CBSE Board
Class X Mathematics
Sample Paper 1 (Basic)

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

General Instructions:

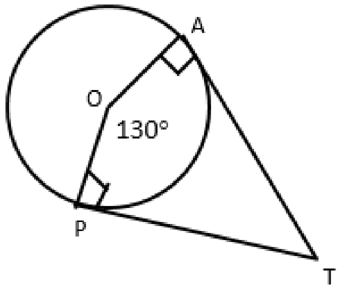
1. This question paper contains **two parts** A and B.
2. Both **Part A** and **Part B** have internal choices.

Part – A:
1. It consists **two sections** - I and II.
2. **Section I** has **16 questions** of **1 mark** each. Internal choice is provided in **5 questions**.
3. **Section II** has **four case – based questions**. Each case study has **5 case-based sub-parts**. An examinee is to attempt any **4 out of 5 sub-parts**. Each subpart carries **1 mark.**

Part – B:
1. It consists **three sections** – III, IV and V
2. **Section III: Question No 21 to 26** are **Very short answer** Type questions of **2 marks** each.
3. **Section IV: Question No 27 to 33** are **Short Answer Type** questions of **3 marks** each.
4. **Section V: Question No 34 to 36** are **Long Answer Type** questions of **5 marks** each.
5. Internal choice is provided in **2 questions of 2 marks, 2 questions of 3 marks and 1 question of 5 marks.**

Part A
Section I
Section I has 16 questions of 1 mark each.
(Internal choice is provided in 5 questions)

1. If the given figure, if TA and TP are tangents to a circle with centre O, so that m∠ AOP = 130° then find m∠ ATP.



OR

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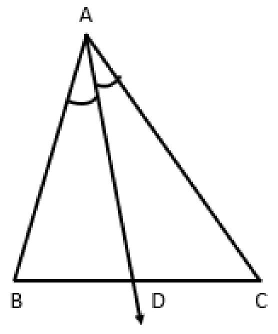
In a triangle ABC, AD is the bisector of ∠ A. If AB = 5.6 cm, AC = 4 cm and DC = 3 cm then find BD.



2. What is the relation between Measures of Central Tendency?

OR

Is $\sqrt{3}$ an irrational number, if yes then give the reason?

3. What is the product of a non-zero rational and an irrational number?

4. A die is thrown once. What is the probability of getting a number less than 3?

OR

What is the probability of occurrence of an event?

5. If α, β are the zeroes of $x^2 + 5x + 8 = 0$ then find the value of $\alpha + \beta$.

6. Write the exponent of 2 in the prime factorization of 144.

7. Find the area of a sector of a circle of radius 28 cm and central angle 45°.

8. If A(-1, 0), B(5, -2) and C(8, 2) are the vertices of a triangle ABC, then find its centroid.

9. In which quadrant does the point (-3, 5) lie?

10. If P $\left(\frac{a}{3}, 4\right)$ is the midpoint of the line segment joining A(-6, 5) and B(-2, 3) then find the value of a.

11. If one zero of $3x^2 + 8x + k$ be the reciprocal of the other, then find the value of k.

OR

Find a quadratic polynomial, in which the sum of zeroes is 0 and product is 3.

12. What is the area of the triangle formed by the line $\frac{x}{a} + \frac{y}{b} = 1$ with the coordinate axes?

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13. Find the value of $\sin 45° \sin 30° + \cos 45° \cos 30°$.

OR

Without using trigonometric tables, find sin 29° – cos 61°.

14. $\Delta ABC \sim \Delta DEF$ such that ar(ΔABC) = 36 cm^2 and ar(ΔABC) = 49 cm^2. Then find the ratio of their corresponding sides?

15. If x = 3 is a solution of the equation $3x^2 + (k - 1)x + 9 = 0$ then find the value of k.

16. If the system of equations 3x – 2y = 0 and kx + 5y = 0 has infinitely many solutions, then what is the value of k?

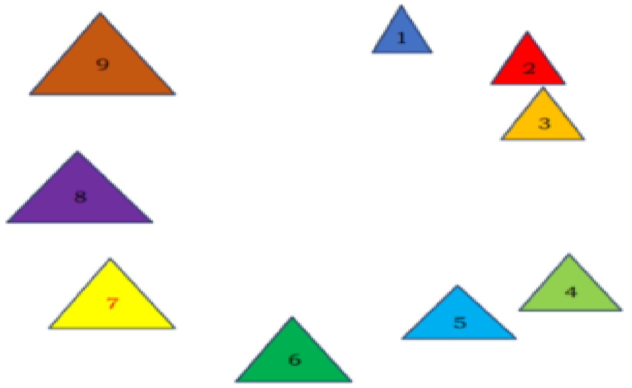
Section II

(Q 17 to Q 20 carry 4 marks each)

Case study based questions are compulsory. Attempt any four sub parts of each question. Each subpart carries 1 mark

17. Case Study Based- 1

Numbers and Equilateral Triangles.



Rahul and Sunil were feeling bored during the lockdown. They both created a number game. Sunil prepared nine equilateral triangles and numbered them from 1 to 9. The numbers written on the triangles also represent length of each side of the triangle (in cm).

Sunil arranged them in the form of a circle. He asked Rahul to remove alternate triangles starting from number 1, going clockwise, until only one triangle remained.

(a) The triangle which Rahul removed in the first round are in order, numbered 1, 3, 5, 7, 9. If Rahul continues in the same manner, which numbered triangle will be left in the last?

(i) 4

(ii) 2

(iii) 8

(iv) 6

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(b) In the second round, Sunil started counting with triangle numbered 1 and eliminated every third triangle, until only one triangle remained. Which of the following triangle will be left in the end?
(i) 1
(ii) 3
(iii) 7
(iv) 6

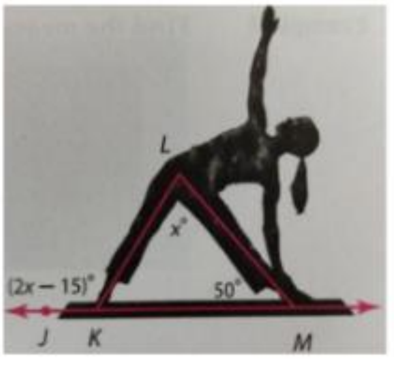
(c) Rahul added two more triangles in the circle and numbered these as triangle 10 and triangle 11. In this round, Rahul started counting with triangle numbered 1, but anticlockwise, and eiminated every fifth triangle, until only one triangle remained. Which triangle will be left in the end?
(i) 2
(ii) 4
(iii) 5
(iv) 8

(d) If there are 9 triangles, will the perimeters of the triangles follow any pattern? If so, write the pattern?
(i) They are multiple of 3.
(ii) They are multiple of 6.
(iii) They are multiple of 2.
(iv) They are multiple of 4.

(e) Are the areas of the triangles numbered 3, 4 and 6, 8 in proportion? If yes then write down the ratio.
(i) 9: 16
(ii) 3: 4
(iii) 7: 8
(iv) 16: 9

18. Case Study based-2
Types of angles and angle sum property of a triangle

It is 7:00 am!
Shikha rolls out her yoga mat and starts her warm up session with stretching and bending. Anaya her daughter is sitting nearby, observing her mother's daily ritual. Anaya takes a picture of her mother while she was in a yoga posture and label it as shown.



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(a) Angles ∠LKM and ∠JKL are called as?
   (i) Linear Pair of angles
   (ii) Vertically opposite angles
   (iii) Complementary angles
   (iv) Corresponding angles

(b) Find m∠LKM.
   (i) 195° – x
   (ii) 185° – 2x
   (iii) 195° – 2x
   (iv) 185° – x

(c) Find m∠KLM.
   (i) 115°
   (ii) 65°
   (iii) 50°
   (iv) 180°

(d) Which of the following is true for △LKM?
   (i) △LKM is an equilateral triangle.
   (ii) △LKM is an isosceles triangle.
   (iii) △LKM is a right angle triangle.
   (iv) All of the above

(e) What is the measurement of the ∠LKJ?
   (i) 115°
   (ii) 65°
   (iii) 50°
   (iv) 180°

19. Case Study Based- 3
THE TREASURE ISLAND

Understanding Graphs:

On the graph sheet, a point is located using a pair of numbers such as (x, y)

- The first number 'x' shows the horizontal distance of the point (i. e left or right) on the horizontal line.
- The second number 'y' shows the vertical distance of the point (i. e up of down) right) on the vertical line.
- The point where X – axis and Y – axis cross each other at 90° called the Origin denoted by (0, 0).
- Clearly the X – axis and Y – axis divide the plane is known as Cartesian plane.
- We measure everything on the Cartesian plane with respect to Origin.

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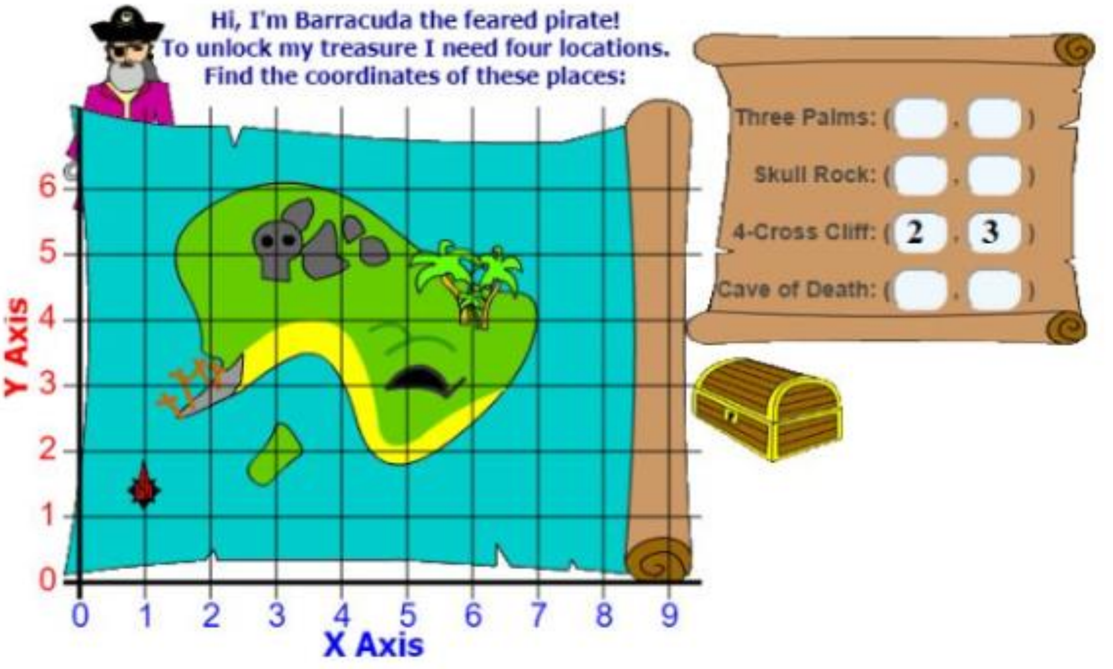
Rita and Renu are playing a board game of Treasure Island.



(a) The coordinate of CAVE of DEATH
- (i) (3, 5)
- (ii) (3, 3)
- (iii) (5, 5)
- (iv) (5, 3)

(b) The coordinate of THREE PALMS
- (i) (6, 3)
- (ii) (3, 6)
- (iii) (5, 2)
- (iv) (9, 5)

(c) The distance between FOUR CROSS CLIFF and the CAVE of DEATH is
- (i) 3 units
- (ii) 5 units
- (iii) 2 units
- (iv) None of these

(d) What is the distance of SKULL ROCK from x – axis?
- (i) 3 units
- (ii) 5 units
- (iii) 2 units
- (iv) None of the

(e) The mid – point of CAVE of DEATH and THREE PALMS is
- (i) (5.5, 3.5)
- (ii) (5, 3)
- (iii) (3.5, 5.5)
- (iv) (3, 5)

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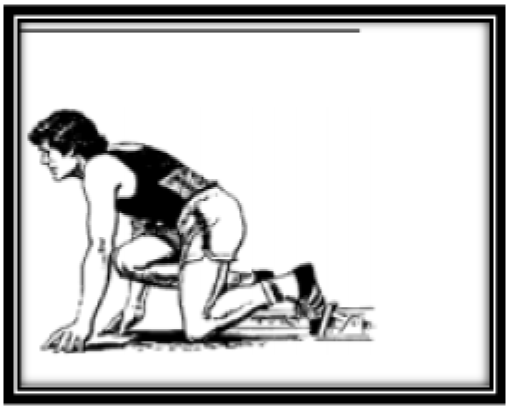
20. Case Study Based- 4

110m RACE

A stopwatch was used to find the time that it took a group of students to run 110m.



Time(in sec)	20 – 40	40 – 60	60 – 80	80 – 100	100 – 120
No. of students	7	10	15	5	3

(a) Estimate the mean time taken by a student to finish the race.
- (i) 54.6
- (ii) 63.5
- (iii) 43.5
- (iv) 50.5

(b) What will be the lower limit of the modal class?
- (i) 20
- (ii) 40
- (iii) 60
- (iv) 80

(c) Which of the following are measures of Central Tendency?
- (i) Mean
- (ii) Median
- (iii) Mode
- (iv) All of the above

(d) The sum of upper limits of median class and modal class is
- (i) 60
- (ii) 120
- (iii) 80
- (iv) 160

(e) How many students finished the race within 1 min?
- (i) 18
- (ii) 37
- (iii) 17
- (iv) 8

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Part B

All questions are compulsory. In case of internal choices, attempt any one.

Section III

(Q 21 to Q 26 carry 2 marks each)

21. A card is drawn at random from a pack of well-shuffled 52 playing cards. Find the probability that the card drawn is

i. an ace

ii. a spade

22. Out of 200 students from a school, 135 like Kabaddi and the remaining students do not like the game. If one student is selected at random from all the students, find the probability that the student selected doesn't like Kabaddi.

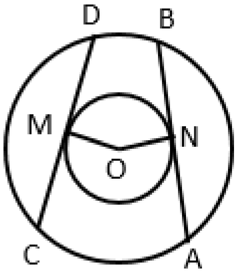
OR

If two coins are tossed, find the probability of the following events:

i. Getting at least one head

ii. Getting no head

23. In two concentric circles, prove that all chords of the outer circle which touch the inner are of equal length.



24. Prove that $\frac{\sin^2\theta}{\cos\theta} + \cos\theta = \sec\theta$

OR

Prove that $\cos^2\theta\,(1 + \tan^2\theta) = 1$

25. If the circumference and the area of a circle are numerically equal then find the diameter of a circle.

26. From the given polynomials,

$x + 2$, $x^2 + 5x + 3$, $x^4 + x^3 + x + 1$, $x^3 + 1$, $x - 1$, $x^3 + x$, $x^2 + 7x$ and $x^3 - x^2$

i. How many are cubic polynomial?

ii. Divide the polynomial $x^2 + 5x + 3$ by $x - 1$.

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Section IV

(Q 27 to Q 33 carry 3 marks each)

27. If α, β are the zeros of the polynomial $f(x) = x^2 - 5x + k$ such that $\alpha - \beta = 1$, find the value of k.

28. Draw a line segment AB of length 6.5 cm and divide it in the ratio 4:7. Measure each of the two parts.

29. The surface areas of a sphere and a cube are equal. Find the ratio of their volumes.

OR

A washing tub is in the shape of a frustum of a cone has height 21 cm. The radii of the circular top and bottom are 20 cm and 15 cm respectively. What is the capacity of the tub? Take $\pi = \frac{22}{7}$

30. If $\sin \theta = \frac{11}{61}$, find the value of $\cos \theta$ using trigonometric identity.

OR

If $\tan \theta + \frac{1}{\tan \theta} = 2$ then show that $\tan^2 \theta + \frac{1}{\tan^2 \theta} = 2$

31. Give prime factorization of 4620.

32. Prove that the lengths of tangents drawn from an external point to a circle are equal.

33. Solve : $6x + 3y = 7$ and $3x + 9y = 11$

Section V

(Q 34 to Q 36 carry 5 marks each)

34. Find the value of p, if the mean of the following distribution is 7.5

x	3	5	7	9	11	13
f	6	8	15	p	8	4

35. Determine the general term of an AP whose 7^{th} term is −1 and 16^{th} term is 17.

OR

The sum of n, 2n and 3n terms of an AP are S_1, S_2 and S_3, respectively. Prove that $S_3 = 3(S_2 - S_1)$.

36. A tree was broken by wind and the top of the tree touched the ground making an angle of 30°. If the point where the top touched the ground to the bottom of the tree is 20 m, then find the height of the tree before it was broken.

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CBSE Board
Class X Mathematics
Sample Paper 1 (Basic) – Solution

Part A
Section I

1. OA is perpendicular to TA by tangent radius theorem.
OP is perpendicular to TP by tangent radius theorem.
$\Rightarrow \angle ATP + \angle OAT + \angle OPT + \angle POA + \angle ATP = 360°$
$\Rightarrow 90° + 90° + 130° + \angle ATP = 360°$
$\Rightarrow m\angle ATP = 50°$

OR

In a triangle ABC, AD is the bisector of $\angle$ A.

$$\Rightarrow \frac{AB}{BD} = \frac{AC}{DC} \Rightarrow \frac{5.6}{BD} = \frac{4}{3} \Rightarrow BD = \frac{5.6 \times 3}{4} = 4.2 \text{ cm}$$

2. The relation between Measures of Central Tendency is given by
Mode = 3Median – 2Mean

OR

Yes, $\sqrt{3}$ is an irrational number.

Since, it cannot be written in the form of $\frac{p}{q}$, where p and q are integers, q≠0 and HCF(p, q)=1.

3. The product of a non-zero rational and an irrational number is always an irrational.

4. The sample space S = {1, 2, 3, 4, 5, 6} ⇒ n(S) = 6
Let A be the event that getting a number less than 3.

$A = \{1, 2\} \Rightarrow n(A) = 2 \Rightarrow P(A) = \frac{2}{6} = \frac{1}{3}$

OR

The probability of occurrence of an event is 1.
Since the probability of an event is neither negative nor greater than zero.

5. Given quadratic polynomial is $x^2 + 5x + 8 = 0$ where a = 1, b = 5 and c = 8.
Sum of the zeroes i. e $\alpha + \beta = -b/a = -5$

6. Prime factorisation of $144 = 2^4 \times 3^2$
Hence, the exponent of 2 in the prime factorization of 144 is 4.

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7. In a circle, radius 28 cm and central angle 45°.

$\theta = 45°, r = 28$ cm

Area of sector = $\frac{\theta}{360} \times \pi r^2 = \frac{45}{360} \times \frac{22}{7} \times 28 \times 28 = 308\ cm^2$

8. A(–1, 0), B(5, –2) and C(8, 2) are the vertices of a triangle ABC, then its centroid is

$\left(\frac{-1+5+8}{3}, \frac{0-2+2}{3}\right) = (4, 0)$

9. In the given point (–3, 5), x coordinate is negative and y coordinate is positive.

⇒The point (–3, 5) lies in the II quadrant.

10. P $\left(\frac{a}{3}, 4\right)$ is the midpoint of the line segment joining A(–6, 5) and B(–2, 3).

⇒ The midpoint of the line segment joining A and B = $\left(\frac{-6-2}{2}, \frac{5+3}{2}\right) = (-4, 4)$

$\Rightarrow \left(\frac{a}{3}, 4\right) = (-4, 4) \Rightarrow \frac{a}{3} = -4 \Rightarrow a = -12$

11. If one zero of $3x^2 + 8x + k$ be the reciprocal of the other, then k = 3.

Let α and $\frac{1}{\alpha}$ be the roots of the polynomial.

Product of the zeros = k/3

$\Rightarrow \alpha \times \frac{1}{\alpha} = \frac{k}{3} \Rightarrow k = 3$

OR

A quadratic polynomial = x^2 – (sum of zeroes) x + (product of zeroes)

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

12. The x-intercept and y-intercept of the line $\frac{x}{a} + \frac{y}{b} = 1$ are a and b respectively.

⇒Area of triangle = $\frac{1}{2} \times bh = \frac{1}{2}ab$

13. $\sin 45° \sin 30° + \cos 45° \cos 30° = \frac{1}{\sqrt{2}} \times \frac{1}{2} + \frac{1}{\sqrt{2}} \times \frac{\sqrt{3}}{2} = \frac{1+\sqrt{3}}{2\sqrt{2}}$

OR

Without using trigonometric tables, sin 29° – cos 61° = 0

sin 29° – cos 61°

= sin 29° – cos(90° – 29°) ∵ cos (90° – θ) = sin θ

= sin 29° – sin 29°

= 0

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14. $\Delta ABC \sim \Delta DEF$ such that ar(ΔABC) = 36 cm^2 and ar(ΔABC) = 49 cm^2. Then the ratio of their corresponding sides is 6:7.
Since, the ratio of the areas of two similar triangles is equal to the square of the ratio of their corresponding sides.

15. x = 3 is a solution of the equation $3x^2 + (k - 1)x + 9 = 0$
$\Rightarrow 3^3 + 3(k - 1) + 9 = 0$
$\Rightarrow 27 + 3(k - 1) + 9 = 0$
$\Rightarrow 3(k - 1) = -36$
$\Rightarrow k - 1 = -12$
$\Rightarrow k = -11$

16. The system of equations $3x - 2y = 0$ and $kx + 5y = 0$ has infinitely many solutions.
Then $k = \frac{-15}{2}$
$a_1 = 3, b_1 = -2, a_2 = k, b_2 = 5$
The system of equations $3x - 2y = 0$ and $kx + 5y = 0$ has infinitely many solutions.

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} \Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} \Rightarrow \frac{3}{k} = \frac{-2}{5} \Rightarrow k = \frac{-15}{2}$$

Section II

17.

(a) In the first round 1, 3, 5, 7 and 9 numbered triangles are removed.
This means, Rahul is the alternate removing triangles.
In the second round 4 and 8 numbered triangles are removed.
In the third round 6 numbered triangle is removed.
So, 2 numbered triangle will be left in the last.

(b) Removed triangles numbered in sequence are
3, 6, 9, 4, 8, 5, 2 and 7.
So, 1 numbered triangle will be left in the end.

(c) Removed triangles numbered in sequence are
8, 3, 9, 2, 6, 10, 11, 7, 4, 1
So, 5 numbered triangle will be left in the end.

(d) The perimeters of the triangle will follow the below pattern
3, 6, 9, 12, 15, 18, 21, 24 and 27
$\Longrightarrow$ They are multiples of 3.

(e) We know that, area of an equilateral triangle = $\frac{\sqrt{3}}{4}(\text{side})^2$
The ratio of the areas of first two triangles whose sides are 3 and 4 is 9: 16
The ratio of the areas of two triangles whose sides are 6 and 8 is 36: 64 = 9: 16.
Hence, they are in proportion as their ratio is same and that is 9: 16.

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18.

(a) Angles ∠LKM and ∠JKL are called as Linear Pair of angles.

(b) m∠LKM + m∠JKL =180°…… Linear Pair

$\Longrightarrow$ 2x – 15 + m∠LKM=180° $\Longrightarrow$ m∠LKM= 195° –2x

(c) In △LKM,

m∠LKM + m∠LMK + m∠KLM=180° ...angle sum property of a triangle

$\Longrightarrow$ 195° – 2x + 50 + x = 180°

$\Longrightarrow$ x = 65° = m∠KLM

(d) m∠LKM = 195° –2x = 195 – 2(65) = 195 – 130 = 65°

In △LKM, m∠LKM = m∠KLM = 65°

$\Longrightarrow$△LKM is an isosceles triangle.

(e) m∠LKJ = 2x – 15 = 2(65) – 15 = 130 – 15 = 115°

19.

(a) The coordinates of CAVE of DEATH is (5, 3).

(b) The coordinates of THREE PALMS is (6, 4).

(c) The coordinates FOUR CROSS CLIFF and CAVE of DEATH are (2, 3) and (5, 3) respectively.

Distance between them = $\sqrt{(5-2)^2 + (3-3)^2} = \sqrt{9} = 3$ units

(d) The distance of SKULL ROCK from x – axis is 5 units.

(e) The mid – point of CAVE of DEATH and THREE PALMS

$= \left(\frac{5+6}{2}, \frac{3+4}{2}\right) = (5.5, 3.5)$

20.

(a)

Time (in sec)	No. of students(f)	X	fx
20 – 40	7	30	210
40 – 60	10	50	500
60 – 80	15	70	1050
80 – 100	5	90	450
100 – 120	3	110	330
	Σf = 40		**Σ**fx = 2540

Mean time taken by a student to finish the race = 2540/40 = 63.5 seconds

(b) The modal class is 60 – 80 as it has the highest frequency i.e 15.

Lower limit of the modal class = 60

(c) Mean, Median and Mode are measures of central tendency.

(d)

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Time (in sec)	No. of students(f)	cf
20 – 40	7	7
40 – 60	10	17
60 – 80	15	32
80 – 100	5	37
100 – 120	3	40
	N= Σf = 40	

Here N/2 = 40/2 = 20, Median Class = 60 – 80, Modal Class = 60 – 80
Sum of upper limits of median class and modal class = 80 + 80 = 160

Number of students who finished the race within 1 min = 7 + 10 = 17

Part B
Section III

21. S is the sample space.
n(S) = 52

i. Let A be the event of getting an ace card
There are 4 ace cards in a pack of well-shuffled 52 playing cards.
n(A) = 4

Hence, P(A) = $\frac{n(A)}{n(S)} = \frac{4}{52} = \frac{1}{13}$

ii. Let B be the event of getting is a spade card.
There are 13 ace cards in a pack of well-shuffled 52 playing cards.
n(A) = 13

Hence, P(A) = $\frac{n(A)}{n(S)} = \frac{13}{52} = \frac{1}{4}$

22. According to the question,
n(S) = 200
There are 135 students like Kabaddi.
There are 200 – 135 = 65 students who do not like Kabaddi.
Let a be the event that the student selected do not like Kabaddi.

n(A) = 65$\Longrightarrow$ P(A) = $\frac{n(A)}{n(S)} = \frac{65}{200} = \frac{13}{40}$

OR

Let S be the sample space.
S = {HH, HT, TH, TT} $\Longrightarrow$ n(S) = 4

i. Let A be the event of getting at least one head.

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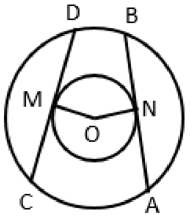
$A = \{HH, HT, TH\} \Longrightarrow n(A) = 3 \Longrightarrow P(A) = \frac{n(A)}{n(S)} = \frac{3}{4}$

ii. Let B be the event of getting no head.

$B = \{TT\} \Longrightarrow n(B) = 1 \Longrightarrow P(B) = \frac{n(B)}{n(S)} = \frac{1}{4}$

23.



Let AB and CD be two chords of the circle which touch the inner circle at N and M resepctively.
We have to prove that AB = CD.
Since AB and CD are tangents to the smaller circle.
OM = ON = radius of the smaller circle
Then, AB and CD are two chords of the larger circle such that they are equidstant from the centre.
Hence, AB = CD.

24. $\frac{\sin^2\theta}{\cos\theta} + \cos\theta$

$= \frac{\sin^2\theta + \cos^2\theta}{\cos\theta} = \frac{1}{\cos\theta} = \sec\theta \qquad \because \sin^2\theta + \cos^2\theta = 1$

$\Rightarrow \frac{\sin^2\theta}{\cos\theta} + \cos\theta = \sec\theta$

OR

$\cos^2\theta\,(1 + \tan^2\theta)$

$= \cos^2\theta \times \sec^2\theta = \cos^2\theta \times \frac{1}{\cos^2\theta} = 1 \quad .... \because \sec\theta = \frac{1}{\cos\theta}$

$= 1$

25. Area of a circle = circumference of a circle
$\Rightarrow \pi r^2 = 2\pi r$
$\Rightarrow r^2 = 2r$
$\Rightarrow r^2 - 2r = 0$
$\Rightarrow r(r - 2) = 0$
Since, $r \neq 0$ hence $r = 2$ cm.
Hence, the diameter is $2r = 2(2) = 4$ cm.

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26.

i. The cubic polynomials are $x^3 + 1$, $x^3 + x$, $x^3 - x^2$.

ii.

$$\begin{array}{r|l} & x + 6 \\ \hline x - 1 & x^2 + 5x + 3 \\ & x^2 - x \\ & - \quad + \\ \hline & \quad 6x + 3 \\ & \quad 6x - 6 \\ & \quad - \quad + \\ \hline & \qquad 9 \end{array}$$

Section IV

27. $f(x) = x^2 - 5x + k$

$\Rightarrow a = 1, b = -5$ and $c = k$

Sum of zeros = $\alpha + \beta = \frac{-b}{a} = 5$ ...(i)

Product of zero = $\alpha\beta = \frac{c}{a} = k$ ...(ii)

Also, $\alpha - \beta = 1$ ...(iii)

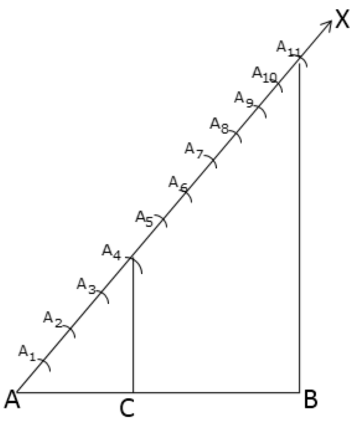
We know that

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

$\Rightarrow 5^2 - 1^2 = 4k$

$\Rightarrow 24 = 4k \Rightarrow k = 6$

28.



Steps of construction:

Step 1: Draw a line segment AB = 6.5 cm

Step 2: Draw a ray AX making an acute angle ∠BAX

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Step 3: Along AX, mark (4 + 7) = 11 points

$A_1, A_2, A_3, A_4, A_5, A_6, A_7, A_8, A_9, A_{10}, A_{11}$ such that

$AA_1 = A_1A_2 = \dots$

Step 4: Join A_{11} B

Step 5: Through A_4, draw a line parallel to A_{11} B meeting AB at C

∴ C is the point on AB, which divides AB in the ratio 4:7

On measuring, AC = 2.4 cm and CB = 4.1 cm

29. According to the question,

Surface area of sphere = surface area cube

⇒ $4\pi r^2 = 6a^2$ where r be the radius of a sphere and a be the length of a cube.

$\Rightarrow \frac{r^2}{a^2} = \frac{6}{4\pi} \Rightarrow a^2 = \frac{4}{6}\pi r^2$ ...(i) $\Rightarrow a = 2r\sqrt{\frac{\pi}{6}}$ ...(ii)

From (i) and (ii),

$$\frac{\text{volume of sphere}}{\text{Volume of cube}} = \frac{\frac{4}{3}\pi r^3}{a^3} = \frac{4}{3} \times \frac{\pi r^3}{a^2 \times a} = \frac{4}{3} \times \frac{\pi r^3}{\frac{4}{6}\pi r^2 \times 2r\sqrt{\frac{\pi}{6}}} = \frac{1}{\sqrt{\frac{\pi}{6}}}$$

OR

The radii of the circular top and bottom are 20 cm and 15 cm respectively.

r_1 = 20 cm and r_2 = 15 cm and h = 21 cm

Capacity of the tub = $\frac{1}{3}\pi h\left(r_1^2 + r_2^2 + r_1 r_2\right)$

$= \frac{1}{3} \times \frac{22}{7} \times 21\left(20^2 + 15^2 + 20 \times 15\right)$

= 22 × 925 = 20350 cm^3 = 20.35 litres ∵ 1 litre = 1000 cm^3

The capacity of the tub is 20.35 litres.

30. $\sin\theta = \frac{11}{61}$

We know that $\sin^2\theta + \cos^2\theta = 1$

$$\Rightarrow \cos\theta = \sqrt{1 - \sin^2\theta} = = \sqrt{1 - \left(\frac{11}{61}\right)^2} = \sqrt{1 - \frac{121}{3721}} = \sqrt{\frac{3600}{3721}} = \frac{60}{61}$$

OR

$\tan\theta + \frac{1}{\tan\theta} = 2$

$\Rightarrow \left(\tan\theta + \frac{1}{\tan\theta}\right)^2 = 4$

$\Rightarrow \tan^2\theta + 2\tan\theta \times \frac{1}{\tan\theta} + \frac{1}{\tan^2\theta} = 4$

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$$\Rightarrow \tan^2\theta + 2 + \frac{1}{\tan^2\theta} = 4$$

$$\Rightarrow \tan^2\theta + \frac{1}{\tan^2\theta} = 2$$

31. Prime Factorisation of 4620

= 2 × 2310

= 2 × 2 × 1155

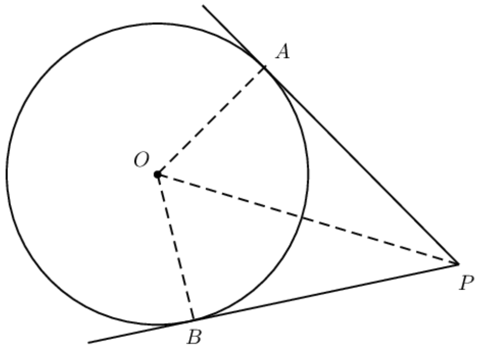
= 2 × 2 × 5 × 231

= 2 × 2 × 5 × 3 × 77

= 2 × 2 × 5 × 3 × 7 × 11

= 2^2 × 5 × 3 × 7 × 11

32.



Here, PA and PB are tangents to the circle with centre O,

and AO and OB are the radii of the Circle.

$\therefore$ PA $\perp$ AO and PB $\perp$ BO.....tangent $\perp$ to radius

In ΔOPA and ΔOPB,

$\angle OAP = \angle OBP$ .....each 90° (radius and tangent are $\perp$ at their poit of contact)

OA = OB .....(radii of the same circle)

OP = OP .....(common)

$\Delta OPA \cong \Delta OPB$........(by RHS Theorem)

$\therefore$ PA = PB......(CPCT)

Hence Proved.

33. 6x + 3y = 7...(i)

3x + 9y = 11...(ii)

Multiplying by 3 to (i)

18x + 9y = 21 ...(iii)

Subtracting (ii) from (iii) we get 15x = 10

x = 2/3

x = 2/3 Put it in (i) we get y = 1

Hence, x = 2/3 and y = 1.

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Section V

34.

X	f	fx
3	6	18
5	8	40
7	15	105
9	p	9p
11	8	88
13	4	52
	$\sum f = 41 + p$	$\sum fx = 303 + 9p$

$\sum f = 41 + p,\ \sum fx = 303 + 9p$

$$\text{Mean} = \frac{\sum fx}{\sum f} \Rightarrow 7.5 = \frac{303 + 9p}{41 + p}$$

$\Rightarrow\ 7.5(41 + p) = 303 + 9p$

$\Rightarrow\ 307.5 + 7.5p = 303 + 9p$

$\Rightarrow\ 4.5 = 1.5p \Rightarrow\ p = 3$

35. Let a be the first term and d be the common difference of the given AP.
Let the AP be $a_1, a_2, a_3 \dots a_n, \dots$
According to the question,
$a_7 = -1$ and $a_{16} = 17$
$a + (7 - 1)d = -1$ and $a + (16 - 1)d = 17$
$a + 6d = -1$ and $a + 15d = 17$
Solving these equations simultaneously, we get
$d = 2$ and $a = -13$
Hence, the general term $= a_n = a + (n - 1)d = -13 + (n - 1)2 = 2n - 15$

OR

In an AP, the first term is a and the common difference is d.

$S_1 = \frac{n}{2}\left[2a + (n - 1)d\right]$ ... (i)

$S_2 = \frac{2n}{2}\left[2a + (2n - 1)d\right]$ ... (ii)

$S_3 = \frac{3n}{2}\left[2a + (3n - 1)d\right]$ ... (iii)

Subtracting (i) from (ii), we get

$S_2 - S_1 = \frac{2n}{2}\left[2a + (n - 1)d\right] - \frac{n}{2}\left[2a + (n - 1)d\right] = \frac{n}{2}\left[2a + (3n - 1)d\right]$

$\Longrightarrow 3(S_2 - S_1) = \frac{3n}{2}\left[2a + (3n - 1)d\right] = S_3$ ....from (iii)

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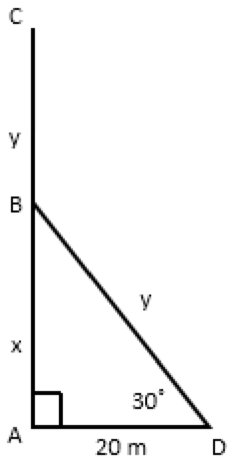
36.



Let AC be the height of the tree before it was broken.
BC is the broken part.
The distance of a point from the bottom of the tree is 20 m.
AC = x + y, BC = BD = y, AB = x and AD = 20 m
Angle of elevation = 30°
In ΔABD,

$$\tan 30^\circ = \frac{x}{20} \Rightarrow \frac{1}{\sqrt{3}} = \frac{x}{20} \Rightarrow x = \frac{20}{\sqrt{3}}$$

$$\sin 30^\circ = \frac{x}{y} \Rightarrow \frac{1}{2} = \frac{20}{\sqrt{3}y} \Rightarrow y = \frac{40}{\sqrt{3}}$$

$$\Rightarrow x + y = \frac{20}{\sqrt{3}} + \frac{40}{\sqrt{3}} = \frac{60}{\sqrt{3}} = \frac{60\sqrt{3}}{3} = 20\sqrt{3} = 20 \times 1.732 = 34.64 \text{ m}$$

Height of the tree before it was broken = 34.64 m

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