Class X Session 2025-26
Subject - Mathematics (Basic)
Sample Question Paper - 08

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

General Instructions:

1. This Question Paper has 5 Sections A, B, C, D and E.
2. Section A has 20 MCQs carrying 1 mark each
3. Section B has 5 questions carrying 02 marks each.
4. Section C has 6 questions carrying 03 marks each.
5. Section D has 4 questions carrying 05 marks each.
6. Section E has 3 case based integrated units of assessment carrying 04 marks each.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2 marks questions of Section E
8. Draw neat figures wherever required. Take $\pi = \frac{22}{7}$ wherever required if not stated.

Section A

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

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

   c) 0.1 d) $\frac{5}{3}$

2. Let b = a + c. Then the equation $ax^2 + bx + c = 0$ has equal roots if **[1]**

   a) a = c b) a = -2c

   c) a = 2c d) a = -c

3. The height of a cone is 30 cm. A small cone is cut off at the top by a plane parallel to the base. If its volume be $\frac{1}{27}$ of the volume of the given cone, then the height above the base at which the section has been made, is **[1]**

   a) 25 cm b) 15 cm

   c) 20 cm d) 10 cm

4. A train travels 360km at a uniform speed. If the speed had been 5 km/hr more, it would have taken 1 hour less for the same journey, then the actual speed of the train is **[1]**

   a) 45 km/hr b) 48 km/hr

   c) 40 km/hr d) 36 km /hr

5. In an A.P., the third term is 16 and the 7th term exceeds the 5th term by 12, then its first term is **[1]**

   a) 3 b) 2

   c) 4 d) 1

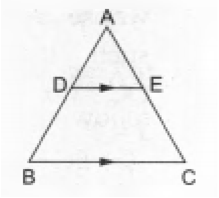
6. The ordinate of the point on the y-axis, which is equidistant from (-4, 1) and (2, 3) is: **[1]**

a) -1
b) 1
c) -2
d) 2

7. The zeroes of the polynomial $3x^2 + 11x - 4$ are: **[1]**

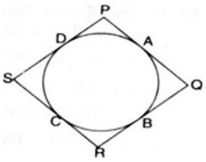
a) $\frac{-1}{3}$, -4
b) $\frac{1}{3}$, -4
c) $\frac{-1}{3}$, 4
d) $\frac{1}{3}$, 4

8. In $\triangle$ABC,DE || BC such that $\frac{AD}{DB} = \frac{3}{5}$. If AC = 5.6 cm then AE = ? **[1]**



a) 2.8 cm
b) 3.1 cm
c) 4.2 cm
d) 2.1 cm

9. Quadrilateral PQRS circumscribes a circle as shown in the figure. The side of the quadrilateral which is equal to PD + QB is **[1]**



a) QR
b) PR
c) PS
d) PQ

10. AB and CD are two parallel tangents to a circle of radius 5 cm. The distance between the tangents is **[1]**

a) 5 cm
b) $2\sqrt{5}$ cm
c) 10 cm
d) $\sqrt{50}$ cm

11. ($\cos^4$A - $\sin^4$A) on simplification, gives **[1]**

a) $2\cos^2A + 1$
b) $2\sin^2A + 1$
c) $2\cos^2A - 1$
d) $2\sin^2A - 1$

12. The HCF of 135 and 225 is: **[1]**

a) 75
b) 45
c) 15
d) 5

13. From a lighthouse, the angles of depression of two ships on opposite sides of the lighthouse are observed to be 30° and 45°. If the height of the lighthouse is h meters, the distance between the ships is **[1]**

a) $1 + \left(1 + \frac{1}{\sqrt{3}}\right)$ h metres
b) $(\sqrt{3} + 1)$ h metres
c) $(\sqrt{3} - 1)$ h metres
d) $\sqrt{3}$ h metres

14. In a circle of radius 21 cm, an arc subtends an angle of 60^o at the centre. The area of the sector formed by the arc is: **[1]**

a) 250 cm^2

b) 231 cm^2

c) 220 cm^2

d) 200 cm^2

15. The minute hand of a clock is 10 cm long. Find the area of the face of the clock described by the minute hand between 8 am and 8.25 am. **[1]**

a) 125.5 cm^2

b) 130.95 cm^2

c) 100 cm^2

d) 120 cm^2

16. A card is drawn at random from a pack of 52 cards. The probability that the drawn card is not a king is **[1]**

a) $\frac{1}{13}$

b) $\frac{9}{13}$

c) $\frac{4}{13}$

d) $\frac{12}{13}$

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

a) 0.7

b) 15%

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

d) - 1.5

18. In the formula $\bar{X}$ = a + h$\left(\frac{1}{N}\sum f_i u_i\right)$ for finding the mean of grouped frequency distribution u_i = **[1]**

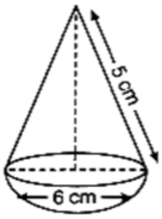
a) h(x_i - a)

b) $\frac{x_i+a}{h}$

c) $\frac{x_i-a}{h}$

d) $\frac{x_i+a}{2h}$

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):** The sum of series with the nth term t_n = (9 - 5n) is 220 when no. of terms n = 6. **[1]**

Reason (R): Sum of first n terms in an A.P. is given by the formula: Sn = 2 n $\times$ [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.

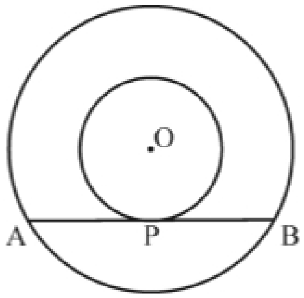
d) A is false but R is true.

Section B

21. Show that $5 - 2\sqrt{3}$ is an irrational number. **[2]**

22. D is a point on the side BC of a triangle ABC such that ∠ADC = ∠BAC. Show that CA^2 = CB·CD. **[2]**

23. Two concentric circles with centre O are of radii 3 cm and 5 cm. Find the length of chord AB of the larger circle which touches the smaller circle at P. **[2]**

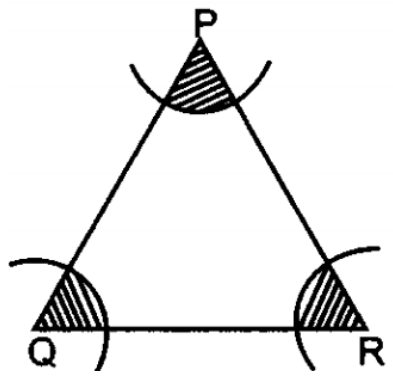


24. Prove that: $\sin\theta\cos(90^\circ-\theta)+\cos\theta\cdot\sin(90^\circ-\theta)=1$ **[2]**

OR

If A = B = 60°, verify that cos (A - B) = cosA cosB + sin A sinB

25. In figure, arcs have been drawn with radii 14 cm each and with centres P, Q and R. Find the area of the shaded region. **[2]**



OR

The perimeter of a sector of a circle of radius 5.2 cm is 16.4 cm. Find the area of the sector.

Section C

26. Every year the Model School celebrates its Sports Day on 4th September. For this, a lot of activities are arranged in the school premises. To avoid inconvenience, the school fixed days for game practice. After every 4 days, the karate team meets at the School's sports ground, the skating team meets after 3 days and the yoga team meets after 2 days. All the groups met on 7th May. Determine the last day when they will meet before the function. **[3]**

27. Prove that the points (2a, 4a), (2a, 6a) and (2a + $\sqrt{3}$a, 5a) are the vertices of an equilateral triangle. **[3]**

28. Nine times the side of one square exceeds a perimeter of a second square by one metre and six times the area of the second square exceeds twenty-nine times the area of the first by one square metre, Find the side of each square. **[3]**

OR

Solve the quadratic equation by factorization:

$\frac{1}{2a+b+2x}=\frac{1}{2a}+\frac{1}{b}+\frac{1}{2x}$

29. If all the sides of a parallelogram touch a circle, show that the parallelogram is a rhombus. **[3]**

OR

A point P is 13 cm from the centre of the circle. The length of the tangent drawn from P to the circle is 12 cm. Find the radius of the circle.

30. In a right triangle ABC, right-angled at B, if tan A = 1, then verify that 2 sin A cos A = 1. **[3]**

31. The angle of elevation of a cloud from a point 200 m above the lake is 30^{o} and the angle of depression of its reflection in the lake is 60^{o}, find the height of the cloud above the lake. **[3]**

Section D

32. Five years hence, father's age will be three times the age of his son. Five years ago, father was seven times as old **[5]**

as his son. Find their present ages.

OR

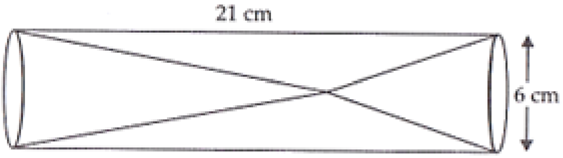
The area of a rectangle gets reduced by 9 square units, if its length is reduced by 5 units and the breadth is increased by 3 units. The area is increased by 67 square units if length is increased by 3 units and breadth is increased by 2 units. Find the perimeter of the rectangle.

33. If the coordinates of the mid points of the sides of a triangle are (1,2),(0,-1)and(2,-1).Find the coordinates of its vertices of the triangle. **[5]**

34. A solid toy is in the form of a hemisphere surmounted by a right circular cone. Height of the cone is 2 cm and the diameter of the base is 4 cm. If a right circular cylinder circumscribes the solid. Find how much more space it will cover. **[5]**

OR

Two solid cones A and B placed in a cylindrical tube as shown in the figure. The ratio of their capacities are 2 : 1. Find the heights and capacities of cones. Also, find the volume of the remaining portion of the cylinder.



35. The sum of the third and the seventh terms of an AP is 6 and their product is 8. Find the sum of the first sixteen terms of the AP. **[5]**

Section E

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

An object which is thrown or projected into the air, subject to only the acceleration of gravity is called a projectile, and its path is called its trajectory. This curved path was shown by Galileo to be a parabola. Parabola is represented by a polynomial. If the polynomial to represent the distance covered is,

$p(t) = -5t^2 + 40t + 1.2$

i. What is the degree of the polynomial $p(t) = -5\ t^2 + 40t + 1.2$? (1)
ii. What is the height of the projectile at the time of 4 seconds after it is launched? (1)
iii. What is the name of the polynomial $p(t) = -5t^2 + 40t + 1.2$ that is classified based on its degree? (2)

OR

What are the factors of the given quadratic equation $p(x) = x^2 - 5x + 6$? (2)

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

COVID-19 Pandemic The COVID-19 pandemic, also known as coronavirus pandemic, is an ongoing pandemic of coronavirus disease caused by the transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) among humans.

The following tables shows the age distribution of case admitted during a day in two different hospitals

Table 1

Age (in years)	5-15	15-25	25-35	35-45	45-55	55-65
No. of cases	6	11	21	23	14	5

Table 2

Age (in years)	5-15	15-25	25-35	35-45	45-55	55
No. of cases	8	16	10	42	24	12

i. **Refer to table 1**

Find the average age for which maximum cases occurred. (1)

ii. **Refer to table 1**

Find the upper limit of modal class. (1)

iii. **Refer to table 2**

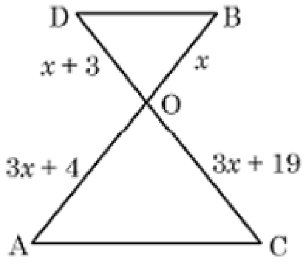
Find the median of the given data. (2)

OR

Find the median of the given data. (2)

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

In the figure given below, a folding table is shown:

The legs of the table are represented by line segments AB and CD intersecting at O. Join AC and BD.

Considering table top is parallel to the ground, and OB = x, OD = x + 3, OC = 3x + 19 and OA = 3x + 4, answer the following questions:

i. Prove that $\triangle$OAC is similar to $\triangle$OBD.

ii. Prove that $\frac{OA}{AC} = \frac{OB}{BD}$

iii. a. Observe the figure and find the value of x. Hence, find the length of OC.

OR

b. Observe the figure and find $\frac{BD}{AC}$.

Solution

Section A

1.

(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.

2. **(a)** a = c

Explanation:

Since, If $ax^2 + bx + c = 0$ has equal roots, then

$b^2 - 4ac = 0$

$\Rightarrow (a + c)^2 - 4ac = 0$ ... [Given: b = a + c]

$\Rightarrow a^2 + c^2 + 2ac - 4ac = 0$

$\Rightarrow a^2 + c^2 - 2ac = 0$

$\Rightarrow (a - c)^2 = 0$

$\Rightarrow a - c = 0$

$\Rightarrow a = c$

3.

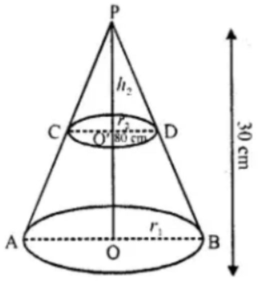
(c) 20 cm

Explanation:

Height of given cone (h_1) = 30 cm

Let r_1 be its radius

Then volume of the larger cone = $\left(\frac{1}{3}\right) \pi r_1^2 h_1$



A cone is cut off from the top of the larger cone, such that volume of smaller cone

$= \frac{1}{27}$ of that of larger cone

$\therefore \frac{\text{Volume of smaller cone}}{\text{Volume of bigger cone}} = \frac{1}{27}$

$= \frac{\frac{1}{3}\pi r_2^2 h_2}{\frac{1}{3}\pi r_1^2 h_1} = \frac{1}{27} \Rightarrow \frac{r_2^2 h_2}{r_1^2 h_1} = \frac{1}{27} = \left(\frac{1}{3}\right)^3$

$\Rightarrow \frac{h_2}{h_1} = \frac{1}{3} \quad \frac{h_2}{30} = \frac{1}{3} \Rightarrow h_2 = \frac{30}{3} = 10$

Height of smaller cone = 10 cm

Height from the base of bigger cone will be

= 30 - 10 = 20 cm

4.

(c) 40 km/hr

Explanation:

Let the actual speed of the train be x km/hr

Time taken to cover 360 km at this speed = $\frac{360}{x}$ hrs.

Time taken to cover 360 km at the increased speed = $\frac{360}{x+5}$ hrs.

According to condition, $\frac{360}{x} - \frac{360}{x+5} = 1$

$\Rightarrow 360\left[\frac{1}{x} - \frac{1}{x+5}\right] = 1$

$\Rightarrow 360\left[\frac{x+5-x}{x(x+5)}\right] = 1$

$\Rightarrow 360\left[\frac{5}{x(x+5)}\right] = 1$

$\Rightarrow x^2 + 5x - 1800 = 0$

$\Rightarrow x^2 + 45x - 40x - 1800$

$\Rightarrow$ x(x + 45) - 40(x + 45) = 0

$\Rightarrow$ (x - 40)(x + 45) = 0

$\Rightarrow$ x - 40 = 0 and x + 45 = 0

$\Rightarrow$ x = 40 km/hr and x = -45 km/hr [But x = -45 is not possible]

Therefore, the actual speed of the train is 40 km/hr.

5.

(c) 4

Explanation:

According to question,

$a_3 = 16$

$\Rightarrow$ a + 2d = 16 ... (i)

And $a_7 = a_5 + 12$

$\Rightarrow$ a + 6d = a + 4d + 12

$\Rightarrow$ a + 6d - a - 4d = 12

$\Rightarrow$ 2d = 12

$\Rightarrow$ d = 6

Putting value of d in eq. (i),

we get a + 2 $\times$ 6 = 16

$\Rightarrow$ a = 4

6. **(a)** -1

Explanation:

A(2, 3) and B(-4, 1) are the given points.

Let C(0.y) be the points are y-axis

AC = $\sqrt{(0-2)^2 + (y-3)^2}$

$\Rightarrow$ AC = $\sqrt{4 + y^2 + 9 - 6y}$

$\Rightarrow$ AC = $\sqrt{y^2 - 6y + 13}$

BC = $\sqrt{(0+4)^2 + (y-1)^2}$

$\Rightarrow$ BC = $\sqrt{16 + y^2 + 1 - 2y}$

$\Rightarrow$ BC = $\sqrt{y^2 - 2y + 17}$

Since AC = BC

$AC^2 = BC^2$

$y^2 - 6y + 13 = y^2 - 2y + 17$

$\Rightarrow$ -6y + 2y = 17 - 13

$\Rightarrow$ -4y = 4

$\Rightarrow$ y = -1

Therefore, the point on y-axis is (0, -1) and here ordinate is -1.

7.

(b) $\frac{1}{3}$, -4

Explanation:

Let $f(x) = 3x^2 + 11x - 4$

$f(x) = 3x^2 + 12x - x - 4$

$f(x) = 3x(x + 4) - 1 (x + 4)$

$f(x) = (x + 4)(3x - 1)$

Put both the factors equal to zero.

$x + 4 = 0, x = -4$

$3x - 1 = 0, x = \frac{1}{3}$

The zeroes of the polynomial $3x^2 + 11x - 4$ are $\frac{1}{3}$ and - 4.

8.

(d) 2.1 cm

Explanation:

In $\triangle$ABC, DE || BC

$\frac{AD}{DB} = \frac{3}{5}, AC = 5.6\text{cm}$

Let AE = x cm, the EC = 5.6 - x

In $\triangle \mathrm{ABC}, \mathrm{DE} \| \mathrm{BC}$

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

$\Rightarrow \frac{\mathrm{AE}}{\mathrm{EC}} = \frac{3}{5} \Rightarrow \frac{x}{5.6-x} = \frac{3}{5}$

$\Rightarrow 5x = 16.8 - 3x$

$\Rightarrow 5x + 3x = 16.8 \Rightarrow 8x = 16.8$

$\Rightarrow x = \frac{16.8}{8} = 2.1$

$\therefore x = 2.1\text{cm}$

9.

(d) PQ

Explanation:

PD + QB = PA + QA [Tangents from an external point to a circle are equal]

$\Rightarrow$ PD + QB = PQ

10.

(c) 10 cm

Explanation:

AB and CD are two parallel tangent to a circle

AB || CD

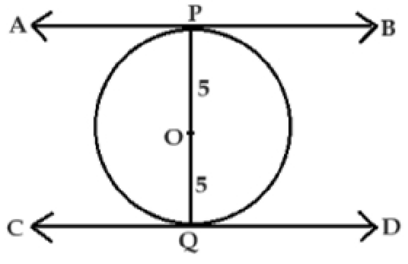
and OP $\perp$ AB

OQ $\perp$ CD

By fig clear that

distance between two tangent is OP + OQ

ie. 5 + 5 = 10 cm.



11.

(c) $2 \cos^2 A - 1$

Explanation:

The given expression is $\cos^4 A - \sin^4 A$.

Factorising the given expression, we have

$\cos^4 A - \sin^4 A = [(\cos^2 A)^2 - (\sin^2 A)^2]$

$= (\cos^2 A + \sin^2 A) \times (\cos^2 A - \sin^2 A)$ ...[$\because (a^2 - b^2) = (a + b)(a - b)$]

$= \cos^2 A - \sin^2 A$ ...[$\because \sin^2 A + \cos^2 A = 1$]

$= \cos^2 A - (1 - \sin^2 A)$

$= \cos^2 A - 1 + \cos^2 A$

$= 2\cos^2 A - 1$

12.

(b) 45

Explanation:

We have,

$135 = 3 \times 45$

$= 3 \times 3 \times 15$

$= 3 \times 3 \times 3 \times 5$

$= 3^3 \times 5$

Now, for 225 will be

$225 = 3 \times 75$

$= 3 \times 3 \times 5 \times 5$

$= 3^2 \times 5^2$

The HCF will be $3^2 \times 5 = 45$

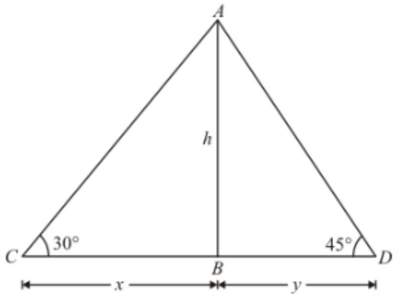
13.

(b) $(\sqrt{3} + 1)$ h metres

Explanation:

Let the height of the light house AB be h meters

Given that: angle of depression of ship are $\angle C = 30^o$ and $\angle D = 45^o$



Distance of the ship C = BC = x and distance of the ship D = BD = y

Here, we have to find distance between the ships.

So we use trigonometric ratios.

In a triangle ABC,

$\Rightarrow \tan C = \frac{AB}{BC}$

$\Rightarrow \tan 30^\circ = \frac{h}{x}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x}$

$\Rightarrow x = \sqrt{3}h$

Again in a triangle ABD,

$\tan D = \frac{AB}{BD}$

$\Rightarrow \tan 45^o = \frac{h}{y}$

$\Rightarrow 1 = \frac{h}{y}$

$\Rightarrow y = h$

Now, distance between the ships = $x + y = \sqrt{3}h + h = (\sqrt{3} + 1)h$

14.

(b) 231 cm^2

Explanation:

The angle subtended by the arc = 60^o

So, area of the sector = $(\frac{60^o}{360^o}) \times \pi r^2$ cm^2

= $(\frac{441}{6}) \times (\frac{22}{7})cm^2$

= 231 cm^2

15.

(b) 130.95 cm^2

Explanation:

Here the angle swept is 150^o. We need to find the area of this sector which subtends 150^o at the centre.

So, area $= \pi r^2 \times \frac{\theta}{360^\circ}$

$= \frac{22}{7} \times 10^2 \times \frac{150}{360}$

= 130.95 cm^2

16.

(d) $\frac{12}{13}$

Explanation:

Total number of possible outcomes = 52

Number of king cards in the pack = 4

$\therefore$ Number of cards that are not king = 52 - 4 = 48

So, favourable number of outcomes = 48

$\therefore$ Required probability = $\frac{48}{52}$ = $\frac{12}{13}$

17.

(d) - 1.5

Explanation:

– 1.5 cannot be the probability of an event because $0 \leqslant P(E) \leqslant 1$.

The probability of a sure event is 1 and the probability of an impossible event is 0.

18.

(c) $\frac{x_i - a}{h}$

Explanation:

Given $\overline{x}$ = a + h $\left(\frac{1}{N}\Sigma f_i u_i\right)$

Above formula is a step deviation formula, where

$u_i = \frac{x_i - a}{h}$

19.

(d) A is false but R is true.

Explanation:

A is false but R is true.

20. **(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.

Section B

21. Let us assume that $5 - 2\sqrt{3}$ is a rational number.

Then, there must exist positive co primes a and b such that

$\Rightarrow\ 5 - 2\sqrt{3} = \frac{a}{b}$

$\Rightarrow\ -2\sqrt{3} = \frac{a}{b} - 5$

$\Rightarrow\ 2\sqrt{3} = 5 - \frac{a}{b}$

$\Rightarrow\ 2\sqrt{3} = \frac{5b-a}{a}$

$\Rightarrow\ \sqrt{3} = \frac{5b-a}{2a}$

The right side $\frac{5b-a}{2a}$ is a rational numbers so $\sqrt{3}$ is a rational number

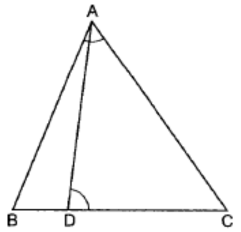
This contradicts the fact that $\sqrt{3}$ is an irrational number

Hence our assumption is incorrect and $5 - 2\sqrt{3}$ is an irrational number.

22. Given: $\triangle ABC$ where $\angle ADC = \angle BAC$

To Prove : $CA^2 = CB.CD$

Proof: In $\triangle ABC$ and $\triangle DAC$, we have



$\angle ADC = \angle BAC$ and $\angle C = \angle C$

Therefore, by AA-criterion of similarity, we obtain

$\Delta ABC \sim \Delta DAC$

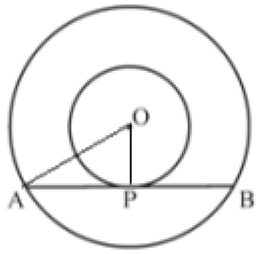
$\Rightarrow\ \frac{AB}{DA} = \frac{BC}{AC} = \frac{AC}{DC}$

$\Rightarrow\ \frac{CB}{CA} = \frac{CA}{CD}$

$\Rightarrow CA^2 = CB.CD$

23. Join OA and OP

OP $\perp$ AB (radius $\perp$ tangent at the point of contact)



OP is the radius of smaller circle and AB is tangent at P.

AB is chord of larger circle and OP $\perp$ AB

$\therefore$ AP = PB($\perp$ from centre bisects the chord)

In right $\triangle AOP$, $AP^2 = OA^2 - OP^2$

$= (5)^2 - (3)^2 = 16$

AP = 4 cm = PB

$\therefore$ AB = 8 cm

24. $\text{L.HS.} = \sin\theta . \cos(90^\circ - \theta) + \cos\theta \cdot \sin(90^\circ - \theta)$

$= \sin\theta \cdot \sin\theta + \cos\theta \cdot \cos\theta$

$= \sin^2\theta + \cos^2\theta = 1 = \text{R.HS}$

OR

Given that: A = B = 60°

$\text{L.H.S.} = \cos(A - B) = \cos(60^\circ - 60^\circ) = \cos 0^\circ = 1$

R.H.S. = cos A cos B + sin A sin B

$= \cos 60^\circ \cos 60^\circ + \sin 60^\circ \sin 60^\circ$

$= \cos^2 60^\circ + \sin^2 60^\circ$

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

∴ LHS = RHS

25. Area of sector on P = $\frac{\angle P}{360^\circ} \times \pi(14)^2$

Area of sector on Q = $\frac{\angle Q}{360^\circ} \times \pi(14)^2$

Area of sector on R = $\frac{\angle R}{360^\circ} \times \pi(14)^2$

Area of shaded region = adding area of all three sectors

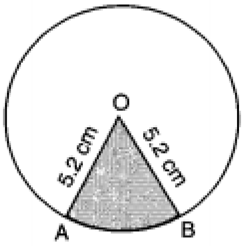
$= \frac{\angle \mathbf{P}}{360^\circ} \times \pi(14)^2 + \frac{\angle \mathbf{Q}}{360^\circ} \times \pi(14)^2 + \frac{\angle \mathbf{R}}{360^\circ} \times \pi(14)^2$

$= \frac{\pi(14)^2}{360^\circ}(\angle P + \angle Q + \angle R)$

$= \frac{\pi \times 196}{360^\circ} \times 180^\circ$

$= \frac{22}{7} \times 98 = 308\text{cm}^2$

OR



Let OAB be the given sector.

It is given that Perimeter of sector OAB = 16.4 cm

⇒OA + OB + arc AB = 16.4 cm

⇒5.2 + 5.2 + arc AB = 16.4

⇒arc AB = 6 cm

$\Rightarrow l = 6cm$

∴Area of sector OAB $= \frac{1}{2}lr = \frac{1}{2} \times 6 \times 5.2\text{cm}^2$ = 15.6 cm^2

Section C

26. We have to take LCM of 2, 4,3

2 = 2 × 1

4 = 2 × 2

3 = 3 × 1

LCM = 12

Thus they will meet at a gap of 12 days.

7 May - 19 May - 31 May - 12 June - 24 June - 6 July - 18 July - 30 July- 11 August - 23 August - 4 Sept.

Therefore the last day before 4th Sept. will be 23rd of August.

27. Let A(2a, 4a), B(2a, 6a) and C(2a + $\sqrt{3}a$, 5a) be the given point:

$AB = \sqrt{(2a - 2a)^2 + (6a - 4a)^2}$

$\Rightarrow \quad AB = \sqrt{(0)^2 + (2a)^2}$

$\Rightarrow \quad AB = \sqrt{4a^2}$

⇒AB = 2a

$BC = \sqrt{(2a + \sqrt{3a} - 2a)^2 + (5a - 6a)^2}$

$\Rightarrow \quad BC = \sqrt{(\sqrt{3}a)^2 + (-a)^2}$

$\Rightarrow \quad BC = \sqrt{3a^2 + a^2}$

$\Rightarrow \quad BC = \sqrt{4a^2}$

⇒BC = 2a

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

$\Rightarrow \quad AC = \sqrt{(\sqrt{3}a)^2 + (a)^2}$

$\Rightarrow \quad AC = \sqrt{3a^2 + a^2}$

$\Rightarrow \quad AC = \sqrt{4a^2}$

⇒AC = 2a

Since, AB = BC = AC

$\therefore$ ABC is an equilateral triangle.

28. Assume side of one square = x m and side of other square = y m, then we have

9x = 4y + 1

$\Rightarrow \frac{9x-1}{4}$ = y ....(i)

According to given situation we have,

$6y^2 = 29x^2 + 1$

$\Rightarrow 6(\frac{9x-1}{4})^2 = 29x^2 + 1$

$\Rightarrow \frac{3(81x^2-18x+1)}{8} = 29x^2 + 1$

$\Rightarrow 243x^2 - 54x + 3 = 232x^2 + 8$

$\Rightarrow 11x^2 - 54x - 5 = 0$

Factorize above quadratic equation we get

$\Rightarrow (x - 5)(11x + 1) = 0$

$\Rightarrow x = 5$ or $x = \frac{-1}{11}$ (negative value is rejected)

$\therefore x = 5m$

When x = 5, then y = $\frac{9\times5-1}{4}$= 11m (From (i))

Hence sides of the square are 5m and 11m.

OR

Consider $\frac{1}{2a+b+2x} = \frac{1}{2a} + \frac{1}{b} + \frac{1}{2x}$

$\Rightarrow \frac{1}{2a+b+2x} - \frac{1}{2x} = \frac{1}{2a} + \frac{1}{b}$

$\Rightarrow$ 2ab (2x - 2a – b – 2x) = (2a + b)2x (2a + b + 2x)

$\Rightarrow$ 2ab (-2a - b) = 2(2a+ b) $(2ax + bx + 2x^2)$

$\Rightarrow -ab = 2ax + bx + 2x^2$

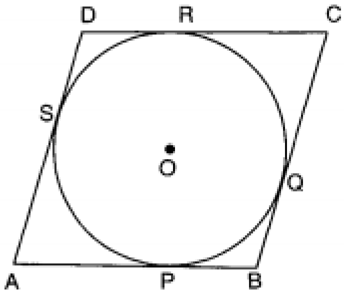
$\Rightarrow 2x^2 + 2ax + bx + ab = 0$

$\Rightarrow$ 2x (x + a) + b (x + a) = 0

$\Rightarrow$ (2x + b) (x + a) = 0

$\Rightarrow x = -a, -\frac{b}{2}$

Hence the roots are $-a, -\frac{b}{2}$.

29. 

Let ABCD be a parallelogram such that its sides touch a circle with centre O.

We know that the tangents to a circle from an exterior point are equal in length.

Therefore,AP = AS [From A] ...(i)

BP = BQ [FromB] ...(ii)

CR = CQ [From C] ...(iii)

and , DR = DS [From D] ...(iv)

Adding (i), (ii), (iii) and (iv), we get,

AP + BP + CR + DR = AS + BQ +CQ + DS

$\Rightarrow$ (AP + BP) + (CR + DR) = (AS + DS) + (BQ + CQ)

$\Rightarrow$ AB + CD = AD + BC

$\Rightarrow$ 2 AB = 2 BC

$\Rightarrow$ AB = BC

Therefore, AB = BC = CD = AD

Thus, ABCD is a rhombus.

OR

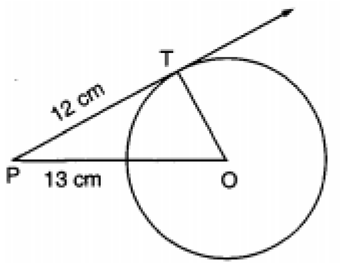
According to question we are given that

PT=12cm and PO=13cm

Now Since tangent to a circle is perpendicular to the radius through the point of contact.

$\therefore \quad \angle OTP = 90^\circ$

In right triangle OTP, we have



$(OP)^2 = (OT)^2 + (PT)^2$ (using Pythagoras theorem)

$\Rightarrow 13^2 = OT^2 + 12^2$

$\Rightarrow OT^2 = 13^2 - 12^2 = (13 - 12)(13 + 12) = 25$

$\Rightarrow OT = 5.$

Hence, radius of the circle is 5 cm.

30. In $\triangle ABC$,

$\tan A = 1$

$\Rightarrow \quad \frac{BC}{AC} = 1$

$\Rightarrow$ BC = x and AC = x

Using Pythagoras theorem,

$\Rightarrow AB^2 = AC^2 + BC^2$

$\Rightarrow \quad AB^2 = x^2 + x^2$

$\Rightarrow \quad AB = \sqrt{2}x$

$\therefore \quad \sin A = \frac{BC}{AB} = \frac{x}{\sqrt{2}x} = \frac{1}{\sqrt{2}}$ and $\cos A = \frac{AC}{\sqrt{2}x} = \frac{x}{\sqrt{2}x} = \frac{1}{\sqrt{2}}$

$2 \sin A \cos A = 2 \times \frac{1}{\sqrt{2}} \times \frac{1}{\sqrt{2}} = 1$

31. In $\triangle$ADC,

$\tan 30^\circ = \frac{H-200}{x}$

$\Rightarrow \quad \frac{1}{\sqrt{3}} = \frac{H-200}{x}$

$\Rightarrow \quad x = \sqrt{3}$ (H - 200) m. ....(1)

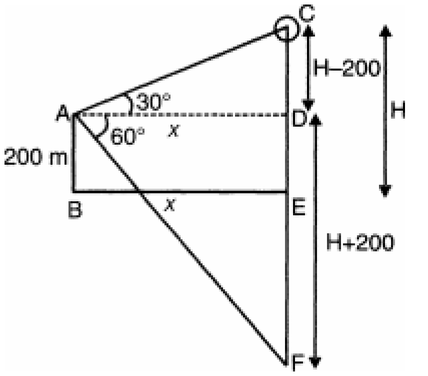
In $\triangle$ADF,

$\tan 60^\circ = \frac{H+200}{x}$

$\sqrt{3} = \frac{H+200}{x}$

$\sqrt{3}x = H + 200$ ....(2)

here H is height of cloud above the lake.



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

3(H - 200) = H + 200

3H - 600 = H + 200

2H = 800

H = 400 m

So height of the cloud above the lake is 400 m.

Section D

32. Suppose, the present age of father be x years and the present age of son be y years.

According to the question,

Five years hence,

Father's age = $(x+5) years$

Using the given information, we have

$x+5=3(y+5)$

$\Rightarrow x-3y-10=0$ ....(i)

Five years ago,

Father's age = $(x-5) years$

Son's age =$(y-5) years$

Using the given information, we get

$(x-5)=7(y-5)$

$\Rightarrow x-7y+30=0$ ....(ii)

Subtracting equation (ii) from equation (i), we get

$4y-40=0$

$\Rightarrow y=10$

Putting y = 10 in equation (i), we get

$x-30-10=0$

$\Rightarrow x=40$

Hence, present age of father is 40 years and present age of son is 10 years.

OR

Let length of given rectangle be x and breadth be y

$\therefore$ area of rectangle = xy

According to the first condition

(x - 5)(y + 3) = x y - 9

or, xy + 3x - 5 y - 15 = xy - 9

or, xy + 3x - 5y - xy = 15 - 9

or, 3x - 5y = 6........(i)

According to the second condition,

(x +3)(y +2) = xy + 67

or, xy + 2x + 3y + 6 = xy + 67

or, xy + 2x + 3y - xy = 67 - 6

or, 2x + 3y = 61 ...(ii)

Multiplying eqn. (i) by 3 and eqn. (ii) by 5 and then adding,

9x-15y = 18

10x + 15y = 305

or, 19x = 323

$\therefore x=\frac{323}{19}=17$

Substituting this value of x in eqn. (i),

3(17)-5y = 6

51 - 5y = 6

or, 5y = 51 - 6

$\therefore$ y = 9

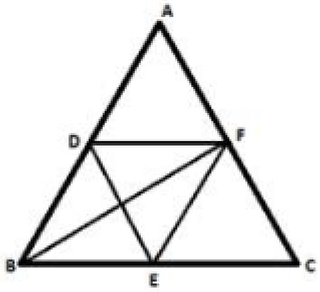
Hence, perimeter = 2(x + y) = 2(17 + 9) = 52 units.

33. Let the vertices of the triangle are $A(x_1, y_1)$, $B(x_2, y_2)$, $C(x_3, y_3)$

D,E AND F are the mid points of sides AB, BC AND AC

Given, D(1,2),E(0,-1)and F(2,-1).

Draw DE, DF, FE and BF



As D and F are mid points of AB and AC

$\therefore$ DF || BE

E and F are mid points of BC and AC

$\therefore$ EF || BD

Hence, DBEF is a parallelogram

We know that, the diagonals of a parallelogram bisect each other.

That means, both diagonals have same mid - point.

Midpoint BF = Midpoint of DE

$\Rightarrow \left(\frac{x_2-2}{2}, \frac{y_2+1}{2}\right) = \left(\frac{1+0}{2}, \frac{2-1}{2}\right)$

On comparing both sides, we get

$\frac{x_2-2}{2} = \frac{1}{2}$ and $\frac{y_2+1}{2} = \frac{1}{2}$

$\Rightarrow x_2 - 2 = 1, y_2 + 1 = 1$

$\therefore x_2 = 3, y_2 = 0$

D is the midpoint of AB

D = $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

(1, 2) = $\left(\frac{x_1+3}{2}, \frac{y_1+0}{2}\right)$

$\Rightarrow x_1 = -1$ and $y_1 = 4$

Now, F is the midpoint of AC

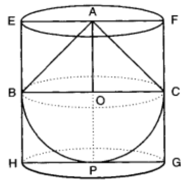
F = $\left(\frac{x_1+x_3}{2}, \frac{y_1+y_3}{2}\right)$

(2, -1) = $\left(\frac{-1+x_3}{2}, \frac{4+y_3}{2}\right)$

$\Rightarrow x_3 = 5$ and $y_3 = -6$

The vertices of the triangle are (1, 2), (3, 0) and (5, - 6)

34. Let BPC be the hemisphere and ABC be the cone mounted on the base of the hemisphere. Let EFGH be the right circular cylinder circumscribing the given toy.



We have,

Given radius of cone, cylinder and hemisphere (r) = $\frac{4}{2}$ = 2 cm

Height of cone (l) = 2 cm

Height of cylinder (h) = 4 cm

Now, Volume of the right circular cylinder = $\pi r^2 h = \pi \times 2^2 \times 4\text{cm}^3 = 16\pi\text{cm}^3$

Volume of the solid toy = $\left\{\frac{2}{3}\pi \times 2^3 + \frac{1}{3}\pi \times 2^2 \times 2\right\}\text{cm}^3 = 8\pi\text{cm}^3$

$\therefore$ Required space = Volume of the right circular cylinder - Volume of the toy

$= 16\pi\text{cm}^3 - 8\pi\text{cm}^3 = 8\pi\text{cm}^3$.

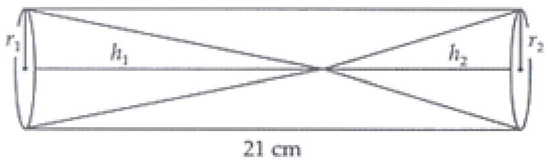
Hence, the right circular cylinder covers $8\pi\text{cm}^3$ more space than the solid toy.

So, remaining volume of cylinder when toy is inserted in it = 8π cm ^{3}

OR

Let height of the cone 1 be 'h' cm and the height of the cone 2 be (21 cm - h) .

As the ratio of volumes of cone c_1 and c_2 is 2 : 1, their radii are same equal to r = $\frac{6}{2}$ cm = 3 cm.



$\therefore \frac{V_1}{V_2} = \frac{\frac{1}{3}\pi r_1^2 h_1}{\frac{1}{3}\pi r_2^2 h_2}$

$\Rightarrow \frac{2}{1} = \frac{h}{21cm - h}$

or 42 cm - 2h = h

or, 3h = 42 cm

⇒ h = 42/3

⇒ h = 14 cm

Hence, height of cone 1 = 14 cm and height of cone 2 = 7 cm

Cone I	**Cone II**	**Cylinder**
$r_1 = \frac{6}{3}$ = 3 cm	r_2 = 3 cm	r = 3 cm
h_1 = 14 cm	h_2 = 7 cm	h = 21 cm

Volume of cone 1= $\frac{1}{3}\pi r_1^2 h_1 = \frac{1}{3} \times \frac{22}{7} \times 3 \times 3 \times 14$ = 132 cm^3

Volume of cone 2= $\frac{1}{3}\pi r_2^2 h_2 = \frac{1}{3} \times \frac{22}{7} \times 3 \times 3 \times 7$ = 22 × 3 = 66 cm^3

Volume of remaining portion of tube = Vol. of cylinder – Vol. of cone 1 – Vol. of cone 2

= $\pi r^2 h$ – 132 – 66

= $\frac{22}{7}$ × 3 × 3 × 21 – 198

= 22 × 27 – 198 = 594 – 198 = 396 cm^3

Hence, the required volume is 396 cm^3.

35. Let the first term and the common difference of the AP be a and d respectively.

According to the question,

Third term + seventh term = 6

⇒ [a + (3 - 1)d] + [a + (7 - 1)d] = 6 = a + (n - 1)d

⇒ (a + 2d) + (a + 6d) = 6 ⇒ 2a + 8d = 6

⇒ a + 4d = 3 ..... (1)

Dividing throughout by 2 &

(third term) (seventh term) = 8

⇒ (a + 2d) (a + 6d) = 8

⇒ (a + 4d - 2d) (a + 4d + 2d) = 8

⇒ (3 - 2d) (3 + 2d) = 8

⇒ 9 - $4d^2$ = 8

$\Rightarrow 4d^2 = 1 \Rightarrow d^2 = \frac{1}{4} \Rightarrow d + \pm\frac{1}{2}$

Case I, when $d = \frac{1}{2}$

Then from (1), $a + 4\left(\frac{1}{2}\right) = 3$

⇒ a + 2 = 3 ⇒ a = 3 - 2 ⇒ a = 1

∴ Sum of first sixteen terms of the AP = S_{16}

$= \frac{16}{2}[2a + (16 - 1)d] \because S_n = \frac{n}{2}[2a + (n - 1)d]$

= 8[2a + 15d]

$= 8[2(1) + 15(\frac{1}{2})]$

$= 8[12 + \frac{15}{2}]$

$= 8[\frac{19}{2}]$

$= 4 \times 19 = 76$

Case II. When $d = -\frac{1}{2}$

Then from (1),

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

$\Rightarrow$ a - 2 = 3 $\Rightarrow$ a = 3 + 2 $\Rightarrow$ a = 5

$\therefore$ Sum of first sixteen terms of the AP = S_{16}

$= \frac{16}{2}[2a + (16 - 1)d]\ \because S_n = \frac{n}{2}[2a + (n - 1)d]$

$= 8[2a + 15d] = 8\left[2(5) + 15\left(-\frac{1}{2}\right)\right] = 8\left[10 - \frac{15}{2}\right] = 8\left[\frac{5}{2}\right] = 20$

Section E

36. i. 2

ii. 81.2 m

iii. quadratic polynomial

OR

(x - 3) and (x - 2)

37. i. Maximum class frequency is 23 belonging to class interval 35-45

Mode = $l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$

= $35 + \left(\frac{23 - 21}{46 - 21 - 14}\right) \times 10$

= 35 + $\frac{2}{11} \times 10$

= 35 + $\frac{20}{11}$

= 35 + 1.81

= 36.81

ii. Since, the modal class is (35-45)

$\therefore$ Upper limit of modal class = 45

iii.

C.I (Age)	No of cases (f)	C.F
5-15	8	8
15-25	16	24
25-35	10	34
35-45	42	76
45-55	24	100
55-65	12	112

$\sum f$ = 112

$\frac{N}{2} = \frac{\sum f}{2}$

$= \frac{112}{2}$ = 56

c.f just greater than 56 is 76

$\therefore$ median class 35-45

median = $l + \left(\frac{\frac{N}{2} - c.f}{f}\right) \times h$

35 + $\left(\frac{56 - 34}{42}\right) \times 10$

35 + $\frac{22}{42} \times 10$

35 + 5.23 = 40.23

OR

C.I (Age)	No of cases (f)	C.F
5-15	6	6
15-25	11	17
25-35	21	38
35-45	23	61
45-55	14	75
55-65	5	80

$\sum f = 80$

$\frac{N}{2} = \frac{\sum f}{2}$

$= \frac{80}{2} = 40$

c.f just greater than 40 is 61

$\therefore$ median class = 35 - 45

median = $l + \left(\frac{\frac{N}{2} - c.f}{f}\right) \times h$

$= 35 + \left(\frac{40-38}{23}\right) \times 10$

$= 35 + \frac{2}{23} \times 10$

$= 35 + \frac{20}{23}$

= 35 + 0.86

= 35.86

38. i. Since $\angle D = \angle C$ and $\angle B = \angle A$ (Alternate interior angles)

$\therefore \triangle OAC \sim \triangle OBD$ (By AA similarity)

ii. $\triangle OAC \sim \triangle OBD \Rightarrow \frac{OA}{OB} = \frac{AC}{BD}$ or $\frac{OA}{AC} = \frac{OB}{BD}$

iii. a. $\triangle OAC \sim \triangle OBD \Rightarrow \frac{OA}{OB} = \frac{OC}{OD}$

$\Rightarrow \frac{3x+4}{x} = \frac{3x+19}{x+3} \Rightarrow x = 2$

$\therefore$ OC = 25

OR

b. $\triangle OBD \sim \triangle OAC \Rightarrow \frac{OB}{OA} = \frac{OD}{OC} = \frac{BD}{AC}$

$\Rightarrow \frac{x}{3x+4} = \frac{x+3}{3x+19} \Rightarrow x = 2$

$\therefore \frac{BD}{AC} = \frac{2}{10}$ or $\frac{1}{5}$