CBSE Board
Class X Mathematics

Time: 3 hrs **Total Marks: 80**

General Instructions:

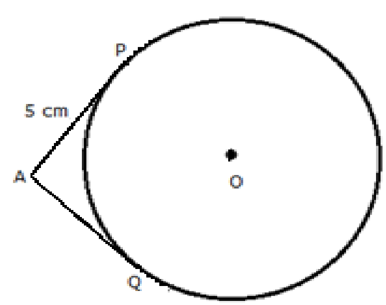
1. **All** questions are **compulsory**.
2. The question paper consists of **30** questions divided into **four sections** A, B, C, and D. **Section A** comprises of **6** questions of 1 mark each, **Section B** comprises of **6** questions of 2 marks each, **Section C** comprises of **10** questions of 3 marks each and **Section D** comprises of **8** questions of 4 marks each.
3. Question numbers **1 to 6** in **Section A** are multiple choice questions where you are to select **one** correct option out of the given four.
4. Use of calculator is **not** permitted.

Section A
(Questions 1 to 6 carry 1 mark each)

1. If the probability of winning a game is 0.3, then find the probability of losing it.

2. A vertical tower is 20 m high. A man at some distance from the tower knows that the cosine of the angle of the elevation of the top of tower is 0.5. Find the distance of the man from the foot of the tower.

3. In the figure, the pair of tangents AP and AQ drawn form an external point A to a circle with centre O are perpendicular to each other and length of each tangent is 5 cm. Find the radius of the circle.



4. If the sum of n terms of an A.P. is $3n^2 + 5n$ then which of its terms is 164?

5. The decimal expansion of the rational number $\frac{2^3}{2^2.5}$ will terminate after how many decimal places?

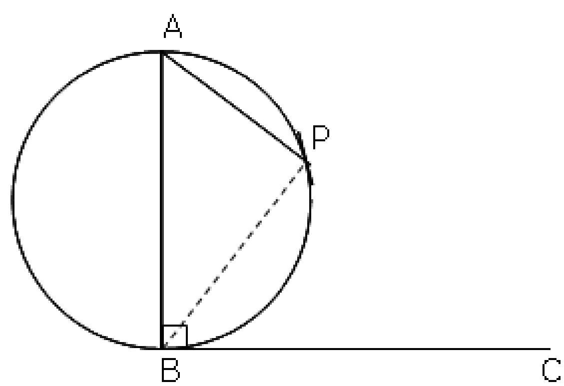
6. $\Delta ABC \sim \Delta PQR$. M is the mid-point of BC and B is the mid-point of QR. The area of ΔABC = 100 sq. cm and that of ΔPQR = 144 sq. cm. If AM = 4 cm, then find PN.

Section B
(Questions 7 to 12 carry 2 marks each)

7. Which term of the A.P.: 5, 15, 25, ... will be 130 more than the 31st term?

8. Can the number 4^n, n being a natural number end with the digit 0? Given reasons.

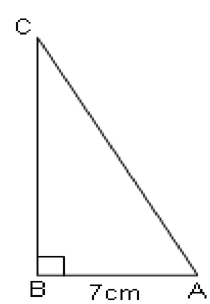
9. AB is a diameter of a circle. BC is the tangent to the circle at B as shown in the given figure. Show that $\angle PBC = \angle BAP$.



10. A car travels a distance of 0.99 km in which each wheel makes 450 complete revolutions. Find the radius of its wheels.

11. If $\cot\theta = \frac{7}{8}$, find the value of $\frac{(1+\sin\theta)(1-\sin\theta)}{(1+\cos\theta)(1-\cos\theta)}$

12. In ΔABC, $m\angle B = 90^\circ$, AB = 7 cm and AC – BC = 1 cm. Determine the values of sin C and cos C.



Section C
(Questions 13 to 22 carry 3 marks each)

13. The horizontal distance between two towers is 140 m. The angle of elevation of the top of the first tower when seen from top of the second tower is 30°. If the height of the second tower is 60 m, find the height of the first tower.

14. If a ≠ b ≠ c, prove that the points (a, a^2), (b, b^2) and (c, c^2) can never be collinear.

15. In a school, students thought of planting trees around the school to reduce air pollution. It was decided that the number of trees which each section of each class would plant will be the same as the class in which they are studying, e.g., a section of class-I will plant 1 tree, a section of class II will plant 2 trees and so on till class XII. There are three sections of each class. How many trees will be planted by the students? What value can you infer from the planting of trees by the students?

16. Solve: $\frac{1}{x+4} - \frac{1}{x-7} = \frac{11}{30}$, where x ≠ −4, 7

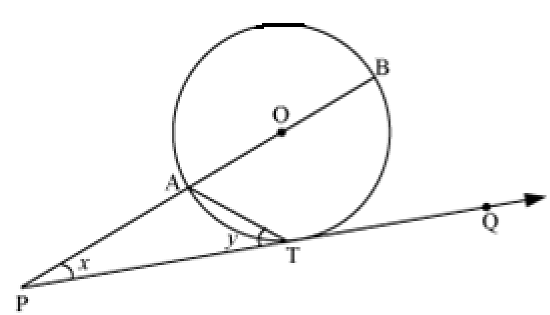
17. Show that $6 + \sqrt{2}$ is irrational.

18. A motor boat whose speed is 24 km/h in still water takes 1 hour more to go 32 km upstream than to return downstream to the same spot. Find the speed of the stream.

19. If the point (x, y) is equidistant from the points (a + b, b − a) and (a − b, a + b), then prove that bx = ay.

20. An integer is chosen at random from 1 to 200. What is the probability that the integer chosen is divisible by 6 or 8?

21. In the given figure, the diameter AB of the circle with centre O is extended to a point P and PQ is a tangent to the circle at the point T. If $\angle$BPT = x and $\angle$ATP = y, then prove that $x + 2y = 90^{\circ}$.

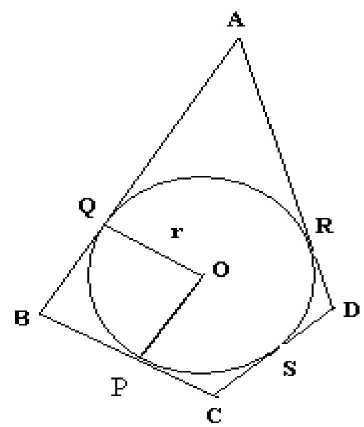


22. Find the median for the following frequency distribution:

Class Interval	10 - 19	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69	70 - 79
Frequency	2	4	8	9	4	2	1

Section D
(Questions 23 to 30 carry 4 marks each)

23. A circle is inscribed in a quadrilateral ABCD in which $m\angle B = 90°$. If AD = 23 cm, AB = 29 cm and DS = 5 cm. Find the radius of the circle.



24. The diagonal of a rectangular field is 60 metres more than the shorter side. If the longer side is 30 metres more than the shorter side, find the length of the sides of the field.

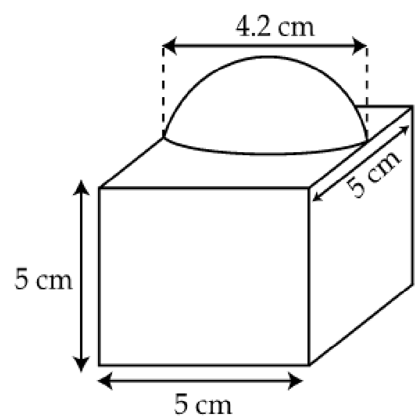
25. Two circles with centre O and O' of radii 3 cm and 4 cm respectively, intersect at two points P and Q such that OP and O'P are tangents to the two circles. Find the length of the common chord PQ.

26. 200 logs are stacked in the following manner: 20 logs in the bottom row, 19 in the next row, 18 in the row next to it and so on. In how many rows are the 200 logs placed and how many logs are in the top row? What value is depicted in the pattern of logs?

27. From an airplane vertically above a straight horizontal road, the angles of depression of two consecutive kilometers stones on opposite sides of the airplane are observed to be 60° and 30°. Show that the height of airplane above the road is $\frac{\sqrt{3}}{4}$ km.

28. A container open from the top, made up of a metal sheet is in the form of a frustum of a cone of height 8 cm with radii of its lower and upper ends as 4 cm and 10 cm respectively. Find the cost of oil which can completely fill the container at the rate of Rs. 50 per litre. Also, find the cost of metal used, if it costs Rs. 5 per 100 cm^2.

29. A decorative block, as shown in the figure, is made up of two solids - a cube and a hemisphere with diameter 4.2 cm fixed on top of the cube. Find total surface area of the block. $\left(\text{take } \pi = \frac{22}{7}\right)$



30. A card is drawn at random from a well shuffled deck of playing cards. Find the probability that the card drawn is

i. a king or a jack
ii. a non–ace card
iii. a red card
iv. neither a king nor a queen

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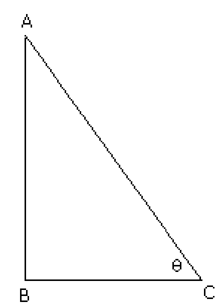
Class X Mathematics
Solution

Section A

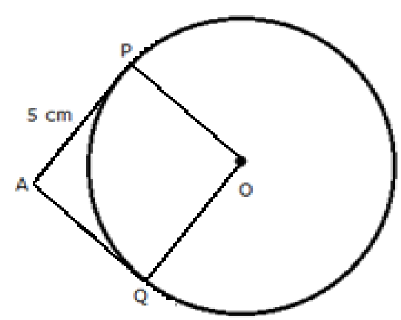
1. P(winning) + P(losing) = 1
   0.3 + P(losing) = 1
   P(losing) = 1 – 0.3 = 0.7

2. In the figure, AB is the vertical tower of height 20 m. C denotes the position of the man.

   Let $\angle ACB = \theta$ denotes the angle of elevation. Then $\cos\theta = 0.5 = \frac{1}{2}$
   i.e. $\theta = 60°$
   Therefore, distance of the man from the foot of the tower = BC
   $\tan 60° = \frac{AB}{BC} \Rightarrow \sqrt{3} = \frac{20}{BC} \Rightarrow BC = \frac{20}{\sqrt{3}}$ m

3. Join O to P and Q.
   It is known that the radius is perpendicular to the tangent at the point of contact.
   $\therefore$ m∠OPA = m∠OQA = 90°
   Thus, APOQ is a square.
   $\therefore$ OP = OQ = 5 cm
   Thus, the radius of the circle is 5 cm.

4. $S_n = 3n^2 + 5n$
   $a_1 = S_1 = 3(1)^2 + 5(1) = 8$
   $a_1 + a_2 = S_2$
   $\Rightarrow 8 + a_2 = 3(2)^2 + 5(2)$
   $\Rightarrow a_2 = 14$
   $\therefore d = a_2 - a_1 = 14 - 8 = 6$
   Let the r^{th} term of the A.P. be 164.
   Then, $a_r = 164$
   $\Rightarrow a + (r - 1)d = 164$
   $\Rightarrow 8 + (r - 1)(6) = 164$
   $\Rightarrow (r - 1)6 = 156$
   $\Rightarrow r = 27$
   Thus, 164 is the 27^{th} term of the AP.

5. If the denominator of a rational number is of the form $2^n 5^m$, then it will terminate after n places if n > m or after m places if m > n.

Now, $\frac{2^3}{2^2 5} = \frac{2}{5} = \frac{2}{2^{\circ} 5}$

Hence, it will terminate after 1 decimal place.

6. ΔABC ~ ΔPQR and AM and PN are the medians of ΔABC and ΔPQR respectively.

$\Rightarrow \frac{A(\Delta ABC)}{A(\Delta PQR)} = \left(\frac{AM}{PN}\right)^2$

$\Rightarrow \frac{100}{144} = \left(\frac{4}{PN}\right)^2$

$\Rightarrow \frac{100}{144} = \frac{16}{PN^2}$

$\Rightarrow PN^2 = \frac{16 \times 144}{100} \Rightarrow PN = \frac{4 \times 12}{10} = \frac{48}{10} = 4.8 \text{ cm}$

Section B

7. Here, a = 5 and d = 10

$a_{31} = a + 30d = 5 + 30(10) = 305$

Let the required term be the n^{th} term.

Then,

$a_n = 130 + a_{31}$

$\Rightarrow a + (n - 1)d = 130 + 305$

$\Rightarrow 5 + (n - 1)10 = 435$

$\Rightarrow (n - 1)10 = 430$

$\Rightarrow n - 1 = 43$

$\Rightarrow n = 44$

Hence, the 44^{th} term of the given A.P. is 130 more than its 31^{st} term.

8. $4^n = (2^2)^n = 2^{2n}$

The only prime in the factorisation of 4^n is 2.

There is no other primes in the factorisation of $4^n = 2^{2n}$

[By uniqueness of the Fundamental Theorem of Arithmetic]

$\Rightarrow$ 5 does not occur in the prime factorisation of 4^n for any n.

$\Rightarrow$ 4^n does not end with the dizit 0 for any natural number n.

9. $m\angle ABC = 90°$

Since AB being diameter is perpendicular to tangent BC at the point of contact.

So $m\angle ABP + m\angle PBC = 90°$ (i)

Also $m\angle APB = 90°$ (angle in the semi-circle)

So $m\angle BAP + m\angle ABP = 90°$ (ii) (using angle sum property of triangles)

From (i) and (ii), $\angle PBC = \angle BAP$

10. Distance travelled by a wheel in 450 complete revolutions = 0.99 km = 990 m

Circumference of the wheel = Distance covered in one revolution

$\Rightarrow 2\pi r = \frac{990}{450}$

$\Rightarrow 2 \times \frac{22}{7} \times r = \frac{990}{450}$

$\Rightarrow r = \frac{990 \times 7}{2 \times 22 \times 450} = \frac{7}{20}\ m = 35\ cm$

11. $\cot\theta = \frac{7}{8}$ (given)

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

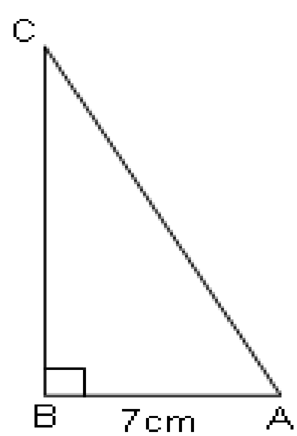
$$= \frac{\cos^2\theta}{\sin^2\theta}$$

$$= \cot^2\theta$$

$$= \left(\frac{7}{8}\right)^2$$

$$= \frac{49}{64}$$

12. In ABC, we have



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

$(1 + BC)^2 = BC^2 + AB^2$

$\Rightarrow 1 + BC^2 + 2BC = BC^2 + AB^2$

$\Rightarrow 1 + 2BC = 7^2$

$\Rightarrow 2BC = 48$

$\Rightarrow BC = 24\ cm$

$\Rightarrow AC = 1 + BC = 1 + 24 = 25\ cm$

Hence, $\sin C = \frac{AB}{AC} = \frac{7}{25}$ and $\cos C = \frac{BC}{AC} = \frac{24}{25}$

Section C

13. Let the distance between the two towers AB and CD be 140 m.

$\Rightarrow$ DE = CB = 140 m

Height of the second tower CD = 60 m

Let the height of first tower, AB, be h m.

CD = BE = 60 m

$\Rightarrow$ AE = (h − 60) m

In Δ AED,

$$\frac{AE}{DE} = \tan 30^{o}$$

$$\frac{h-60}{140} = \frac{1}{\sqrt{3}}$$

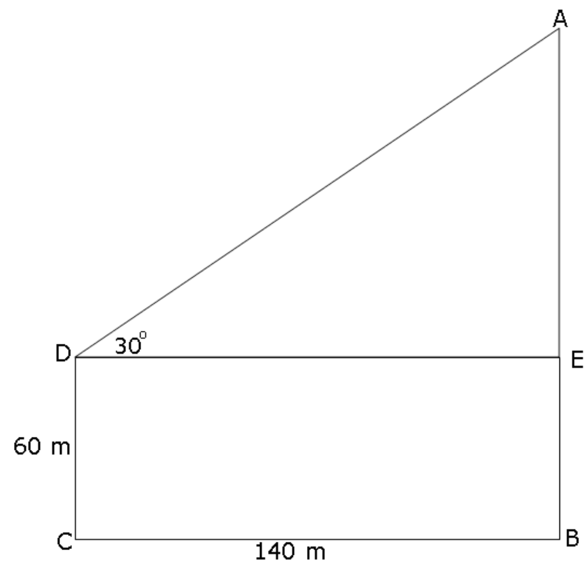
$\Rightarrow \sqrt{3}h - 60\sqrt{3} = 140$

$\Rightarrow \sqrt{3}h = 140 + 60\sqrt{3}$

$\Rightarrow h = \frac{140+60\sqrt{3}}{\sqrt{3}} = \frac{140}{\sqrt{3}} + 60$

$\Rightarrow$ h = 80.83 + 60 = 140.83 m

Thus, the height of the first tower is 140.83 m.



14. If the area of the triangle formed by joining the given points is zero, then the points will be collinear.

$$\text{Area of triangle} = \frac{1}{2}\left[x_1(y_2-y_3) + x_2(y_3-y_1) + x_3(y_1-y_2)\right]$$

Here, $x_1 = a, y_1 = a^2; x_2 = b, y_2 = b^2; x_3 = c, y_3 = c^2$

Substituting the values in the formula, we get

$$\text{Area of triangle} = \frac{1}{2}\left[a\left(b^2-c^2\right)+b\left(c^2-a^2\right)+c\left(a^2-b^2\right)\right]$$

$$= \frac{1}{2}\left[ab^2 - ac^2 + bc^2 - a^2b + a^2c - cb^2\right]$$

$$= \frac{1}{2}\left[-a^2(b-c) + a(b^2-c^2) - bc(b-c)\right]$$

$$= \frac{1}{2}\left[(b-c)\{-a^2 + a(b+c) - bc\}\right]$$

$$= \frac{1}{2}\left[(b-c)(-a^2 + ab + ac - bc)\right]$$

$$= \frac{1}{2}\left[(b-c)\{-a(a-b) + c(a-b)\right]$$

$$= \frac{1}{2}\left[(b-c)(a-b)(c-a)\right]$$

It is given that a ≠ b ≠ c, therefore, area of the triangle ≠0

Hence, the given points can never be collinear.

15. There are three sections of each class and it is given that the number of trees planted by any class is equal to the class number.

The number of trees planted by class I = number of sections $\times$ 1 = 3 $\times$ 1 = 3

The number of trees planted by class II = number of sections $\times$ 2 = 3 $\times$ 2 = 6

The number of trees planted by class III = number of sections $\times$ 3 = 3 $\times$ 3 = 9

Therefore, we have the sequence: 3, 6, 9, ..., (12 terms)

This sequence is an A.P.

To find the total number of trees planted by all the students, we need to find the sum of the 12 terms of the sequence.

First term = a = 3

Common difference = d = 6 − 3 = 3

n = 12

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

$S_{12} = \frac{12}{2}[6 + (12 - 1)(3)] = 6(6 + 33) = 6 \times 39 = 234$

Thus, in total 234 trees will be planted by the students.

Values inferred are environment friendly and social awareness.

16. $\frac{1}{x+4} - \frac{1}{x-7} = \frac{11}{30}$, where $x \neq -4, 7$

$\Rightarrow \frac{x-7-x-4}{(x+4)(x-7)} = \frac{11}{30}$

$\Rightarrow \frac{-11}{(x+4)(x-7)} = \frac{11}{30}$

$\Rightarrow -30 = x^2 - 7x + 4x - 28$

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

$\Rightarrow (x - 2)(x - 1) = 0$

$\therefore x = 2, 1$

Thus, the roots of given equation are 1, 2.

17. Let 6 + $\sqrt{2}$ be rational and equal to $\frac{a}{b}$.

Then, $\frac{6+\sqrt{2}}{1}=\frac{a}{b}$, where a and b are co primes, $b\neq 0$

$\therefore \sqrt{2}=\frac{a}{b}-6=\frac{a-6b}{b}$

Here a and b are integers. so, $\frac{a-6b}{b}$ is rational.

Therefore, $\sqrt{2}$ is rational. This is a contradiction as $\sqrt{2}$ is irrational.

Hence, our assumption is wrong. Thus, 6 + $\sqrt{2}$ is an irrational number.

18. Let the speed of the stream be s km/h.

Speed of the motor boat $= 24$ km/h

Speed of the motor boat upstream $= 24 - s$

Speed of the motor boat downstream $= 24 + s$

According to the given condition,

$$\frac{32}{24-s}-\frac{32}{24+s}=1$$

$$\therefore 32\left(\frac{1}{24-s}-\frac{1}{24+s}\right)=1$$

$$\therefore 32\left(\frac{24+s-24+s}{576-s^2}\right)=1$$

$$\therefore 32\times 2s=576-s^2$$

$$\therefore s^2+64s-576=0$$

$$\therefore (s+72)(s-8)=0$$

$$\therefore s=-72 \text{ or } s=8$$

Since, speed of the stream cannot be negative, the speed of the stream is 8 km/h.

19. Let P(x, y), Q(a + b, b – a) and R(a – b, a + b) be the given points.

It is given that PQ = PR $\Rightarrow PQ^2 = PR^2$

$\{x-(a+b)\}^2+\{y-(b-a)\}^2=\{x-(a-b)\}^2+\{y-(a+b)\}^2$

$\Rightarrow x^2-2x(a+b)+(a+b)^2+y^2-2y(b-a)+(b-a)^2$

$= x^2+(a-b)^2-2x(a-b)+y^2-2y(a+b)+(a+b)^2$

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

$\Rightarrow -ax-bx-by+ay=-ax+bx-ay-by$

$\Rightarrow 2bx = 2ay$

$\Rightarrow bx = ay$

20. Total number of outcomes = 200

Multiples of 6 from 1 to 200:

6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66, 72, 78, 84, 90, 96, 102, 108, 114, 120, 126, 132, 138, 144, 150, 156, 162, 168, 174, 180, 186, 192, 198.

Total outcomes = 33

Multiples of 8 from 1 to 200:

8, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, 96, 104, 112, 120, 128, 136, 144, 152, 160, 168, 176, 184, 192, 200.

Total outcomes = 25

Multiples of 6 and 8 from 1 to 200:

24, 48, 72, 96, 120, 144, 168, 192

Total outcomes = 8

Number of multiples of 6 or 8 = 33 + 25 – 8 = 50

P (chosen integer is a multiple of 6 or 8) = $\frac{50}{200} = \frac{1}{4}$

21. Join OT.

It is known that the tangent at any point of a circle is perpendicular to the radius through the point of contact.

$\therefore$ m$\angle$OTP = 90°

In a triangle, the measure of an exterior angle is equal to the sum of the measures of its opposite interior angles.

Therefore, in Δ PAT,

$\angle$OAT = $\angle$APT + $\angle$ATP

$\therefore$ $\angle$OAT = x + y

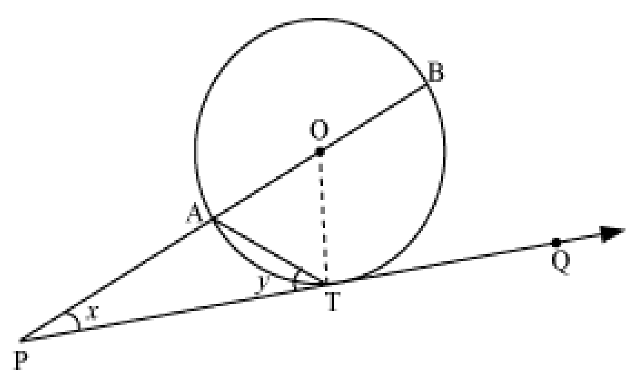
In Δ OAT, OA = OT (Radii of the same circle)

$\therefore$ $\angle$OAT = $\angle$OTA

$\Rightarrow$ x + y = $\angle$OTP − $\angle$ATP

$\Rightarrow$ x + y = 90° − y

$\Rightarrow$ x + 2y = 90°



22. Converting the given distribution to continuous distribution, we have:

C.I.	f	c.f.
9.5 - 19.5	2	2
19.5 - 29.5	4	6
29.5 - 39.5	8	14
39.5 - 49.5	9	23
49.5 - 59.5	4	27
59.5 - 69.5	2	29
69.5 - 79.5	1	30

Here, N = 30 $\Rightarrow \frac{N}{2} = 15$

Median class is 39.5 - 49.5

Here, l = 39.5, c.f. = 14, f = 9, h = 10

Median = $l + \left(\frac{\frac{N}{2} - cf}{f} \right) \times h$ = 39.5 + $\frac{10}{9}(15 - 14) = 39.5 + 1.1 = 40.6$

Section D

23. Since tangents drawn from an external point to a circle are equal.

DR = DS = 5 cm

Now, AR = AD − DR = 23 − 5 = 18 cm

But, AR = AQ

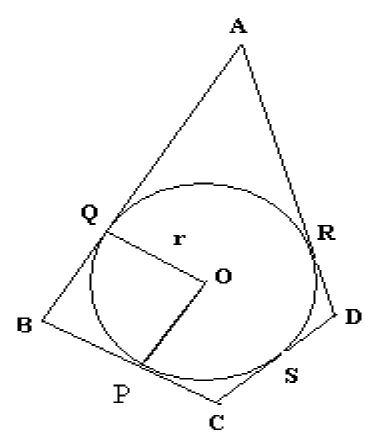
$\therefore$ AQ = 18 cm

Also, BQ = AB − AQ = 29 − 18 = 11 cm

But, BP = BQ

$\therefore$ BP = 11 cm

Also, m $\angle$ Q = m $\angle$ P = 90°.



In quadrilateral OQBP,

m$\angle$QOP + m$\angle$P + m$\angle$Q + m$\angle$B = 360°

m$\angle$QOP = 360° − ($\angle$P + $\angle$Q + $\angle$B) = 360° − (90° + 90° + 90°) = 90°

Hence, OQBP is a square.

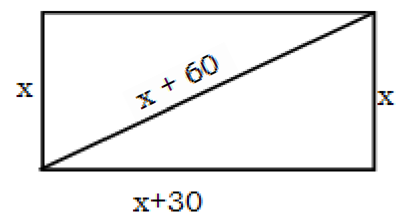
$\therefore$ BQ = OQ = OP = BP = 11 cm

Hence, the radius of the circle is 11 cm.

24. Let the shorter side be x metres.

$\Rightarrow$ Diagonal = (x + 60) metres

$\Rightarrow$ Longer side = (x + 30) metres



By applying Pythagoras theorem,

$(x + 30)^2 + x^2 = (x + 60)^2$

$\Rightarrow x^2 + 60x + 900 + x^2 = x^2 + 3600 + 120x$

$\Rightarrow x^2 - 60x - 2700 = 0$

$\Rightarrow x^2 - 90x + 30x - 2700 = 0$

$\Rightarrow x(x - 90) + 30(x - 90) = 0$

$\Rightarrow (x - 90)(x + 30) = 0$

$\Rightarrow x = 90$ or $x = -30$

But, side cannot be negative.

So, x = 90 = shorter side

$\Rightarrow$ Longer side = x + 30 = 90 + 30 = 120 m

Thus, shorter side = 90 m, longer side = 120 m

25. Since, the radius is perpendicular to the tangent at the point of contact, m∠OPO' = 90°.

$O'O = \sqrt{4^2 + 3^2} = 5$ cm (Using Pythagoras theorem)

Let O'L = x, then OL = 5 – x

$\therefore PL^2 = 4^2 - x^2 = 3^2 - (5 - x)^2$

$\Rightarrow 16 - x^2 = 9 - (25 + x^2 - 10x)$

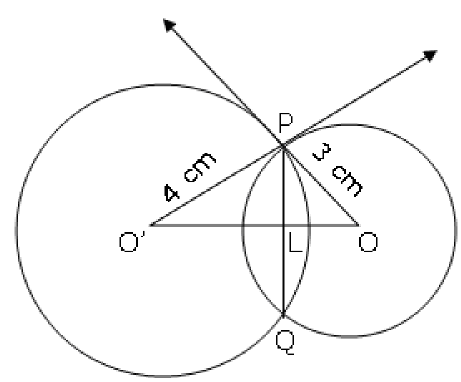
$\Rightarrow 16 = 9 - 25 + 10x$

$\Rightarrow 10x = 32$

$\Rightarrow x = \frac{32}{10} = 3.2$ cm

$\therefore PL = \sqrt{4^2 - (3.2)^2} = \sqrt{16 - 10.24} = \sqrt{5.76} = 2.4$

$\therefore PQ = 2 \times 2.4$ cm = 4.8 cm



26. Suppose 200 logs are stacked in 'n' rows.

There are 20 logs in the first row, 19 logs in the second row, 18 logs in the third row, and so on.

So, number of logs in various rows form an A.P. whose first term is a = 20 and common difference is d = 19 – 20 = −1

Given: Sum of n terms of this A.P. = 200

$\Rightarrow \frac{n}{2}\left[2\times 20+(n-1)\times(-1)\right]=200 \quad \left[\because S_n=\frac{n}{2}\left[2a+(n-1)d\right]\right]$

$\Rightarrow$ 40n – n(n – 1) = 400

$\Rightarrow$ 40n – n^2 + n = 400

$\Rightarrow$ n^2 – 41n + 400 = 0

$\Rightarrow$ n^2 – 25n – 16n + 400 = 0

$\Rightarrow$ n(n – 25) – 16(n – 25) = 0

$\Rightarrow$ (n – 25) (n – 16) = 0

$\Rightarrow$ n – 25 = 0 or n – 16 = 0

$\Rightarrow$ n = 25 or n = 16

When n = 25, then number of logs in the 25^{th} row = 25^{th} term of an A.P.

= a + (25 – 1)d

= 20 + 24(−1)

= −4, not possible

When n = 16, then number of logs in the 16^{th} row = 16^{th} term of an A.P.

= a + (16 – 1)d

= 20 + 15(−1)

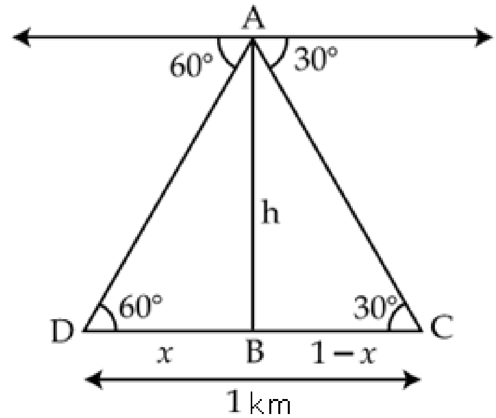
= 20 – 15

= 5

Hence, there are 16 rows in which 200 logs are placed and 5 logs are in the top row.

Value depicted: Space saving, Creative, Reasoning, Balancing

27. In the figure, AB denotes the height of the airplane. Points C and D denote the two stones which are 1 km apart.



In Δ ABD,

$$\tan 60° = \frac{h}{x}$$

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

$$\Rightarrow x = \frac{h}{\sqrt{3}} \qquad ....(1)$$

In Δ ABC,

$$\tan 30° = \frac{h}{1-x}$$

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

$$\sqrt{3}h = 1 - x$$

$$\Rightarrow x = 1 - \sqrt{3}h \qquad ....(2)$$

From (1) and (2),

$$\frac{h}{\sqrt{3}} = 1 - \sqrt{3}h$$

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

$$\Rightarrow \frac{4h}{\sqrt{3}} = 1$$

$$\Rightarrow h = \frac{\sqrt{3}}{4} \text{km}$$

Thus, the height of airplane is $\frac{\sqrt{3}}{4}$ km.

28. Let l be the slant height of the frustum.

$r_1 = 10$ cm, $r_2 = 4$ cm and h = 8 cm

$\therefore l = \sqrt{h^2 + (r_1 - r_2)^2} = \sqrt{8^2 + 6^2} = 10$ cm

Let V be the volume of the container.

$$\therefore V = \frac{1}{3}\pi h({r_1}^2 + {r_2}^2 + r_1 r_2)$$

$$= \frac{1}{3} \times 3.14 \times 8(100 + 16 + 40)$$

$$= 3.14 \times 8 \times \frac{156}{3} = 1306.24 \text{ cm}^3$$

Thus, volume of container is 1306.24 cm^3.

But, $1 \text{ cm}^3 = \frac{1}{1000}$ l

So, the capacity of container is $1306.24 \times \frac{1}{1000}$ l $= 1.30624$ l

$\therefore$ Cost of oil at the rate of Rs. 50 per litre = Rs. (50 × 1.30624) = Rs. 65.31

Let S be the surface area of the frustum.

Then,

$S = \pi(r_1 + r_2)l + \pi {r_1}^2$

$= 3.14 \times (10 + 4) \times 10 + 3.14 \times 4^2$

$= 3.14 \times 156$

$= 489.84 \text{ cm}^2$

$\therefore$ Cost of metal used = $\frac{5}{100} \times 489.84$ = Rs. 24.49

29. Let the radius of hemisphere be r cm.

Total surface area of a cube = 6 × 5 × 5 cm^2 = 150 cm^2

Base area of hemisphere = πr^2

C.S.A. of the hemisphere = $2\pi r^2$

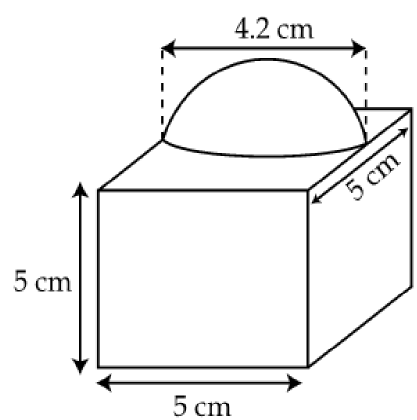
S.A. of the decorative block

$= 150 - \pi r^2 + 2\pi r^2$

$= 150 + \pi r^2$

$= 150 + \frac{22}{7} \times 2.1 \times 2.1$

$= 163.86 \text{ cm}^2$



30. Total number of outcomes = 52

i. Favorable outcomes = 4 + 4 = 8

$\therefore$ Required probability = $\frac{\text{Favourable outcomes}}{\text{Total outcomes}} = \frac{8}{52} = \frac{2}{13}$

ii. Ace cards are 4 in number.

$\therefore$ Non–ace cards = 52 – 4 = 48

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

iii. Number of red cards = 26

$\therefore$ Required probability = $\frac{26}{52} = \frac{1}{2}$

iv. Number of kings and queens = 4 + 4 = 8

$\therefore$ Number of cards which are neither king nor queen = 52 – 8 = 44

$\therefore$ Required probability = $\frac{44}{52} = \frac{11}{13}$