months? Will she be able to send her daughter to the school next year?

30. If the mean of the following frequency distribution is 62·8, then find the missing frequency x : **[3]**

Class	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100	100 – 120
Frequency	5	8	x	12	7	8

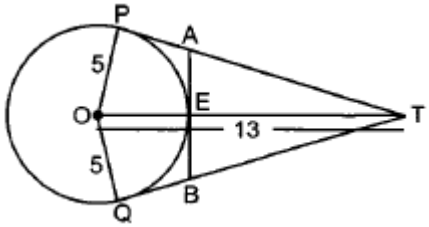
31. In the given figure, two concentric circles have radii 3 cm and 5 cm. Two tangents TR and TP are drawn to the circles from an external point T such that TR touches the inner circle at R and TP touches the outer circle at P. If $TR = 4\sqrt{10}\ cm$, then find **[3]**

the length of TP.



OR

In figure, O is the centre of a circle of radius 5 cm. T is a point such that OT = 13 cm and OT intersects circle at E. If AB is a tangent to the circle at E, find the length of AB. where TP and TQ are two tangents to the circle.



Section D

32. The angle of elevation of the top of a tower, 300 m high, from a point on the ground is observed as 30°. At an instant a hot air balloon passes vertically above the tower and at that instant its angle of elevation from same point on the ground is 60°. Find height of the balloon from the ground and distance of tower from point of observation. (Use $\sqrt{3} = 1.73$) **[5]**

33. The following table gives the monthly consumption of electricity of 100 families: **[5]**

Monthly Consumption (in units)	130 - 140	140 - 150	150 - 160	160 - 170	170 - 180	180 - 190	190 - 200
Number of families	5	9	17	28	24	10	7

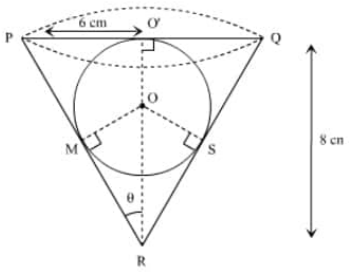
Find the median of the above data.

34. Find the value(s) of k for which the equation $2x^2 + kx + 3 = 0$ has real and equal roots. Hence, find the roots of the equations so obtained. **[5]**

OR

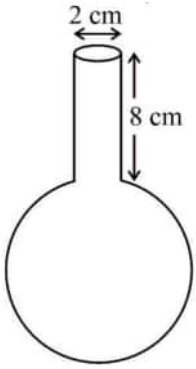
Sum of the areas of two squares is 452 m^2. If the difference of their perimeters is 8 m, find the sides of the two squares.

35. A conical vessel of radius 6 cm and height 8 cm is completely filled with water. A sphere is lowered into the water and its size is such that when it touches the sides, it is just immersed as shown in Figure. What fraction of water over flows? **[5]**



OR

A spherical glass vessel (shown below) has a cylindrical neck, which is 8 cm long and 2 cm wide. The diameter of the spherical part is 9 cm. Find the capacity of the glass vessel in mL. (Take $1\ cm^3 = 1\ mL$ and $\pi = \frac{22}{7}$)



Section E

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



Lokesh, a production manager in Mumbai, hires a taxi everyday to go to his office. The taxi charges in Mumbai consists of a fixed charges together with the charges for the distance covered. His office is at a distance of 10 km from his home. For a distance of 10 km to his office, Lokesh paid ₹ 105. While coming back home, he took another route. He covered a distance of 15 km and the charges paid by him were ₹ 155.

i. What are the fixed charges? (1)

ii. What are the charges per km? (1)

iii. If fixed charges are ₹ 20 and charges per km are ₹ 10, then how much Lokesh have to pay for travelling a distance of 10 km? (2)

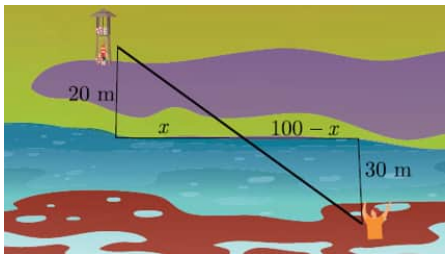
OR

Find the total amount paid by Lokesh for travelling 10 km from home to office and 25 km from office to home. [Fixed charges and charges per km are as in (i) & (ii). (2)

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

Swimmer in Distress: A lifeguard located 20 metre from the water spots a

swimmer in distress. The swimmer is 30 metre from shore and 100 metre east of the lifeguard. Suppose the lifeguard runs and then swims to the swimmer in a direct line, as shown in the figure.



i. How far east from his original position will he enter the water? (Hint: Find the value of x in the sketch.) (1)

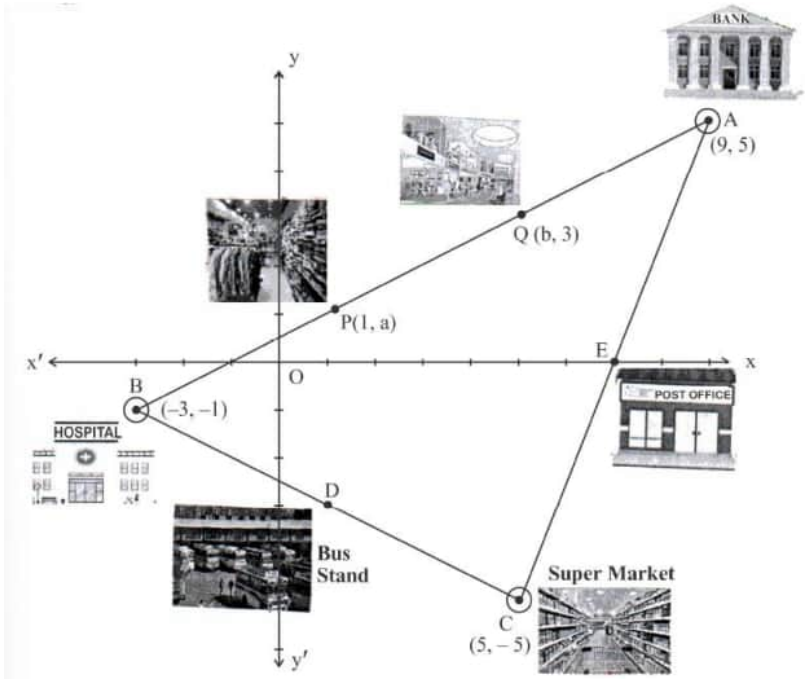
ii. Which similarity criterion of triangle is used? (1)

iii. What is the distance of swimmer from the shore? (2)

OR

What is the length of AD? (2)

38. Partha, a software engineer, lives in Jerusalem for his work. He lives in the most convenient area of the city from where bank, hospital, post office and supermarket can be easily accessed. In the graph, the bank is plotted as $A(9, 5)$, hospital as $B(-3, -1)$ and supermarket as $C(5, -5)$ such that A, B, C form a triangle. **[4]**



Based on the above given information, answer the following questions:

i. Find the distance between the bank and the hospital. **(1)**

ii. In between the bank and the supermarket, there is a post office plotted at E which is their mid-point. Find the coordinates of E. **(1)**

iii. a. In between the hospital and the supermarket, there is a bus stop plotted as D, which is their mid-point. If Partha wants to reach the bus stand from the bank, then how much distance does he need to cover? **(2)**

OR

b. P and Q are two different garment shops lying between the bank and the hospital, such that $BP = PQ = QA$. If the coordinates of P and Q are $(1, a)$

and $(b, 3)$ respectively, then find the values of 'a' and 'b'. **(2)**

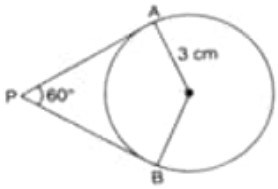
Solution

Section A

1. **(a)** 0
   Explanation:
   Here, $8^n = (2 \times 2 \times 2)^n$
   $\therefore$ prime factorization of 6^n are 2^3
   But 8^n, for any natural number n, ends with digit 0, then it must contain the prime number 2 and 5.
   Hence, 8^n can not end with digit 0 for any natural number n.
2. **(b)** 1
   Explanation:
   Here, the graph y = p(x) cuts the x-axis at exactly one point.
   $\therefore$ The number of zeroes of p(x) from the graph is 1.
3. **(a)** no solution
   Explanation:
   Since, we have y = 0 and y = -6 are two parallel lines.
   therefore, no solution exists.
4. **(a)** $x^3 = (x+1)^3$
   Explanation:
   $x^3 = (x+1)^3$
5. **(d)** -15
   Explanation:
   First term, a = -3
   Common difference, d = -2
   And
   $a_7 = a + 6d$
   = -3 + 6(-2)
   = -3 - 12
   = -15
6. **(a)** 20
   Explanation:
   20
7. **(a)** $\sqrt{41}$
   Explanation:
   The distance of the point (5, 4) from origin
   $= \sqrt{5^2 + 4^2}$
   $= \sqrt{25 + 16} = \sqrt{41}$unit
8. **(a)** 2 : 5
   Explanation:
   Let AD= 2K and DB = 3K
   So AB = AD + DB
   = 2K + 3K

= 5K
And also AD : AB = 2K : 5K
= 2 : 5
Since DE II BC
By BPT
AD : AB = DE : BC
DE :B C = 2 : 5

9. **(a)** $3\sqrt{3}$
Explanation:
Let O be the centre. Construction: Joined OP.



Since OP bisects ∠P, therefore, $\angle APO = \angle OPB = 30^\circ$ And $\angle OAP = 90^\circ$

$\therefore \tan 30^\circ = \frac{OA}{AP} \Rightarrow \frac{1}{\sqrt{3}} = \frac{3}{AP}$

$\Rightarrow AP = 3\sqrt{3}$ cm Since each tangent from an external point to a circle are equal.
Therefore, PA = PB = $3\sqrt{3}$ cm

10. **(b)** 132°
Explanation:
132°

11. **(c)** $\sin 60^o$
Explanation:
$\frac{2tan30^o}{1+tan^2 30^o} = \frac{2\times\frac{1}{\sqrt{3}}}{1+(\frac{1}{\sqrt{3}})^2}$

$\frac{\frac{2}{\sqrt{3}}}{1+\frac{1}{3}} = \frac{\frac{2}{\sqrt{3}}}{\frac{4}{3}} = \frac{2}{\sqrt{3}} \times \frac{3}{4} = \frac{\sqrt{3}}{2}$

= $\sin 60^o$

12. **(d)** $\sqrt{3}$
Explanation:
$\cos\theta = \frac{\sqrt{3}}{2}$
$\cos\theta = \cos 30^\circ$
$\theta = 30^\circ$
$\sin\phi = \frac{1}{2}$
$\sin\phi = \sin 30^\circ$
$\phi = 30^\circ$
Now,
$\text{Tan}(\theta + \phi) = \text{Tan}(30^\circ + 30^\circ)$
$= \text{Tan}\, 60^\circ$
$= \sqrt{3}$

13. **(a)** 45°

Explanation:

Let the angle be x

$\Rightarrow$ tan x = $\frac{\text{Height of tower}}{\text{Distance}}$

$\Rightarrow$ tan x = $\frac{30}{30}$ = 1

$\Rightarrow$ tan x = $\tan 45^\circ$

$\Rightarrow$ x = 45°

14.

(c) $\frac{77}{3} sqcm$

Explanation:

$\frac{77}{3}$ sq. cm.

15.

(d) $\frac{\theta}{720} \times 2\pi r^2$

Explanation:

Area of circle = πr^2

And

Fraction of a sector of angle θ in a circle

$= \frac{\theta}{360^\circ}$

$\therefore$ Area of the sector

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

$= \left(\frac{\theta}{360} \times \pi r^2\right) \times \frac{2}{2} = \frac{\theta}{720} \times 2\pi r^2$

16.

(d) $\frac{5}{3}$

Explanation:

We know that

$0 \leq$ Probability ≤ 1

but $\frac{5}{3}$ is greater than 1, So, this can not be the possible value of probability.

17. **(a)** $\frac{1}{52}$

Explanation:

A card is drawn at random from a pack of well shuffled 52 playing cards. 'S' is the sample space.

$\therefore$ n(S) = 52

Event A: The card drawn is an ace of spade

$\therefore$n(A) = 1

$\therefore$ P(A) = $\frac{n(A)}{n(S)}$

= $\frac{1}{52}$

18.

(c) 24

Explanation:

Mean = 28
Mode = 16
Mode = 3 Median - 2 Mean
Hence, $\text{Median} = \frac{\text{Mode} + 2\text{Mean}}{3}$
$= \frac{16+2(28)}{3}$
$= \frac{16+56}{3}$
$= \frac{72}{3}$
= 24

19.

(d) A is false but R is true.
Explanation:
A is false but R is true.

20.

(c) A is true but R is false.
Explanation:
a_{10} = a + 9d
= 5 + 9(3) = 5 + 27 = 32

Section B

21. $\text{LHS} = \frac{(\sec^2\theta - \tan^2\theta) + (\sec\theta - \tan\theta)}{1 + \sec\theta + \tan\theta}$
$= \frac{(\sec\theta - \tan\theta)(\sec\theta + \tan\theta + 1)}{1 + \sec\theta + \tan\theta}$
$= \sec\theta - \tan\theta$
$= \frac{1}{\cos\theta} - \frac{\sin\theta}{\cos\theta}$
$= \frac{1-\sin\theta}{\cos\theta} = \text{RHS}$

OR

L.H.S. = (cosec A – sin A)(sec A – cos A) = $\left(\frac{1}{\sin A} - \sin A\right)\left(\frac{1}{\cos A} - \cos A\right)$
$= \left(\frac{1-\sin^2 A}{\sin A}\right)\left(\frac{1-\cos^2 A}{\cos A}\right)$
= $\frac{\cos^2 A}{\sin A}\frac{\sin^2 A}{\cos A}$ = sin A cos A
R.H.S. = $\frac{1}{\tan A + \cot A}$
= $\frac{1}{\frac{\sin A}{\cos A} + \frac{\cos A}{\sin A}}$
= $\frac{\cos A \sin A}{\sin^2 A + \cos^2 A}$
= sin A cos A
Hence, L.H.S. = R.H.S.

22. Let $\sqrt{5}$ is a rational no $\sqrt{5} = \frac{a}{b}$, where a and b are co-primes
Squaring both sides
5 = $\frac{a^2}{b^2}$
$5b^2 = a^2$
5 divides a^2 ($\because$ 5 divides $5b^2$)
5 divides a ...(i)
a = 5c for some integer 'c'
squaring both sides

$a^2 = 25c^2$

$5b^2 = 25c^2$ ($\because a^2 = 5b^2$)

$b^2 = 5\ c^2$

5 divides b^2 ($\because$ 5 divides $5c^2$)

5 divides b ...(ii)

From (i) and (iii), we can conclude 5 is also a common factor of a and b

But this contradicts the fact that a and b are co-primes.

It means our assumption is incorrect

Hence, $\sqrt{5}$ is an irrational no.

23. In$\triangle ABC$, $AB \| DE$.

$\therefore \quad \frac{CD}{DA} = \frac{CE}{EB}$ ...(i) [by Thales' theorem]

In $\triangle CDB$, $BD \| EF$

$\therefore \quad \frac{CF}{FD} = \frac{CE}{EB}$ ...(ii) [by Thales' theorem]

From (i) and (ii) we get

$\frac{CD}{DA} = \frac{CF}{FD}$

$\Rightarrow \quad \frac{DA}{DC} = \frac{FD}{CF}$ [taking reciprocals]

$\Rightarrow \quad \frac{DA}{DC} + 1 = \frac{FD}{CF} + 1$

$\Rightarrow \frac{DA+DC}{DC} = \frac{FD+CF}{CF}$

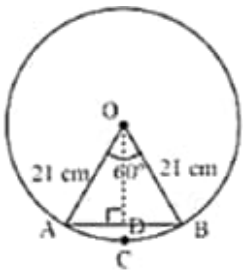
$\Rightarrow \quad \frac{AC}{DC} = \frac{DC}{CF}$

$\Rightarrow \quad DC^2 = CF \times AC$

24. Radius (r) of circle = 21 cm

Angle subtended by the given arc = 60°

Length of an arc of a sector of angle $\theta = \frac{\theta}{360^\circ} \times 2\pi r$



Area of sector OACB = $\frac{60^\circ}{360^\circ} \times \pi r^2$

$= \frac{1}{6} \times \frac{22}{7} \times 21 \times 21$

= 231 cm^2

Length of arc ACB = $\frac{60^\circ}{360^\circ} \times 2 \times \frac{22}{7} \times 21$

$= \frac{1}{6} \times 2 \times 22 \times 3$

= 22 cm

OR

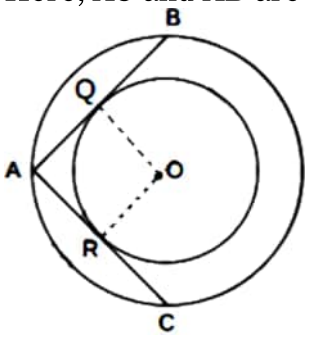
Area of the shaded region = area of square - area of sector

$= (10)^2 - \frac{90}{360}\pi(5)^2$

$= 100 - \frac{3.14 \times 25}{4}$

$= 80.38 sq.\ cm$

25. Here, AC and AB are the tangents from external point A to the smaller circle.



$\therefore$ AC = AB

Now, AB is the chord of bigger circle and OQ is the perpendicular bisector of chord AB.

$\therefore$ AQ = QB

or, AB = 2AQ

or, AB = 2(5) = 10 cm ...[$\because$ Given AQ = 5 cm]

or, AC = 10 cm

Section C

26. $144 = 2^4 \times 3^2$

$180 = 2^2 \times 3^2 \times 5$

$192 = 2^6 \times 3$

$HCF = 2^2 \times 3 = 12$

Number of stacks of Physics Books $= \frac{144}{12} = 12$

Number of stacks of Chemistry Books $= \frac{180}{12} = 15$

Number of stacks of Mathematics Books $= \frac{192}{12} = 16$

27. Let the given polynomial is $p(x) = 4x^2 + 4x + 1$

Since, α, β are zeroes of p(x),

$\therefore \alpha + \beta$ = sum of zeroes = $\frac{-4}{4}$

Also, $\alpha . \beta$= Product of zeroes = $\alpha . \beta = \frac{1}{4}$

Now a quadratic polynomial whose zeroes are 2α and 2β

x^2 - (sum of zeroes)x + Product of zeroes

$= x^2 - (2\alpha + 2\beta)x + 2\alpha \times 2\beta$

$= x^2 - 2(\alpha + \beta)x + 4(\alpha\beta)$

$= x^2 - 2 \times (-1)x + 4 \times \frac{1}{4}$

$= x^2 + 2x + 1$

The quadratic polynomial whose zeroes are 2α and 2β is $x^2 + 2x + 1$

28. To prove : $\frac{\tan\theta}{1-\tan\theta} - \frac{\cot\theta}{1-\cot\theta} = \frac{\cos\theta+\sin\theta}{\cos\theta-\sin\theta}$

L.H.S = $\frac{\tan\theta}{1-\tan\theta} - \frac{\cot\theta}{1-\cot\theta}$

$= \frac{\frac{\sin\theta}{\cos\theta}}{1-\frac{\sin\theta}{\cos\theta}} - \frac{\frac{\cos\theta}{\sin\theta}}{1-\frac{\cos\theta}{\sin\theta}}$ ...[$\because \tan\theta = \frac{\sin\theta}{cos\theta}$]

$= \frac{\sin\theta}{\cos\theta-\sin\theta} + \frac{\cos\theta}{\cos\theta-\sin\theta}$

$= \frac{\sin\theta+\cos\theta}{\cos\theta-\sin\theta}$

= R.H.S.

29. Let a be the first term and d be the common difference of the given AP. Then, in general, the mth and nth terms can be written as

$T_m = a + (m - 1) d$ and $T_n = a + (n - 1)d$ respectively.

According to the question,we are given that,

$(m.T_m) = (n.T_n)$

$\Rightarrow$ m.{a + (m - 1)d} = n.{a + (n - 1)d}

$\Rightarrow$ a.(m - n) + {$(m^2 - n^2)$ - (m - n)} . d = 0

$\Rightarrow$ (m - n).{a + (m + n - 1)}d.

$\Rightarrow$ (m - n).T_{m+n} = 0

$\Rightarrow T_{m+n} = 0$ [$\because$ (m-n)$\neq$0].

Hence, the (m + n)th term is zero.

OR

Savings of Resham in a year = ₹450 + ₹470 + ₹490 +.....

This forms an A.P. with a = 450, d = 20 and n = 12

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

$\Rightarrow S_{12} = \frac{12}{2}[2 \times 450 + 11 \times 20]$

= 6[900 + 220]

= 6(1120)

= 6720

Thus, Resham saved ₹6720 in 12 months.

Since amount required for admission is less than the saving, Resham would be able to send her daughter to the school next year.

30. We have

Class interval	Frequency (f_i)	Class mark (x_i)	$f_i x_1$
0 - 20	5	10	50
20-40	8	30	240
40-60	x	50	50x
60-80	12	70	840
80-100	7	90	630
100-120	8	110	880
Total	$\Sigma f_i = 40 + x$		$\Sigma f_i x_i = 2640 + 50x$

Here, $\Sigma f_i x_i = 2640 + 50x$, $\Sigma f_i = 40 + x$, $\bar{X} = 62.8$

$\therefore \quad \text{Mean}(\bar{X}) = \frac{\Sigma f_i x_i}{\Sigma f_i}$

$\Rightarrow \quad 62.8 = \frac{2640+50x}{40+x}$

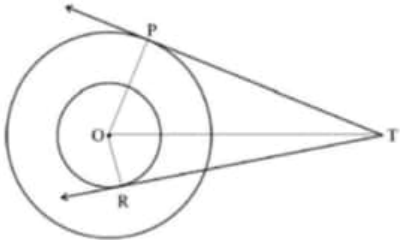
$\Rightarrow$ 2512 + 62.8x = 2640 + 50x

$\Rightarrow$ 62.8x - 50x = 2640 - 2512

$\Rightarrow$ 12.8x = 128

$\therefore \quad x = \frac{128}{12.8} = 10$

Hence, the missing frequency is 10

31. 

Join OR, OP and OT

In $\triangle ORT$,

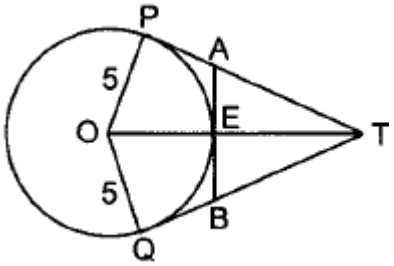
$OT^2 = OR^2 + TR^2 = 3^2 + (4\sqrt{10})^2 = 169$

$\therefore OT = 13\ cm$

In $\triangle OPT$,
$TP^2 = OT^2 - TP^2 = 13^2 - 5^2 = 144$
$\therefore TP = 12\ cm$

OR

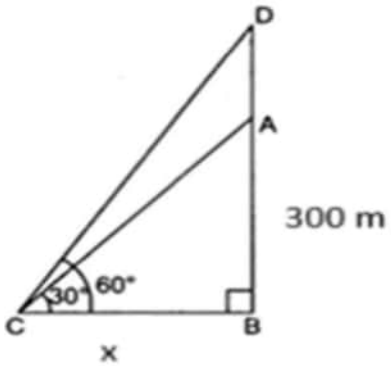
According to the question,
O is the centre of a circle of radius 5 cm. T is a point such that OT = 13 cm and OT intersects circle at E.



$\because$ OP $\perp$ TP [Radius from point of contact of the tangent]
$\therefore \angle$OPT = 90°
In right $\triangle$OPT *
$OT^2 = OP^2 + PT^2$
$\Rightarrow (13)^2 = (5)^2 + PT^2 \Rightarrow$ PT = 12 cm
Let AP = x cm AE = AP $\Rightarrow$ AE = x cm
and AT = (12 - x)cm
TE = OT - OE = 13 - 5 = 8 cm
$\because$OE $\perp$ AB [Radius from the point of contact]
$\therefore \angle$AEO = 90° $\Rightarrow \angle$AET = 90°
In right $\triangle$AET,
$AT^2 = AE^2 + ET^2$
$(12 - x)^2 = x^2 + 8^2$
$\Rightarrow 144 + x^2 - 24x = x^2 + 64$
$\Rightarrow \quad 24x = 80 \Rightarrow x = \frac{80}{24} = \frac{10}{3}$cm
Also BE = AE = $\frac{10}{3}$ cm
$\Rightarrow \quad AB = \frac{10}{3} + \frac{10}{3} = \frac{20}{3}$ cm

Section D

32.



Let AB be the tower, D be the position of balloon and x be the distance of tower from the point of observation.
In $\triangle ABC, \tan 30^\circ = \frac{300}{x} \Rightarrow x = 300\sqrt{3}$
$\Rightarrow x = 519$
In $\triangle DBC, \tan 60^\circ = \frac{DB}{x} \Rightarrow DB = x\sqrt{3}$
$\Rightarrow DB = 897.87$

The distance of the tower from the point of observation is 519 m
And height of the balloon from the ground is 897.87 m

33. From the given table

Monthly Consumption	Number of Families (f)	Cumulative frequency (C.f.)
130 - 140	5	5
140 - 150	9	14
150 - 160	17	31
160 - 170	28	59
170 - 180	24	83
180 - 190	10	93
190 - 200	7	100

We have, N = 100

$\frac{N}{2}$ = 50

Median class = 160 - 170

$\Rightarrow$ I = 160, f = 28, Cf = 31, h = 10

Median = $l + \left[\frac{\left(\frac{N}{2} - Cf\right)}{f}\right] \times h$

= $160 + \left[\frac{(50-31)}{28}\right] \times 10$

= $160 + \left[\frac{19}{28}\right] \times 10$

= 160 + 6.78

= 166.78

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

$k^2 - 24 = 0$

$\Rightarrow k = \pm 2\sqrt{6}$

Equations are

$2x^2 + 2\sqrt{6}x + 3 = 0;\ 2x^2 - 2\sqrt{6}x + 3 = 0$

Roots are $x = -\sqrt{\frac{3}{2}}, -\sqrt{\frac{3}{2}}; x = \sqrt{\frac{3}{2}}, \sqrt{\frac{3}{2}}$

OR

Let sides of two square x m and y m (x > y)

$x^2 + y^2 = 452$ ...(i)

4x - 4y = 8 ...(ii)

$\Rightarrow$ x - y = 2

By (i) & (ii)

$x^2 + (x - 2)^2 = 452$

$\Rightarrow x^2 - 2x - 224 = 0$

$x^2 - 16x + 14x - 224 = 0$

(x - 16) (x + 14) = 0

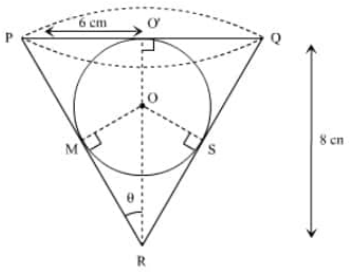
x = 16, x = -14 (rejected)

y = 14

Sides are 16 m and 14 m

35. Radius (R) of conical vessel = 6 cm

Height (H) of conical vessel = 8 cm



Volume of conical vessel (V_c) = $\frac{1}{3}\pi r^2 h$

= $\frac{1}{3} \times \pi \times 6 \times 6 \times 8$

= $96\pi cm^3$

Let the radius of the sphere be r cm

In right Δ PO'R by pythagoras theorem We have

$l^2 = 6^2 + 8^2$

$l = \sqrt{36+64}$ = 10 cm

In right triangle MRO

$\sin\theta = \frac{OM}{OR}$

$\Rightarrow \quad \frac{3}{5} = \frac{r}{8-r}$

$\Rightarrow$ 24 - 3r = 5r

$\Rightarrow$ 8r = 24

$\Rightarrow$ r = 3 cm

$\therefore V_1$ = Volume of the sphere ,= $\frac{4}{3}\pi \times 3^3 cm^3 = 36\pi cm^3$

V_2 = Volume of the water = Volume of the cone = $\frac{1}{3}\pi \times 6^2 \times 8 cm^3 = 96\pi cm^3$

Clearly, volume of the water that flows out of the cone is same as the volume of the sphere i.e., V_1.

$\therefore$ Fraction of the water that flows out =$V_1 : V_2 = 36\pi : 96\pi = 3 : 8$

OR

Volume of vessel = Volume of sphere + Volume of Cylinder

$= \frac{4}{3}\pi R^3 + \pi r^2 \ h$

$= \frac{4}{3} \times \frac{22}{7} \times \frac{9}{2} \times \frac{9}{2} \times \frac{9}{2} + \frac{22}{7} \times 1 \times 1 \times 8$

$= 407 cu. \ cm = 407 ml$

Section E

36. i. Let the fixed charge be ₹ x and per kilometer charge be ₹ y

$\therefore$ x + 10y = 105 ...(i)

x + 15y = 155 ...(ii)

From (i) and (ii)

5y = 50

y = $\frac{50}{5}$ = 10

From equation (i)

x + 100 = 105

x = 105 - 100 = 5

Fixed charges = ₹ 5

ii. Let the fixed charge be ₹ x and per kilometer charge be ₹ y

$\therefore$ x + 10y = 105 ...(1)

x + 15y = 155 ...(2)

From (1) and (2)

5y = 50

y = $\frac{50}{5}$ = 10

From equation (1)

x + 100 = 105

x = 105 - 100 = 5

Per km charges = ₹ 10

iii. Let the fixed charge be ₹ a and per kilometer charge be ₹ b

a + 10b

20 + 10 × 10 = ₹ 120

OR

Total amount = x + 10y + x + 25y

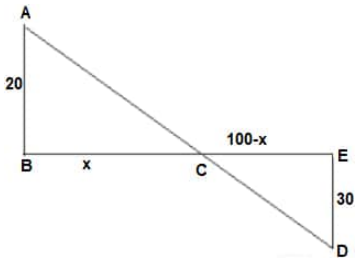
= 2x + 35y

= 2 × 5 + 35 × 10

= 10 + 350

= ₹ 360

37. i.



△ABC ∼ △DEC

$\frac{20}{30} = \frac{x}{100-x}$

2000 - 20x = 30x

2000 = 50x

x = 40 m

ii. AA

iii. 60 metres

OR

AD = AC + CD

$= \sqrt{20^2 + 40^2} + \sqrt{60^2 + 30}^2$

$= \sqrt{400 + 1600} + \sqrt{3600 + 900}$

$= \sqrt{2000} + \sqrt{4500}$

$\Rightarrow 20\sqrt{5}$ + $30\sqrt{5}$

$\Rightarrow 50\sqrt{5}$ m

38. i. Distance between bank and hospital $= \sqrt{(-3-9)^2 + (-1-5)^2}$

$= \sqrt{180}$ units or $6\sqrt{5}$ units

ii. Coordinates of E are $\left(\frac{9+5}{2}, \frac{5+(-5)}{2}\right) = (7, 0)$

iii. a. Coordinates of D are $\left(\frac{-3+5}{2}, \frac{-1+(-5)}{2}\right) = (1, -3)$

Distance Partha need to cover $= \sqrt{(9-1)^2 + (5-(-3))^2}$

$= \sqrt{128}$ units or $8\sqrt{2}$ units

OR

b. P is mid-point of BQ

$\therefore a = \frac{-1+3}{2} = 1$

Q is mid-point of PA

$\therefore b = \frac{1+9}{2} = 5$