Odisha board Class 10 Maths Sample Paper

Class: X

Subject: Mathematics

PART-I

Total: 50 Marks

GENERAL INSTRUCTIONS:

1. 50 multiple choice questions (MCQ) are given in part (A). All the questions are compulsory. Each question carries 1 mark.

2. For each question select the correct alternative from four given alternatives to answer the question and darken the circle O as ● by ball pen (Blue / Black) against the alphabet corresponding to that alternative in the given OMR sheet

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1. Find the value of $6x + 2y$ by solving the given simultaneous equations:

$5x + 7y = 9$

$7x + 5y = 6$

a) -2

b) 2

c) $\frac{19}{4}$

d) 4

2. From the given simultaneous equations $3x + 5y - 9 = 0$ and $6x + 9y = 12$ find the solution set of the given equations:

a) $\{(-7,6)\}$

b) Empty set

c) Infinite set

d) $\{(6,-7)\}$

3. Meher is 25 years older than her son. If after five years' her age will be twice that of her son, then find their present ages.

a) 45 years , 20 years

b) 35 years , 10 years

c) 50 years , 18 years

d) 25 years , 10 years

4. Find the solution set of the in equation $6x - 4 \leq 16, if\ x \in \{-3,-2,-1,0,1,2,3,4\}$.

a) $\{-3,-2,-1,1,2,3\}$

b) $\{-3,-2,-1,1\}$

c) $\{-3,-2,-1,0,1,2,3\}$

d) $\{0,1,2,3,4,5\}$

5. If $x \in R$, then the solution set of $18 \leq -6(2x-4) < 36$ is

a) $\left\{x : x \in R, -1 < x \leq \frac{1}{2}\right\}$

b) $\left\{x : x \in R, 0 < x < \frac{1}{2}\right\}$

c) $\left\{x : x \in R, -1 < x < \frac{1}{2}\right\}$

d) $\left\{-1, \frac{1}{2}\right\}$

6. If $\frac{1}{3}$ is a root of the quadratic equation $a^2 + 3pa - \frac{82}{9} = 0$, then the value of p is

a) 9

b) 7

c) 83

d) 81

7. The quadratic equation $4x^2 - 2\sqrt{5}x + 2 = 0$ has

a) Two distinct real roots

b) Two equal real roots

c) No real roots

d) More than two real roots

8. Find the value of $\frac{\alpha\beta}{\alpha+\beta}$ if the quadratic equation $5x^2 - 2x - 4 = 0$ has the roots $\alpha\ and\ \beta$.

a) -4

b) 5

c) -2

d) 2

9. Find the value(s) of k for which the quadratic equation $6x^2 + kx + 9 = 0$ has real and equal roots:

a) 36

b) 6

c) $-6\sqrt{6}$

d) $\pm 6\sqrt{6}$

10. If given $k^2 + 4k + 8, 2k^2 + 3k + 6,\ 3k^2 + 4k + 4$, find the value of k if these three are in A.P.

a) 2

b) 0

c) 3

d) 5

11. Find the 20th term of the list of numbers $9, 5, -3, -7, -11, \ldots \ldots$.

a) −75

b) −79

c) −67

d) -83

12. Find the sum of the A.P. $-2, -7, -12, -17, \ldots \ldots\ upto\ the\ term -77$.

a) 623

b) −632

c) 632

d) −623

13. If the given equation $-4 + (-1) + 2 + \cdots . + x = 437$ forms an A.P. then find the value of nth term and x.

a) 19, 50

b) 20, 50

c) 17, 20

d) 27, 85

14. Find the number of total outcomes if a die is thrown thrice.

a) 36

b) 18

c) 6

d) 216

15. One letter is selected at random out of the consonants of the English alphabets. The probability of selecting 'g' is

a) $\frac{1}{26}$

b) $\frac{1}{21}$

c) $\frac{21}{26}$

d) $\frac{1}{5}$

16. From a well-shuffled deck of 52 cards, a card is selected at random. The probability of it being a black face card is

a) $\frac{3}{39}$

b) $\frac{3}{26}$

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

d) $\frac{3}{13}$

17. Riya has a die whose six faces show the letters as given:

D	C	F	D	G	H

If she throws the die once then the probability of getting D is

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

b) $\frac{1}{6}$

c) $\frac{1}{5}$

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

18. The labours working in a factory has a mean height of 152cm. If there were 8 labours initially then if two more labours of height 143cm and 156cm join the factory. What is the new mean height?

a) 151.5cm

b) 150.5cm

c) 156cm

d) 152.5cm

19. Given mean = 4 – median and mode = 32. From this determine the median.

a) 6

b) 9

c) 8

d) 4.8

20. Find the class corresponding to the class mark 46, if the class mark of a continuous frequency distribution is $22, 30, 38, 46, 54, 62$.

a) 41.5 – 49.5

b) 42 – 50

c) 41 – 49

d) 41 – 50

21. Find the inter quartile range if in a class test, the marks scored by 11 students are $13,17,20,5,3,19,7,6,11,15,17$.

a) 11

b) 5.5

c) 13

d) 6

22. Find the equation of the median through R of the triangle STR, if $S(3,4), T(7,-2)$ and $R(-2,-1)$ are the vertices of the given triangle STR.

a) $2x - 7y = 3$

b) $2x + 7y = 3$

c) $7x + 2y = 3$

d) $2x + 7y = 9$

23. The coordinates of points P and Q are $(-4,3)$ and $(2,-1)$ respectively. Hence find the coordinates of the points of trisection of the line segment $\overline{PQ}$.

a) $(0,1)$

b) $(1,0)$

c) $\left(0,\frac{1}{3}\right)$

d) $\left(\frac{1}{3},0\right)$

24. If M, N and P are the points $(1,3), (4,b)$ and $(a,1)$ respectively. Then find the values of a and b if M, N and P forms a triangle MNP with a centroid $G(4,3)$.

a) $a = 5, b = 7$

b) $a = 7, b = 5$

c) $a = 8, b = 4$

d) $a = 4, b = 8$

25. Find the area of the square with vertices $(0,-2), (3,1), (-3,1)$ and $(0,4)$.

a) 18 square units

b) 15 square units

c) $\sqrt{18}$ square units

d) 13 square units

26. By section formula determine that the points of a quadrilateral $(4,-2), (2,-6), (-4,-2)$ and $(10,-6)$ is a

a) Rhombus

b) Square

c) Trapezium

d) Parallelogram

27. In the triangle $PQR, \overline{QM}$ bisects $\angle Q$ and is $\perp\ PR$. If the sides of the triangle are such as $PQ = 2x, QR = 3y + 8, PM = x \ and \ RM = 2y$. then find the values of x and y respectively.

a) 16,8

b) 19,8

c) 8,17

d) 20,5

28. The areas of two triangles $\triangle PQR \ and \ \triangle LMN$ are $81cm^2 \ and \ 49cm^2$ respectively. If these two are similar triangles and an altitude of the smaller triangle is 3.5cm, then the altitude of the bigger triangle will be

a) 9cm

b) 6cm

c) 4.5cm

d) 7cm

29. Find the area of the quadrilateral ABCD, if given from a point which is at a distance of 13cm from the centre C of a circle of radius 5cm, the pair of tangents AB and AD to the circle are drawn.

a) $60cm^2$

b) $30cm^2$

c) $32.5cm^2$

d) $65cm^2$

30. Given a circle with centre O and the tangents PM and PN from an exterior point P to a circle are inclined to each other at an angle of $80°$, then $\angle POM$ is equal to

a) 100°

b) 70°

c) 60°

d) 50°

31. If radii of two concentric circles are 4cm and 5cm, then the length of each chord of one circle which is tangent to the other is

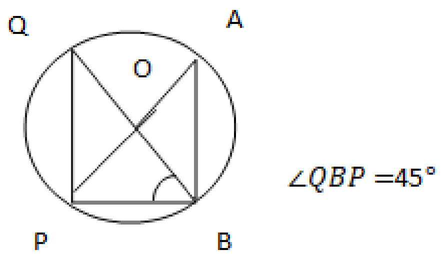
a) 1cm

b) 9cm

c) 6cm

d) 3cm

32. From the given figure, O is the centre of the circle and $\angle SNM = 45°$. Find $\angle STN$



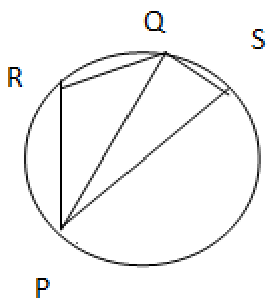
a) 85°

b) 45°

c) 55°

d) 90°

33. In the given figure, R and Q are points on the circumference of the circle with SP as the diameter and $\angle SPQ = 70°$ and $\angle QSR = 30°, then\ \angle SQR = ?$



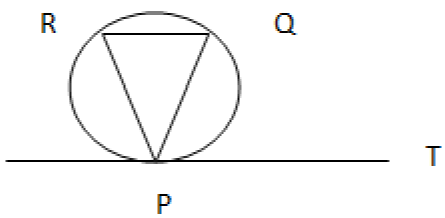
a) 40°

b) 50°

c) 20°

d) 80°

34. In the figure given, PT is a tangent to the circle at A. $\angle RPQ = 60°$ and $\angle TPQ = 55°, then\ \angle PQR = ?$



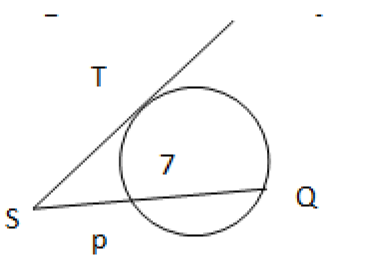
a) 10°

b) 50°

c) 65°

d) 45°

35. Find the value of SP if given in the figure where, SPQ is a secant and ST is tangent to the given circle.



a) 8cm

b) 9cm

c) 10cm

d) 6.5cm

36. When any point lies inside the circle the how many tangents can be drawn to the circle passing through the point which lies inside the circle.

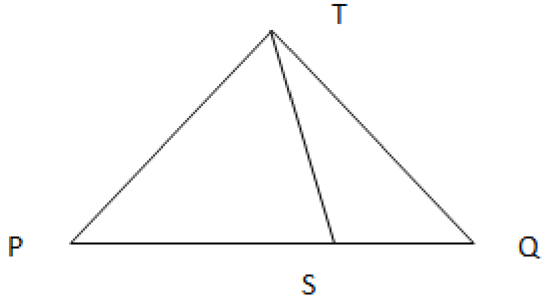
a) No tangent can be drawn

b) Only one tangent

c) Infinite

d) Two tangent

37. From the given figure, $\angle PRQ = \angle RSP$. If PR = 8cm and PS = 3cm, SQ = ?



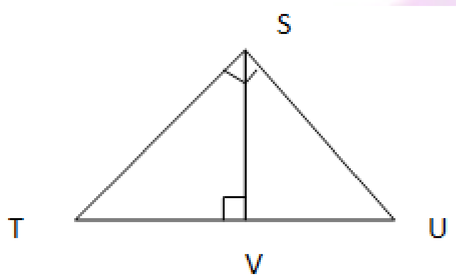
a) $19\frac{1}{3}cm$

b) $15\frac{1}{3}cm$

c) $14\frac{1}{3}cm$

d) $18\frac{1}{3}cm$

38. $\Delta STU$is a right angled triangle at S and SV is perpendicular to TU . If TU = 13cm and SU = 5cm, find the ratio of the areas of ΔSTU and ΔSUV.



a) $\frac{169}{25}$

b) $\frac{144}{25}$

c) $\frac{25}{169}$

d) $\frac{25}{144}$

39. Find the total surface area of the cylinder if given that the radius of the cylinder is $\frac{r}{4}$ and the height is h.

a) $\frac{1}{2}\pi r(r + 2h)$

b) $\frac{1}{2}r(r+2h)$

c) r(r + 2h)

d) $\pi r(r+2h)$

40. A bowl made of glass is of the shape of the hemisphere, 0.25 cm thick. The inner radius of the bowl is 5cm. Find the total outer surface area of the bowl.

a) $295.875cm^2$

b) $295.857cm^2$

c) $259.875cm^2$

d) $250.875cm^2$

41. A quadrant of a circle is made by a copper wire, if the perimeter of the quadrant of a circle is 12.5cm. How much is its area?

a) 8cm

b) $9.625cm^2$

c) $8cm^2$

d) 9.625cm

42. If cone whose height is 12cm and the diameter of the base of a cone 10cm then its curved surface area will be

a) $85\pi cm^2$

b) $75\pi cm^2$

c) 65 πcm^2

d) 55 πcm^2

43. Find the area of the equilateral triangle if the perimeter of the equilateral triangle is $6\sqrt{3}cm$.

a) $9cm^2$

b) $3\sqrt{3}cm^2$

c) $6\sqrt{3}cm^2$

d) $9\sqrt{3}cm^2$

44. If the surface area of the sphere is $256\pi cm^2$, then the diameter of the sphere is

a) 4cm

b) 8cm

c) 6cm

d) 16cm

45. If two cylinder and their height are in the ratio 5:3 and the radii are in the ratio 2:3.How much is the ratio of their volumes?

a) 20:27

b) 20:23

c) 17:27

d) 20:37

46. Given $\tan\theta = \frac{1}{\sqrt{5}}$, find $\frac{\operatorname{cosec}^2\theta - \sec^{-1}\theta}{\operatorname{cosec}^2\theta + \sec^{-1}\theta}$

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

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

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

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

47. By using trigonometrical identities and not using the tables, evaluate:

$\csc^2 57° - \tan^2 33° + \cos 44° \csc 46° - \sqrt{2}\cos 45° - \tan^2 60°$

a) −2

b) 2

c) 4

d) 3

48. Find the value of: $\frac{\sin^2 63° + \sin^2 27°}{\cos^{-1} 17° \cos^{-1} 73}$

a) 1

b) 0

c) 3

d) 5

49. Evaluate: $\sin 25° \cos 65° + \cos 25° \sin 65°$

a) 0

b) 5

c) 1

d) 9

50. A cat is climbing a 20m long rope, which is tightly stretched and tied from the top of a vertical pole to the ground. Find the height of the pole, if the angle made by the rope with the ground level is $30°$.

a) 10m

b) 20m

c) 15m

d) 12m

PART -II

Total Marks - 50

GENERAL INSTRUCTIONS:

1. There are Five Questions in this part of the question paper.

2. All the questions are compulsory and all are having internal options.

3. Draw figures where-ever required.

4. The numbers at right hand side represent the marks of the question.

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1. (a) Solve the system of linear equations:

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

OR

Solve the equation $2x^2 - 3x + 1 = 0$ by the method of completing the squares.

(b) If the sum of the first 16 terms of an A.P. is 432. If its first term is 12, then find the 25th term.

OR

Two dice are thrown simultaneously. Find the probability that the sum of the number appearing on the top of two dice is less than or equal to 8.

2. (a) Mother is 15 years older than her daughter. If after five years' her age will be twice that of her son, then find their present ages.

OR

Find the value of m so that the equation $(m+2)x^2-(m+3)x+1=0$ has real and equal roots

(b) Calculate the sum of the given A.P. $5+\frac{15}{2}+\ 10+\cdots+80.$

OR

Find the mode and the median from the data given below:

x	**10**	**15**	**20**	**25**	**30**	**35**
f	6	8	4	5	7	3

(c) Show that the points A, B and C are collinear. If they have vertices (4,2), (7,5) and (9,7) respectively.

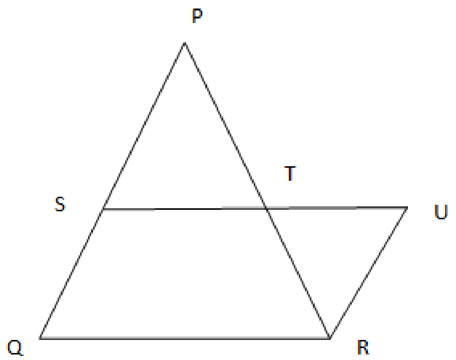
OR

Find the mean of the following

CLASS INTERVALS	**80 – 90**	**90 – 100**	**100 – 110**	**110 – 120**	**120 – 130**
FREQUENCY	8	12	15	10	5

3. (a) The straight line which is not a diameter, is perpendicular to the chord, which will be drawn from the center of a circle to bisect a chord. Prove it

OR



In the figure given above, PQR and RTU are two triangles where PQ is parallel to RU and PT : PR = 5:8. Prove that $\Delta PST \sim \Delta RTU$

(b) Construct the circumscribed circle of a given triangle with sides PQ = 4.5cm, QR = 4cm and RP = 3.5cm

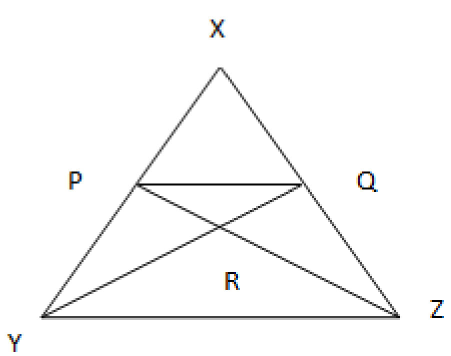
OR

Construct a circle which is inscribe in the given triangle with sides as QR = 6.4cm, PR = 5.8cm and $\angle Q = 60°$.

4. (a) Prove that the tangent at any point on a circle and radius of the circle through the point where tangent touch the circle are perpendicular to each other.

OR

In the figure given below, $PQ \parallel YZ$ and $XP : PY = 5:4$. Hence find $PQ : YZ$.



(b) A kite is flying at a height of 60m from the ground, attached to a string inclined at 45° to the horizontal. Find the length of the string.

OR

Prove that

$$\frac{\cos A}{1-\tan A}+\frac{\sin A}{1-\cot A}= \sin A+\cos A.$$

5. (a) There are two concentric circles. If the area of the circular ring enclosed between two concentric

OR

A cone of height 12cm has base diameter 10cm. Find the total surface area of the cone and the volume of the cone.

(b) The total surface area of a right circular cone of slant height 27cm is $90\pi cm^2$. calculate its radius.

OR

The surface area of a sphere is $616cm^2$. It recasted into smaller spheres of the diameter $\frac{7}{8}$cm. Calculate the number of spheres that is made.

Answers & Explanations

1. The given equations are

$5x + 7y = 9 \quad \rightarrow \quad (1) \qquad and \quad 7x + 5y = 6 \quad \rightarrow \quad (2)$

Multiplying equation (1) by 7 and (2) by 5, we get

$35x + 49y = 63$

$35x + 25y = 30$

Subtracting equation (2) from (1), we get

$24\,y = 33$

$y = \frac{11}{8}$

Putting the value of y in (2), we get

$5x + \frac{77}{8} = 9$

$x = -\frac{1}{8}$

Hence

$6x + 2y = \frac{-6}{8}+\frac{22}{8} = 2$

Option b.

2. The equations are

$3x + 5y - 9 = 0 \quad \rightarrow (1) \quad and \quad 6x + 9y = 12 \quad \rightarrow (2)$

Multiplying (1) by 2, we get

$6x + 5y = 18 \quad \rightarrow (3)$

Subtracting equation (2) from (3), we get

$y = 6$

Putting the value of y in equation (1) we get

$3x + 30 = 9$

$x = -7$

Option a.

3. Let the son's age be x

Meher's age = $x + 25$

After 5 years their age will be

Son's = $x + 5$

Meher's = $x + 25 + 5 = x + 30$

According to the given

$x + 30 = 2(x + 5)$

$x = 20$ years

son's age = 20 years

Meher's age = $x + 25 = 45$ years

Option a.

4. Given inequation $6x - 4 \leq 16, if\ x \in \{-3, -2, -1, 0, 1, 2, 3, 4\}$

$For\ x = -3$

$6x - 4 = -22 \leq 16$

$For\ x = -2$

$6x - 4 = -16 \leq 16$

$For\ x = -1$

$6x - 4 = -10 \leq 16$

$For\ x = 0$

$6x - 4 = -4 \leq 16$

$For\ x = 1$

$6x - 4 = 2 \leq 16$

$For\ x = 3$

$6x - 4 = 14 \leq 16$

$For\ x = 4$

$6x - 4 = 20 > 16$

Therefore the solution set is $\{-3, -2, -1, 0, 1, 2, 3\}$.

Option c.

5. From the given $18 \leq -6(2x-4) < 36$

$-6(2x-4) < 36$

$x > -1$

and

$18 \leq -6(2x-4)$

$x \leq \frac{1}{2}$

Option a.

6. Given

$a^2 + 3pa - \frac{82}{9} = 0$ where $\frac{1}{3}$ is a root of the equation's

$\Rightarrow 9a^2 + 27pa - 82 = 0$

$\Rightarrow 9 \times \frac{1}{9} + 27p \times \frac{1}{3} - 82 = 0$

$\Rightarrow p = 9$

Option a.

7. $4x^2 - 2\sqrt{5}x + 2 = 0$

Comparing it with $ax^2 + bx + c = 0$

$\Rightarrow a = 4, b = -2\sqrt{5}, c = 2$

∴Discriminant = $b^2 - 4ac$

$= (-2\sqrt{5})^2 - 4 \times 4 \times 2$

$= 20 - 32$

$= -12 < 0$

Therefore, the equation has no real roots.

Option c.

8. $5x^2 - 2x - 4 = 0$

$\Rightarrow x^2 - \frac{2}{5}x - \frac{4}{5} = 0$

$comparing\ it\ with\ x^2 + \frac{b}{a}x + \frac{c}{a} = 0$, we get

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

$\frac{c}{a} = -\frac{4}{5}$

We know that

$\alpha+\beta=-\frac{b}{a}=\frac{2}{5}$
$\alpha\beta=\frac{c}{a}=-\frac{4}{5}$
The value of,
$\frac{\alpha\beta}{\alpha+\beta}=\frac{-\frac{4}{5}}{\frac{2}{5}}=-2$
Option c.

9. $6x^2+kx+9=0$

Comparing it with $ax^2+bx+c=0$
$\Rightarrow a=6, b=k, c=9$
∴Discriminant = b^2-4ac
$=k^2-4\times 6\times 9$
For the equation to have equal and real roots
$k^2-216=0$
$\therefore k=\pm 6\sqrt{6}$
Option d.

10. Given $k^2+4k+8, 2k^2+3k+6,\ 3k^2+4k+4$ are in A.P.

$(2k^2+3k+6)-(k^2+4k+8)=(3k^2+4k+4)-(2k^2+3k+6)$
$\Rightarrow k^2-k-2=k^2+k-2$
$\Rightarrow -k=k\Rightarrow 2k=0\Rightarrow k=0$
Option b.

11. Given the list of numbers 9, 5, – 3, – 7, – 11, … … . $are\ in\ A.P.$

Therefore the 20th term of the A.P. will be
$a_n=a+(n-1)d$ where $a=9, n=20, d=-4$
$a_{20}=9+(20-1)(-4)=-67$
Option c.

12. The sum of the A.P. –2, –7,–12,–17,….. upto the term –77

$a=-2, d=-5, l=-77$
Let the nth term be –77
$a_n=a+(n-1)d$
$-77=-2+(n-1)(-5)$
$\Rightarrow n=16$
$\therefore S_n=\frac{n}{2}(a+l)$
$=\frac{16}{2}(-2-77)$
$=-632$

Option b.

13. The given equation $-4 + (-1) + 2 + \cdots . + x = 437$ forms an A.P

Where $a = -4, d = 3, S_n = 437$
According to the given
$S_n = \frac{n}{2}(2a + (n-1)d) = 437$
$\Rightarrow \frac{n}{2}(2(-4) + (n-1)3) = 437$
$\Rightarrow 3n^2 - 11n - 874 = 0$
$\Rightarrow n = 19, -\frac{46}{3}$
But n cannot be negative
$\Rightarrow n = 19$
Hence nth term x is 19
$a_n = a + (n-1)d$
$a_{19} = -4 + (19-1)3$
$= 50$
Option a.

14. If a die is thrown thrice the total outcomes would be $= 6 \times 6 \times 6$

$$= 216$$

Option d.

15. The total sample space for selecting a letter out of the consonants of the English alphabets = 21

Event = selecting 'g'
Total favorable outcomes = 1
$P\ (selecting\ 'g') = \frac{total\ favourable\ outcomes}{sample\ space} = \frac{1}{21}$
Option b.

16. The total sample space for selecting a card from a well-shuffled pack of 52 cards = 52

Event = selecting a black face card
Total favorable outcomes = 6
$P\ (selecting\ a\ black\ face\ card) = \frac{total\ favourable\ outcomes}{sample\ space} = \frac{6}{52} = \frac{3}{26}$
Option b.

17. The total sample space of throwing the once and getting a random letter = 6

Event = getting D
Total favorable outcomes = 2

$P\ (getting\ D)\ = \frac{total\ favourable\ outcomes}{sample\ space} = \frac{2}{6} = \frac{1}{3}$
Option d.

18. Mean height of 8 labors = $\frac{sum\ of\ heights\ of\ 8\ labours}{8}$

$\Rightarrow 152cm = \frac{sum\ of\ heights\ of\ 8\ labours}{8}$
$\Rightarrow sum\ of\ heights\ of\ 8\ labours = 1216cm$
New sum of heights when 2 more join the group.
$\Rightarrow sum\ of\ heights\ of\ 8\ labours = 1216cm + 143cm + 156cm$
$= 1515cm$
Hence
New mean height $= \frac{sum\ of\ heights\ of\ 10\ labours}{10}$
$= \frac{1515}{10} = 151.5cm$
Option a.

19. Mode = 3 Median – 2 Mean

Mean = 4 – Median
Mode = 32
$\Rightarrow 32 = 3Median - 2(4 - \ Median)$
Median = 8
Option c.

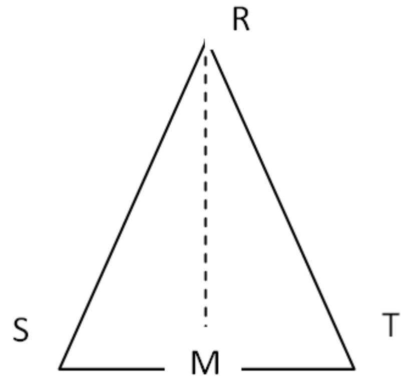
20. $Class\ mark\ = \frac{lower\ class + upper\ class}{2} = \frac{42+50}{2} = 46$

Therefore, the class is $42 - 50$
Option b.

21. Given variates in ascending order

3,5,6,7,11,13,15,17,17,19,20.
Lower quartile $(Q_1) = \frac{n+1}{4} th\ observation = 3rd\ observation = 6$
Upper quartile $(Q_3)\ = \frac{3(n+1)}{4} th\ observation\ = 9th\ observation\ = 17$
Inter quartile range = $(Q_3) - (Q_1) = 17 - 6 = 11$
Option a.

22. The vertices of the ΔSTR are given as S (3,4), T (7, –2) and R(–2,–1)



Coordinates of M $= \left(\frac{3+7}{2}, \frac{4-2}{2}\right) = (5,1)$

Slope of RM = $\frac{1-(-1)}{5-(-2)} = \frac{2}{7}$ $\left[m = \frac{y_2-y_1}{x_2-x_1}\right]$

The equation of the line RM median through R is

$y - (-1) = \frac{2}{7}(x - (-2))$

$\Rightarrow 7y + 7 = 2x + 4$

$\Rightarrow 2x - 7y - 3 = 0$

Option a.

23. Let MN be the points of the trisection of the line segment PQ

$PM = MN = NQ \Rightarrow 2PM = MQ$

$\Rightarrow \frac{PM}{MQ} = \frac{1}{2} \Rightarrow M\ divides\ PQ\ in\ the\ ratio\ 1:2.$

$\therefore Coordinates\ of\ M = \left(\frac{1\times2+2\times(-4)}{1+2}, \frac{1\times(-1)+2\times3}{1+2}\right) = \left(-2, \frac{5}{3}\right)$

$As\ MN = NQ$ Q will be the midpoint of MQ.

$\therefore Coordinates\ of\ Q = \left(\frac{-2+2}{2}, \frac{\frac{5}{3}+(-1)}{2}\right) = \left(0, \frac{1}{3}\right)$

Option c.

24. The centroid of the ΔMNP IS G (4,3)

Given

$\frac{1+4+a}{3} = 4 \quad and \quad \frac{3+b+1}{3} = 3$

$\Rightarrow a = 7 \quad and \quad b = 5$

Option b.

25. Let the vertices of the square be

$P\ (0,-2), Q\ (3,1), R\ (0,4), S\ (-3,1)$

Since all four sides of a square are equal

$PQ = QR = RS = PS$

$\therefore PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$= \sqrt{(3-0)^2 + (1-(-2))^2}$

$= \sqrt{18}$

Area of the square = $(side)^2 = (\sqrt{18})^2 = 18\ square\ units$

Option a.

26. Let the vertices be P(4,–2), Q(–4,–2), R(2,–6) and S (10,–6)

If a quadrilateral's diagonal bisects each other it is a parallelogram.

Hence, we need to find that the mid-points of PR and QS are equal as they will bisect at the common point.

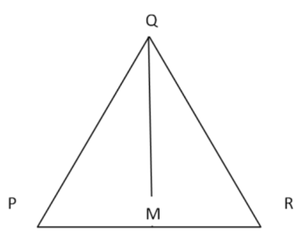
Mid-point of PS = $\left(\frac{10+(-4)}{2}, \frac{-6-2}{2}\right) = (3, -4)$

Mid-point of QS = $\left(\frac{2+4}{2}, \frac{-6-2}{2}\right) = (3, -4)$

Hence the mid-point of the diagonals is equal thus means that they bisect each other. Therefore, PQRS is a parallelogram.

Option d.

27.



In $\Delta PQM\ and\ \Delta QRM$

As QM bisects $\angle Q$, $\angle PQM = \angle RQM$

Given QM is ⊥ PR $\angle PMQ = \angle RMQ = 90°$

QM = QM (common)

$\therefore \Delta PQM \cong \Delta RQM$

$PM = MR = x = 2y$ → 1)

And PQ = RQ ⇒ $2x = 3y + 8$ → 2)

Putting the value of x in equation (2)

$4y = 3y + 8$

$\Rightarrow y = 8$

$\therefore x = 16$

Option a.

28. Let the altitude of the bigger triangle be x.

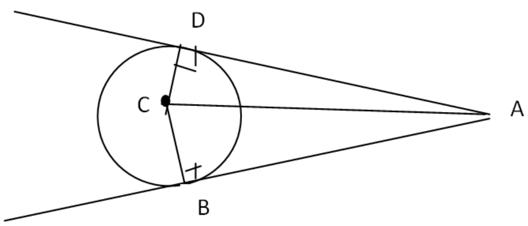
Given $\triangle PQR$ and $\triangle LMN$ are similar triangles. By theorem

$\frac{x^2}{3.5^2} = \frac{81}{49}$

$\Rightarrow x^2 = \frac{81}{49} \times 3.5^2 \Rightarrow x = \frac{9}{7} \times 3.5 = 4.5$

Option c.

29.



Given radius of the circle is CD = CB = 5cm

CA = 13 cm

By Pythagoras theorem

$AD^2 = AC^2 + CD^2$

$AD^2 = 13^2 + 5^2$

$AD = 12cm$

Similarly, AB = 12cm

Therefore, the area of the quadrilateral is $= 12 \times 5 = 60cm^2$

Option a.

30. Given the tangents PM and PN are inclined to each other at an angle of 80° which means that $\angle MPN = 80°$

We know that the tangents are equally inclined to the line joining the point and the centre of the circle.

Therefore $\angle MPO = \angle NPO = 40°$

In the ΔMPO

The tangent at any point of a circle and the radius through the point are perpendicular. $\angle OMP = 90°$

$\therefore \angle OMP + \angle OPM + \angle POM = 180°$ [Sum of angles in a triangle is 180°]

$\angle POM = 180° - 90° - 40° = 50°$

Option d.

31. The radii of two concentric circles are given 4cm and 5cm respectively

Then the length of each chord one circle which is tangent to the other is 6cm.

Option c.

32. As O is the center of the circle, MN is the diameter

Being an angle in a semicircle
$\angle MSN = 90°$
In ΔMSN,
$\therefore \angle SMN + \angle SNM + \angle MSN = 180°$ [Sum of angles in a triangle is 180°]
$\angle SMN = 180° - 90° - 45° = 55°$
$\angle SMN = \angle STN = 45°$ (Angles in the same segment of a circle are equal)
Option b.

33. Being an angle in a semicircle

$\angle SQP = 90°$
$\angle PSQ = 180° - 90° + 70° = 20°$ [Sum of angles in a triangle is 180°]
$\angle SRQ = 180° - 70° = 110°$
$\angle SQR = 180° - 110° - 30° = 40°$
Option a.

34. As PQ is a chord from the point of contact P and PT is the tangent to a circle at T,

$\angle PRQ = \angle TPQ$ $(angles\ in\ alternate\ segments\ are\ equal\ )$
Given
$\angle TPQ = 55°$
$\angle PQR = \angle TPQ = 55°$
In ΔPQR,
$\angle PQR + 55° + 60° = 180°$ [Sum of angles in a triangle is 180°]
$\angle PQR = 65°$
Option c.

35. We know that if a chord and a tangent intersect externally, then the product of the lengths of segments is equal to the square of the length of tangent.

$SP.SQ = ST^2 \Rightarrow x(x + 7) = 12^2$
Either $x = 9\ or\ x = -16$ but x cannot be negative
$\therefore SP = 9cm$
Option b.

36. When any point lies inside the circle the no tangents can be drawn to the circle passing through the point which lies inside the circle.

Option a.

37. In $\Delta PQR\ and\ \Delta PSR$

Same angle $\angle QPR = \angle SPR$

Given $\angle PRQ = \angle RSP$

$\therefore By\ A.A. rule\ of\ similarity\ \Delta PQR \sim \Delta PSR$

$\Rightarrow \frac{PR}{PS} = \frac{PQ}{PR} \Rightarrow \frac{8}{3} = \frac{PQ}{8}$

$\Rightarrow PQ = \frac{64}{3} cm$

$\therefore SQ = PQ - PS = \frac{64}{3} cm - 3cm = \frac{55}{3} cm = 18\frac{1}{3} cm$

Option d.

38. In $\Delta STU\ and\ \Delta VSU,$

As each angle is 90 $\angle TSU = \angle SVU$

Being same angle $\angle SUT = \angle SUV$

$\therefore By\ A.A. rule\ of\ similarity\ \Delta STU \sim \Delta VSU$

As the side TU of ΔSTU is the corresponding side SU of ΔVSU

$\therefore \frac{area\ of\ \Delta STU}{area\ of\ \Delta VSU} = \frac{TU^2}{SU^2} = \frac{13^2}{5^2} = 169: 25$

Option a.

39. The total surface area of the cylinder = $2\pi r(r + h)$

$$= 2\pi \frac{r}{2}\left(\frac{r}{2} + h\right)$$
$$= \frac{1}{2}\pi r(r + 2h)$$

Option a.

40. Radius of outer hemispherical bowl = inner radius + thickness = $5 + 0.25$

$$= \frac{21}{4} cm$$

Total outer surface area = $3\pi r^2 = \left(3 \times \frac{22}{7} \times \left(\frac{21}{4}\right)^2\right) cm^2 = 259.875 cm^2$

Option c.

41. Let r be the radius of the copper wire circle

Perimeter of a quadrant of the circle = $\frac{1}{4} \times 2\pi r + 2r$

Given

$\frac{1}{4} \times 2\pi r + 2r = 12.5$

$r = 3.5cm$

Therefore, area of the quadrant = $\frac{1}{4} \times \pi r^2 = \left(\frac{1}{4} \times \frac{22}{7} \times \left(\frac{7}{2}\right)^2\right) cm^2$

$$= 9.625 cm^2$$

Option b.

42. Slant height of the given cone will be $l = \sqrt{r^2 + h^2} = \sqrt{5^2 + 12^2} = 13$

Curved surface area of the given cone = $\pi r l = \pi \times 5 \times 13 = 65\pi cm^2$
Option c.

43. Given perimeter of an equilateral triangle = $6\sqrt{3}cm$.

Let the side be a
$Perimeter\ =\ 3a\ \Rightarrow 6\sqrt{3}cm = 3\text{a} \Rightarrow a = 2\sqrt{3}cm$
Area of the equilateral triangle = $\frac{\sqrt{3}}{4}a^2 = \frac{\sqrt{3}}{4}(2\sqrt{3})^2 = 3\sqrt{3}cm^2$
Option b.

44. Given the surface area of the sphere = $256\pi cm^2$

$4\pi r^2 = 256\pi cm^2 \Rightarrow r = 8cm$
Therefore, the diameter of the sphere = $2r\ =\ 2 \times 8\ =\ 16cm$
Option d.

45. Let the radii be 2r and 3r respectively of the given two cylinders

Let the height be 5h and 3h respectively
Volume = $\pi r^2 h$
Ratio of the volume of the given cylinders = $\frac{\pi(2r)^2 5h}{\pi(3r)^2 3h} = \frac{20}{27}$
Option a.

46. $\tan\theta = \frac{1}{\sqrt{5}} \Rightarrow \cot\theta = \sqrt{5}$

$\sec^2\theta = 1 + \tan^2\theta = 1 + \left(\frac{1}{\sqrt{5}}\right)^2 = \frac{6}{5}$
$\text{cosec}^2\theta = 1 + \cot^2\theta = 1 + \left(\sqrt{5}\right)^2 = 6$
$\therefore \frac{\text{cosec}^2\theta - \sec^2\theta}{\text{cosec}^2\theta + \sec^2\theta} = \frac{6-\frac{6}{5}}{6+\frac{6}{5}} = \frac{2}{3}$
Option b.

47. $\csc 57° = \csc(90° - 33°) = \sec 33°$

$\csc 46° = \csc(90° - 44°) = \sec 44°$
$\csc^2 57° - \tan^2 33° + \cos 44° \csc 46° - \sqrt{2}\cos 45° - \tan^2 60°$
$= \sec^2 33° - \tan^2 33° + \cos 44° \sec 44° - \sqrt{2} \times \frac{1}{\sqrt{2}} - \left(\sqrt{3}\right)^2$
$= 1 + 1 - 1 - 3 = -2$
Option a.

48. $\frac{\sin^2 63°+\sin^2 27°}{\cos^2 17°+\cos^2 73} = \frac{\cos^2 27°+\sin^2 27°}{\cos^2 17°+\sin^2 17°}$ $[\sin 63° = \sin(90° - 27°) = \cos 27°]$

$[\cos 73° = \cos(90° - 17°) = \sin 17°]$

$= 1$ $[\therefore \sin^2\theta + \cos^2\theta = 1]$

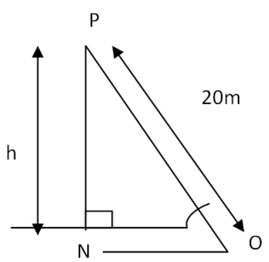
Option a.

49. $\sin 25° \cos 65° + \cos 25° \sin 65°$ $[\cos 65° = \cos(90° - 25°) = \sin 25°] =$
$sin\, 25° \sin 25° + \cos 25° \cos 25°$ $[\sin 65° = \sin(90° - 25°) = \cos 25°]$

$= sin^2\, 25° + \cos^2 25° = 1$ $[\therefore \sin^2\theta + \cos^2\theta = 1]$

Option c.

50.



Let PO be the vertical pole and PN be the rope which is tightly stretched and tied from the top of the pole to the ground which the cat climbs.

NP = 20m

Let h be the height of the vertical pole OP.

Given the angle of elevation $\angle PNO = 30°$

From right angled ΔPNO,

$\sin 30° = \frac{PO}{PN} \Rightarrow \frac{1}{2} = \frac{h}{20}$

$\Rightarrow h = 10m$

The length of the vertical pole which the cat climbs through the rope is = $10m$

Option a.

PART - II

1. (a)

$\frac{a}{2}+\frac{2b}{3}=-1 \quad \rightarrow (1)$ and $\quad a-\frac{b}{3}=3 \quad \rightarrow (2)$

Multiplying equation (2) on both the sides by 2, we get

$2a-\frac{2b}{3}=6 \quad \rightarrow (3)$

On adding equations (1) and (3), we get

$\frac{a}{2}+2a=5 \Rightarrow \frac{5}{2}a=5 \Rightarrow a=2$.

Substituting this value of a in equation (2), we get

$2-\frac{b}{3}=3 \Rightarrow -\frac{b}{3}=1 \Rightarrow b=-3$

$\therefore\ a\ =\ 2\ and\ b\ =-3$

OR

The given quadratic equation is $2x^2-\ 3x+1=0$

$\Rightarrow\ x^2-\frac{3}{2}x+\frac{1}{2}=0$ [Dividing throughout by 2]

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

Adding $(\frac{1}{2}\times\frac{3}{2})^2=\frac{9}{16}$ to both sides,

$\Rightarrow\ x^2-\frac{3}{2}x+\frac{9}{16}=\ -\frac{1}{2}+\frac{9}{16}$

$\Rightarrow\ (x-\frac{3}{2})^2=\frac{1}{16}$

$\therefore \left(x-\frac{3}{2}\right)=\pm\frac{1}{4}$

$\therefore x=1\ or\ \frac{1}{2}$

1. (b)

Here, $S_{16} = 432, n = 16 \; and \; a = 12$

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

$\Rightarrow 432 = \frac{16}{2}[2 \times 12 + (16-1) \times d]$

$\Rightarrow 432 = 192 + 120d$

$\Rightarrow d = 2$

$\therefore the \; 25th \; term = a + (25-1)d = 12 + 24 \; \times 2 = 60$

OR

The total number of outcomes, when 2 dice are thrown simultaneously = 36

Let E be the event "sum of two number appearing on top of the 2 dice is less than or equal to 8".

The outcomes in favour to the event $\bar{E} \; = \; (5,4), (4,5), (5,5), (6,4), (4,6), (6,5), (5,6) \; AND \; (6,6)$.

The number of outcomes for $\bar{E} = 8$

$\therefore P(\bar{E}) = \frac{outcomes \; in \; favour \; of \; the \; event}{total \; number \; of \; outcomes}$

$\therefore P(\bar{E}) = \frac{8}{36} = \frac{2}{9}$

$\therefore P(E) = \; 1 - P(\bar{E})$

$\therefore P(E) = \; 1 - \frac{2}{9} = \frac{7}{9}$

2. (a)

Let the daughter's age be x
Mother's age = $x \; + \; 15$
After 5 years their age will be
Daughter's = $x \; + \; 5$
Mother's = $x \; + \; 15 \; + 5 \; = \; x \; + \; 20$
According to the given
$x \; + \; 20 \; = \; 2(x \; + \; 5)$
$x \; = \;$ 10 years
Daughter's age = 10 years

Mother's age = $x + 15 = 25$ years

OR

According to the equation $(m+2)x^2 - (m+3)x + 1 = 0$
On comparing with the $ax^2 + bx + c = 0$, we get

$\Rightarrow a = m+2, b = m+3 \; and \; c = 1$

$\therefore Disciminant = b^2 - 4ac = 0$ [As they have real and equal roots]

$(m+3)^2 - 4(m+2) \times 1 = 0$

$\Rightarrow m^2 + 6m + 9 - 4m - 8 = 0$

$\Rightarrow m^2 + 2m + 1 = 0$

$\Rightarrow (m+1)(m+1) = 0$

$\Rightarrow m = 1$

2. (b)

The given A.P. with $a = 5 \; and \; d = \frac{15}{2} - 5 = \frac{5}{2}$.

Let the nth term be 80.

$\therefore a_n = a + (n-1)d$

$\Rightarrow 5 + (n-1) \times \frac{5}{2} = 80$

$\Rightarrow n = 31$

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

$\Rightarrow \frac{31}{2} [2 \times 5 + (31-1) \times \frac{5}{2}]$

$= \frac{31}{2} [10 + 75] = \frac{2635}{2}$.

OR

From the frequency distribution table,

x	f	xf
10	6	60
15	8	120
20	4	80
25	5	125
30	7	210
35	3	105
Total	33	700

Mode = Observation with the highest number of frequencies

In the table, 15 is the mode with 8 as highest number of frequencies.

$$Mean = \frac{\Sigma fx}{\Sigma f} = \frac{700}{33} = 21.21.$$

2. (c)

The given points are A(4,2), B(7,5) and C(9,7)

$$AB = \sqrt{(7-4)^2 + (5-2)^2} = \sqrt{9+9} = \sqrt{18} = 3\sqrt{2}$$
$$AC = \sqrt{(9-4)^2 + (7-2)^2} = \sqrt{25+25} = \sqrt{50} = 5\sqrt{2}$$
$$BC = \sqrt{(9-7)^2 + (7-5)^2} = \sqrt{4+4} = \sqrt{8} = 2\sqrt{2}$$
$$\therefore AB + BC = 3\sqrt{2} + 2\sqrt{2} = 5\sqrt{2} = AC$$

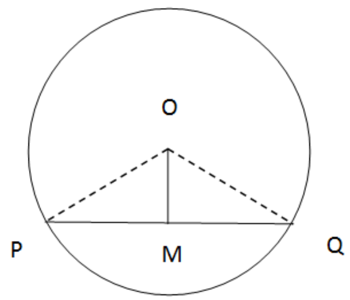
Hence the given points are collinear.

OR

CLASSES	CLASS MARK	FREQUENCY	$f_i x_i$
80 – 90	85	8	680
90 – 100	95	12	1140
100 – 110	105	15	1575
110 – 120	115	10	1150
120 – 130	125	5	625
Total		50	5170

$$\text{Mean} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{5170}{50} = 103.5$$

3. (a)



PQ is a chord of a circle with center O and that OC bisects PQ at C.

By drawing a circle and joining OP and OQ.

In ΔOPC and ΔOQC

As OP and OQ are the radii of the same circle

OP = OQ

C being the mid – point of PQ

PC = CQ

OC = OC (common)

$\therefore\ \Delta OPC\ \cong\ \Delta\, OQC$ (by S.S.S. axiom of congruency)

$\angle PCO = \angle OCQ$ ('c.p.c.t.')

$\angle PCO + \angle OCQ = 180°$ $(\because PCQ\ is\ a\ straight\ line)$

$\therefore \angle PCO = 90°$ $(\because \angle PCO = \angle OCQ)$

Hence proved that OC ⊥ PQ

OR

In the given diagram

In $\Delta PST\ and\ \Delta RUT$

Being vertically opposite angles

$\angle PTS = \angle RUT$

$\angle SPT = \angle URT$ $(\because PQ \parallel RU, alternate\ angles)$

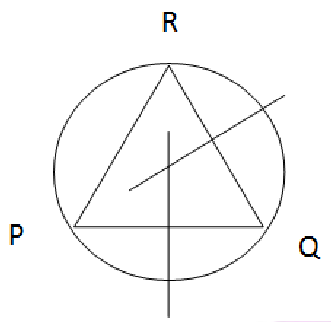
$\therefore$ By A.A. axiom of similarity

$\Delta PST \sim \Delta RUT$

Hence proved.

3. (b)

Construction of circumscribed circle with the given triangle.



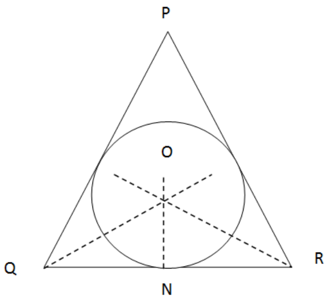
Steps for construction:

1. Construct the triangle PQR with the sides as 4.5cm, 4cm and 3.5cm respectively.
2. Draw the perpendicular bisector of line RQ and PQ. The point at with the bisectors meet is O.
3. Taking O as the center of the circle and OP as its radius, draw the circle.

The circle drawn through the points P,Q and R and is the required circumcircle of triangle PQR.

OR

Construction of inscribed circle of a given triangle.



Steps of construction

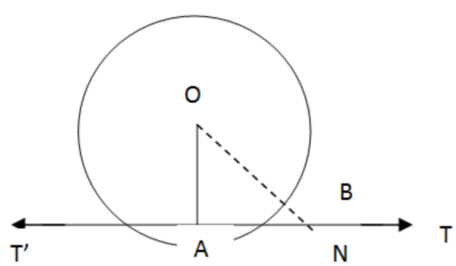
1. Draw the triangle PQR with the sides and angle provided.

2. Draw the angle bisector of $\angle Q$ and $\angle R$. The bisectors meet at the point O.

3. Draw ON perpendicular to the side QR from point O.

4. O is the center of the circle with radius ON. the circle touches all the sides of the triangle PQR.

4. (a)



T'TA is a tangent to the circle with center O, through the point of contа T A is the radius.

By drawing OA if it is not perpendicular to T'AT, ON⊥ $T'AT$, to meet the circle at B (since ever point of a tangent other than the point of contact lies outside the circle, ON > radius)

Being radii of the same circle

$OA = OB$

By drawing, $ON \perp T'AT \Rightarrow \angle ONA = 90°$

$\angle OAN < 90°$ (as in a right -angle triangle other two angles are acute)

$\therefore \angle ONA > \angle OAN$

$OA > ON$ (Side opposite greater angle is greater.)

$OB > ON$ $(\because OA = OB)$

But OB < ON (a part is less than the whole)

$\therefore$ Our supposition was wrong.

Hence proved that $OA \perp T'AT$

OR

Given $\frac{XP}{PY} = 5:4 \Rightarrow \frac{XP}{XP+PY} = \frac{5}{5+4} \Rightarrow \frac{XP}{XY} = \frac{5}{9}$

In ΔXPQ and ΔXYZ,

$\angle XPQ = \angle XYZ$ (PQ ∥ YZ, corresponding angles are equal)

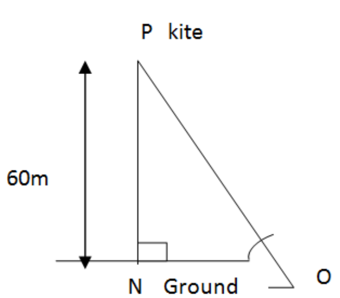
And $\angle X = \angle X$

$\Rightarrow \Delta XPQ \sim \Delta XYZ$

$\Rightarrow \frac{PQ}{YZ} = \frac{XP}{XY} = \frac{5}{9}$

$\Rightarrow PQ:YZ = 5:9$

4. (b)



Let P be the kite and NP = 60m

The string is held at the point O

Then $\angle NOP = 45°$

And OP is the length of the string.

From right angled ΔONP,

$\sin 45° = \frac{NP}{OP} \Rightarrow \frac{1}{\sqrt{2}} = \frac{60}{OP}$

$\Rightarrow OP = 60\sqrt{2}m$

The length of the string $= 60\sqrt{2}m$

OR

L.H.S. $= \frac{\cos A}{1-\tan A} + \frac{\sin A}{1-\cot A}$

$= \frac{\cos A}{1-\frac{\sin A}{\cos A}} + \frac{\sin A}{1-\frac{\cos A}{\sin A}} = \frac{\cos^2 A}{\cos A-\sin A} + \frac{\sin^2 A}{\sin A-\cos A}$

$= \frac{\cos^2 A}{\cos A-\sin A} - \frac{\sin^2 A}{\cos A-\sin A} = \frac{\cos^2 A-\sin^2 A}{\cos A-\sin A}$

$= \frac{(\cos A+\sin A)(\cos A-\sin A)}{\cos A-\sin A} = \cos A + \sin A$

Hence proved.

5. (a)

Let the radii of the outer and the inner circles be x and y respectively.

According to the given,

$x - y = 7$ →(1)

and $\pi(x^2 - y^2) = 286$

$\pi(x-y)(x+y) = 286$

$\frac{22}{7} \times 7(x+y) = 286$

$x + y = 13$ →(2)

Adding (1) and (2), we get

x = 10

Subtracting (1) from (2) we get

y = 3

Therefore, the radii of the two circles are 10cm and 3cm.

OR

The slant height of the cone = $l = \sqrt{r^2 + h^2} = \sqrt{5^2 + 12^2} = \sqrt{169} = 13cm$

Total surface area of the cone = $\pi r(l + r)$

$$= \frac{22}{7} \times 5 \times (13 + 5) = 282.857cm^2$$

Volume of the cone = $\frac{1}{3}\pi r^2 \;\; = \frac{1}{3} \times \frac{22}{7} \times 5^2 \times 12 = 314.286cm^2$

5. (b)

Let r be the radius, h be the height and l=10cm be the slant height of the cone.

Total surface area = $\pi r(l + r) = \pi r(27 + r)$

Given

$\pi r(27 + r) = 90\pi$

$27r + r^2 = 90$

$(r - 3)(r + 30) = 0$

Either $r = 3cm$ or $r = -30$ (but r cannot be negative)

Therefore, radius of the cone is 3 cm.

OR

Let the radius be r cm of the sphere.

Given

$4\pi r^2 = 616$

$\therefore r = 7cm$

$\therefore$ Volume of the initial sphere = $\frac{4}{3}\pi r^3 = \frac{4}{3}\pi 7^3 cm^3$

$\therefore$ Volume of small sphere = $\frac{4}{3}\pi r^3 = \frac{4}{3}\pi \frac{7^3}{8} cm^3$

∴ The number of small spheres $= \frac{\frac{4}{3}\pi 7^3 cm^3}{\frac{4}{3}\pi \frac{7^3}{8}\ cm^3}$

= 512.