SAMPLE QUESTION PAPER (BASIC) - 08

Class 10 - Mathematics

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

General Instructions:

1. This Question Paper has 5 Sections A-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 (04 marks each) with subparts of the values of 1, 1 and 2 marks each respectively.
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 2marks questions of Section E.
8. Draw neat figures wherever required. Take π =22/7 wherever required if not stated.

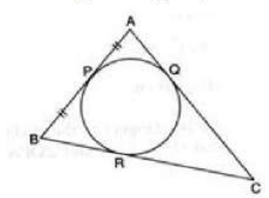
Section A

1. The distance between the points (a, a) and $(-\sqrt{3}a, \sqrt{3}a)$ is **[1]**

   a) $2\sqrt{2}$ units b) $3\sqrt{2}a$ units

   c) 2 units d) $2a\sqrt{2}$ units

2. In the given figure, if AP = PB, then AC = **[1]**



   a) AC = BC b) AB = BC

   c) AQ = QC d) AC = AB

3. The probability expressed as a percentage of a particular occurrence can never be **[1]**

   a) anything but a whole number b) greater than 1

   c) less than 100 d) less than 0

4. The point on the x-axis which is equidistant from points (-1, 0) and (5, 0) is **[1]**

   a) (0, 3) b) (2, 0)

   c) (3, 0) d) (0, 2)

5. The graph of y + 2 = 0 is a line **[1]**

a) making an intercept of -2 on the y-axis

b) parallel to the y-axis at a distance of 2 units to the left of y-axis

c) making an intercept of -2 on the x-axis

d) parallel to the x-axis at a distance of 2 units below the x-axis

6. The distance between (at^2, 2at) and $\left(\frac{a}{t^2}, \frac{-2a}{t}\right)$ is **[1]**

a) $a\left(t^2 + \frac{1}{t^2}\right)$ units

b) $a\left(t - \frac{1}{t}\right)^2$ units

c) $a\left(t + \frac{1}{t}\right)^2$

d) $\left(t + \frac{1}{t}\right)^2$ units

7. The probability of getting a sum of 13 in a single throw of two dice is **[1]**

a) $\frac{5}{6}$

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

c) 0

d) 1

8. If a marble of radius 2.1 cm is put into a cylindrical cup full of water of radius 5cm and height 6 cm, then how much water flows out of the cylindrical cup? **[1]**

a) 38.8 cm^3

b) 471.4 cm^3

c) 19.4 cm^3

d) 55.4 cm^3

9. A number is selected at random from 1 to 75. The probability that it is a perfect square is **[1]**

a) $\frac{10}{75}$

b) $\frac{8}{75}$

c) $\frac{6}{75}$

d) $\frac{4}{75}$

10. The positive value of k for which the equation $x^2 + kx + 64 = 0$ and $x^2 - 8x + k = 0$ will both have real roots, is **[1]**

a) 12

b) 4

c) 8

d) 16

11. Which one of the following is not a quadratic equation? **[1]**

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

b) $(x + 2)^2 = 2(x + 3)$

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

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

12. $\frac{2\tan 30^\circ}{1+\tan^2 30^\circ} =$ **[1]**

a) cos 60°

b) sin 60°

c) sin 30°

d) tan 60°

13. The HCF of two consecutive numbers is **[1]**

a) 2

b) 0

c) 3

d) 1

14. If the point C(k, 4) divides the join of the points .4(2, 6) and B(5,1) in the ratio 2:3 then the value of k is **[1]**

a) 16

b) $\frac{28}{5}$

c) $\frac{8}{5}$

d) $\frac{16}{5}$

15. The measure of the angle of elevation of the top of a tower $75\sqrt{3}$ m high from a point at a distance of 75 m from **[1]**

the foot of the tower in a horizontal plane is

a) 15°
b) 30°
c) 45°
d) 60°

16. If the mode of the data: 16, 15, 17, 16, 15, x, 19, 17, 14 is 15, then x = **[1]**

a) 19
b) 15
c) 16
d) 17

17. Which of the following is a pair of co-primes? **[1]**

a) (14, 35)
b) (18, 25)
c) (32, 62)
d) (31, 93)

18. The sum of the digits of a two-digit number is 15. The number obtained by interchanging the digits exceeds the given number by 9. The number is **[1]**

a) 69
b) 87
c) 78
d) 96

19. **Assertion (A):** $\sqrt{a}$ is an irrational number, where a is a prime number. **[1]**
Reason (R): Square root of any prime number is an irrational number.

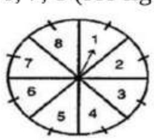
a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

20. **Assertion (A):** D and E are points on the sides AB and AC respectively of a $\triangle ABC$ such that AB = 10.8 cm, AD = 6.3 cm, AC = 9.6 cm and EC = 4 cm then DE is parallel to BC. **[1]**
Reason (R): If a line is parallel to one side of a triangle then it divides the other two sides in the same ratio.

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. A game of chance consists of spinning an arrow which comes to rest pointing at one of the numbers 1, 2, 3, 4, 5, 6, 7, 8 (see figure) and these are equally likely outcomes. What is the probability that it will point at: **[2]**

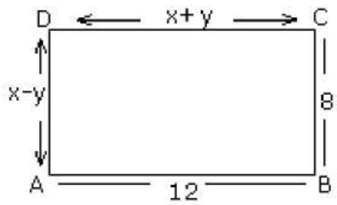


i. 8?
ii. an odd number?
iii. a number greater than 2?
iv. a number less than 9?

22. Solve algebraically the following pair of linear equations for x and y **[2]**
148x + 231y = 610, 231x + 148y = 527.

OR

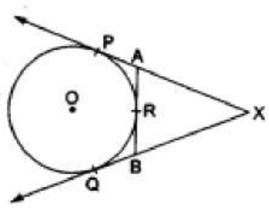
ABCD is a rectangle if the value of AB = 12 is given, find the values of x and y.



23. Find the zeroes of quadratic polynomial given as: $6x^2 - 3 - 7x$ and also verify the relationship between the zeroes and the coefficients. **[2]**

24. If the points A (6, 1), B (8, 2), C (9, 4) and D (p, 3) are the vertices of a parallelogram, taken in order, find the value of p. **[2]**

25. In the given figure, XP and XQ are two tangents to the circle with centre O, drawn from an external point X. ARB is another tangent, touching the circle at R. Prove that XA +AR = XB + BR. **[2]**

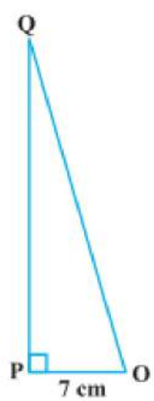


OR

Two concentric circles are of radii 7 cm and r cm respectively where r > 7. A chord of the larger circle of the length 48 cm, touches the smaller circle. Find the value of r.

Section C

26. In $\triangle OPQ$ right angled at P, OP = 7 cm, OQ - PQ = 1 cm. Determine the values of sin Q and cos Q. **[3]**



27. A train covered a certain distance at a uniform speed. If the train would have been 10 km/h faster, it would have taken 2 hours less than the scheduled time. And, if the train were slower by 10 km/h, it would have taken 3 hours more than the scheduled time. Find the distance covered by the train. **[3]**

28. Prove that $7\sqrt{5}$ is irrational. **[3]**

OR

Define HCF of two positive integers and find the HCF of the pair of numbers: 56 and 88.

29. If $\triangle ABC \sim \triangle DEF$, AB = 4 cm, DE = 6 cm, EF = 9 cm and FD = 12 cm, find the perimeter of $\triangle ABC$. **[3]**

30. If d_1, d_2 ($d_2 > d_1$) be the diameters of two concentric circles and c be the length of a chord of a circle which is tangent to the other circle, prove that $d_2^2 = c^2 + d_1^2$. **[3]**

OR

Two tangents TP and TQ are drawn to a circle with centre O from an external point T. Prove that $\angle PTQ = 2\angle OPQ$.

31. The pilot of an aircraft flying horizontally at a speed of 1200 km/hr. observes that the angle of depression of a **[3]**

point on the ground changes from 30° to 45° in 15 seconds. Find the height at which the aircraft is flying.

Section D

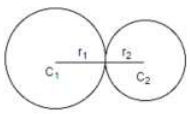
32. The diagonal of a rectangular field is 60 metres more than the shorter side. If, the longer side is 30 metres more than the shorter side, find the sides of the field. **[5]**

OR

Sum of areas of two squares is 468 m^2 . If, the difference of their perimeters is 24 metres, find the sides of the two squares.

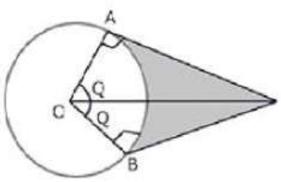
33. Prove that if a line is drawn parallel to one side of a triangle to intersect the other two sides, then the two sides are divided in the same ratio. **[5]**

34. Two farmers have circular plots. The plots are watered with the same water source placed in the point common to both the plots as shown in the figure. The sum of their areas is 130π and the distance between their centres is 14 m.Find the radii of the circles.What value is depicted by the farmers? **[5]**



OR

An elastic belt is placed around therein of a pulley of radius 5cm. One point on the belt is pulled directly away from the center O of the pulley until it is at P, 10cm from O. Find the length of the best that is in contact with the rim of the pulley. Also, find the shaded area.



35. The median of the following data is 525. Find the values of x and y, if the total frequency is 100. **[5]**

Class interval	Frequency
0-100	2
100-200	5
200-300	x
300-400	12
400-500	17
500-600	20
600-700	y
700-800	9
800-900	7
900-1000	4

Section E

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

Rohan makes a project on coronavirus in science for an exhibition in his school. In this Project, he picks a sphere which has volume 38808 cm^3 and 11 cylindrical shapes each of Volume 1540 cm^3 with 10 cm length.

(i) Find the area covered by cylindrical shapes on the surface of a sphere.

(ii) Find the diameter of the sphere.

(iii) Find the total volume of the shape.

OR

Find the curved surface area of the cylindrical shape.

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

Suman is celebrating his birthday. He invited his friends. He bought a packet of toffees/candies which contains 360 candies. He arranges the candies such that in the first row there are 3 candies, in second there are 5 candies, in third there are 7 candies and so on.

(i) Find the total number of rows of candies.

(ii) How many candies are placed in last row?

(iii) If Aditya decides to make 15 rows, then how many total candies will be placed by him with the same arrangement?

OR

Find the number of candies in 12th row.

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

An observer on the top of a 40m tall light house (including height of the observer) observes a ship at an angle of depression 30^o coming towards the base of the light house along straight line joining the ship and the base of the light house. The angle of depression of ship changes to 45^o after 6 seconds.

(i) Find the distance of ship from the base of the light house after 6 seconds from the initial position when angle of depression is 45^o.

(ii) Find the distance between two positions of ship after 6 seconds?

(iii) Find the speed of the ship?

OR

Find the distance of ship from the base of the light house when angle of depression is 30^o.

Solution

SAMPLE QUESTION PAPER (BASIC) - 08

Class 10 - Mathematics

Section A

1. **(d)** $2a\sqrt{2}$ units

   Explanation: Let the points be A(a, a) and B$(-\sqrt{3}a, \sqrt{3}a)$

   $\therefore$AB = $\sqrt{\left(-\sqrt{3}a-a\right)^2+\left(\sqrt{3}a-a\right)^2}$

   = $\sqrt{3a^2+a^2+2\sqrt{3}aa+3a^2+a^2-2\sqrt{3}aa}$

   = $\sqrt{6a^2+2a^2}$

   = $\sqrt{8a^2}$

   = $2a\sqrt{2}$ units

2. **(a)** AC = BC

   Explanation: Since Tangents from an external point to a circle are equal.

   $\therefore$ PB = BR ……….(i)

   PA = AQ ………...(ii)

   CQ = CR ………..(iii)

   Adding eq. (i) and (iii), we get

   PB + CQ = BR + CR

   $\Rightarrow$ AP + CQ = BC [Given: PB = AP]

   $\Rightarrow$AQ + CQ = BC [From eq. (ii) AP = AQ]

   $\Rightarrow$ AC = BC

3. **(d)** less than 0

   Explanation: We know that the probability expressed as a percentage always lie between 0 and 100. So, it cannot be less than 0.

4. **(b)** (2, 0)

   Explanation: Let the required point be P(x, 0). Then,

   $PA^2 = PB^2 \Rightarrow (x+1)^2 = (x-5)^2$

   $\Rightarrow x^2+2x+1 = x^2-10x+25$

   $\Rightarrow 12x = 24 \Rightarrow x = 2$

   So, the required point is P(2, 0).

5. **(d)** parallel to the x-axis at a distance of 2 units below the x-axis

   Explanation: The graph of y + 2 = 0 is a line parallel to the x-axis at a distance of 2 units below the x-axis.

6. **(c)** $a\left(t+\frac{1}{t}\right)^2$

   Explanation: The distance between $(at^2, 2at)$ and $\left(\frac{a}{t^2}, \frac{-2a}{t}\right)$

   = $\sqrt{\left(\frac{a}{t^2}-at^2\right)^2+\left(\frac{-2a}{t}-2at\right)^2}$

   = $a\sqrt{\frac{1}{t^4}+t^4-2+\frac{4}{t^2}+4t^2+8}$

   = $a\sqrt{\frac{1}{t^4}+t^4+\frac{4}{t^2}+4t^2+6}$

   = $a\sqrt{\frac{1}{t^4}+t^4+4+2+\frac{4}{t^2}+4t^2}$

   = $a\sqrt{\left(t^2+\frac{1}{t^2}+2\right)^2}$

   = $a\left(t^2+\frac{1}{t^2}+2\right)$

   = $a\left(t+\frac{1}{t}\right)^2$ units

7. **(c)** 0

   Explanation: Elementary events are

   (1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6)

   (2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6)

(3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6)
(4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6)
(5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6)
(6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)

$\therefore$ Number of Total outcomes = 36

And Number of possible outcomes (sum of numbers appearing on die is 13) = 0

$\therefore$ Required Probability = $\frac{0}{36} = 0$

8. **(a)** 38.8 cm^3

Explanation: We have,

radius of spherical marble = r = 2.1 cm

Now, volume of spherical marble = $\frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times \frac{21}{10} \times \frac{21}{10} \times \frac{21}{10} = 38.808\text{cm}^3$

When a marble is dropped into the cylindrical cup full of water, then

volume of water that flows out of the cup = volume of marble = 38.808 cm^3

9. **(b)** $\frac{8}{75}$

Explanation: Number of possible outcomes = {1, 4, 9, 16, 25, 36, 49, 64} = 8

Number of Total outcomes = 75

$\therefore$ Probability (of getting a perfect square) = $\frac{8}{75}$

10. **(d)** 16

Explanation: In the equation $x^2 + kx + 64 = 0$

a = 1, b = k, c = 64

D = $b^2 - 4ac = k^2 - 4 \times 1 \times 64$

= $k^2 - 256$

$\because$ The roots are real

$\therefore D \geq 0 \Rightarrow k^2 \geq (\pm 16)2$

$\Rightarrow k \geq 16$ .....(i)

Only positive value is taken.

Now in second equation

x2 - 8x + k = 0

D =(-8)2 - 4 $\times$ 1 $\times$ k = 64 - 4k

$\because$ Roots are real

$\therefore D \geq 0 \Rightarrow 64 - 4k \geq 0 \Rightarrow 64 \geq 4k$

$16 \geq k$ ....(ii)

From (i) and

$16 \geq k \geq 16 \Rightarrow k = 16$

11. **(c)** $(x + 2)(x - 1)=x^2 - 2x - 3$

Explanation: Degree of the equation is more than 2 i.e. 3.

12. **(b)** sin 60^o

Explanation: $\frac{2tan30^o}{1+tan^2 30^o} = \frac{2\times\frac{1}{\sqrt{3}}}{1+(\frac{1}{\sqrt{3}})^2}$

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

= sin60^o

13. **(d)** 1

Explanation: The HCF of two consecutive numbers is always 1. (e.g. HCF of 24, 25 is 1).

14. **(d)** $\frac{16}{5}$

Explanation: By Section Formula,

The X-coordinate of C = $\frac{2(5)+3(2)}{2+3}$

$\Rightarrow$ K = $\frac{16}{5}$

15. **(d)** 60°

Explanation: Given: distance from a point to the foot of the tower = 75 m and the height of the tower = $75\sqrt{3}$ m

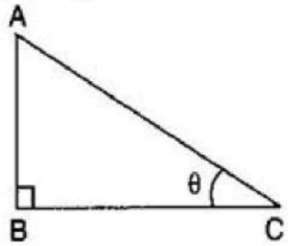
$\therefore \tan\theta = \frac{AB}{BC}$

$\Rightarrow \tan\theta = \frac{75\sqrt{3}}{75}$

$\Rightarrow \tan\theta = \sqrt{3}$

$\Rightarrow \tan\theta = \tan 60^\circ$

$\Rightarrow \theta = 60^\circ$



16. **(b)** 15

Explanation: Mode of 16, 15, 17, 16, 15, x, 19, 17, 14 is 15

∵ By definition mode of a number which has maximum frequency. Here, given that 15 is the mode i.e, 15 has maximum frequency

∴ x = 15

17. **(b)** (18, 25)

Explanation: The numbers that do not share any common factor other than 1 are called co-primes.

factors of 18 are: 1, 2, 3, 6, 9 and 18

factors of 25 are: 1, 5, 25

The two numbers do not share any common factor other than 1.

They are co-primes to each other.

18. **(c)** 78

Explanation: Let us assume the tens and the unit digits of the required number be x and y respectively

∴ Required number = (10x + y)

According to the given condition in the question,

we have

x + y = 15 .....(i)

By reversing the digits, we obtain the number = (10y + x)

∴ (10y + x) = (10x + y) + 9

10y + x - 10x - y = 9

9y - 9x = 9

y - x = 1 .....(ii)

Now, on adding (i) and (ii) we get:

2y = 16

∴ y = $\frac{16}{8}$ = 8

Putting the value of y in (i), we get:

x + 8 = 15

x = 15 - 8

x = 7

∴ Required number = (10x + y) = 10 × 7 + 8 = 70 + 8 = 78

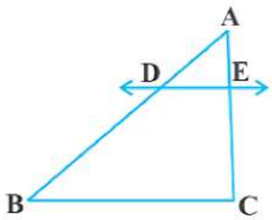
19. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation: As we know that square root of every prime number is an irrational number. So, both assertion and reason are correct and reason explains assertion.

20. **(b)** Both A and R are true but R is not the correct explanation of A.

Explanation:

We know that if a line is parallel to one side of a triangle then it divides the other two sides in the same ratio. This is the Basic Proportionality theorem.



So, Reason is correct.

DB = 10.8 - 6.3 = 4.5 cm and AE = 9.6 - 4 = 5.6 cm

Now, $\frac{AD}{DB} = \frac{6.3}{4.5} = \frac{63}{45} = \frac{7}{5}$ and $\frac{AE}{EC} = \frac{5.6}{4} = \frac{56}{40} = \frac{7}{5}$

$\Rightarrow \frac{AD}{DB} = \frac{AE}{EC}$

By Converse of Basic Proportionality theorem, DE||BC

So, Assertion is correct.

But reason (R) is not the correct explanation of assertion (A).

Section B

21. Out of 8 numbers, an arrow can point any of the numbers in 8 ways.

$\therefore$Total number of outcomes = 8

$Proabibilty\ of\ the\ event = \frac{Number\ of\ favourble\ outcomes}{Total\ number\ of\ possible\ outcomes}$

i. Favourable number of outcomes = 1

Hence, P (arrow points at 8) = $\frac{1}{8}$

ii. Favourable number of outcomes = 4

Hence, P (arrow points at an odd number) = $\frac{4}{8} = \frac{1}{2}$

iii. Favourable number of outcomes = 6

Hence, P (arrow points at a number greater than 2) = $\frac{6}{8} = \frac{3}{4}$

iv. Favourable number of outcomes = 8

Hence, P (arrow points at a number less than 9) = $\frac{8}{8} = 1$

22. Given equations are

148x + 231y = 610............(i)

231x + 148y = 527.............(ii)

adding (i) and (ii)

379x + 379y = 1137

$\Rightarrow$ x + y = 3.....................(iii)

now subtracting (i) and (ii)

-83x + 83y = 83

$\Rightarrow$ -x + y = 1 ....(iv)

adding (iii) and (iv) we get

2y = 4 $\Rightarrow$ y = 2 put in (iii) we get

x = 1

OR

x + y = 12 ...(i)

x - y = 8 ...(ii)

On adding (i) and (ii),

2x = 20

$\Rightarrow$ x = 10

$\therefore$ 10 + y = 12

$\Rightarrow$ y = 2

23. We have given the quadratic equation as: $6x^2 - 3 - 7x$

First of all we will write it into standard form as: $6x^2 - 7x - 3$

(Now we will factorize 7 such that the product of the factors is equal to - 18 and the sum is equal to - 7)

It can be written as

$= 6x^2 + 2x - 9x - 3$

= 2x(3x + 1) - 3(3x + 1)

= (3x + 1)(2x - 3)

The value of $6x^2 - 3 - 7x$ is zero when $3x + 1 = 0$ or $2x - 3 = 0$,

i.e. $X = \frac{-1}{3}$ or $\frac{3}{2}$

Therefore, the zeroes of $6x^2 - 3 - 7x$ are $\frac{-1}{3}$ and $\frac{3}{2}$

Sum of zeroes = $\frac{-1}{3} + \frac{3}{2} = \frac{7}{6} = \frac{-(-7)}{6} = \frac{-(\text{ coefficient of } x)}{\text{coefficient of } x^2}$

Product of zeroes = $\frac{-1}{3} \times \frac{3}{2} = \frac{-1}{2} = \frac{-3}{6} = \frac{\text{constant term}}{\text{coefficient of } x^2}$

Hence, verified

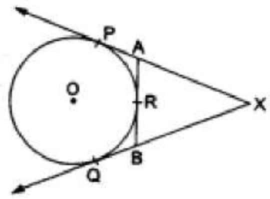
24. We know that the diagonals of a parallelogram bisect each other. So, coordinates of the mid-point of diagonal AC are same as the coordinates of the mid-point of diagonal BD.

$\therefore \quad \left(\frac{6+9}{2}, \frac{1+4}{2}\right) = \left(\frac{8+p}{2}, \frac{2+3}{2}\right)$

$\Rightarrow \quad \left(\frac{15}{2}, \frac{5}{2}\right) = \left(\frac{8+p}{2}, \frac{5}{2}\right)$

$\Rightarrow \quad \frac{15}{2} = \frac{8+p}{2} \Rightarrow 15 = 8 + p \Rightarrow p = 7$

25.



We know that the lengths of tangents drawn from an exterior point to a circle are equal.

XP = XQ, ...(i) [tangents from X]

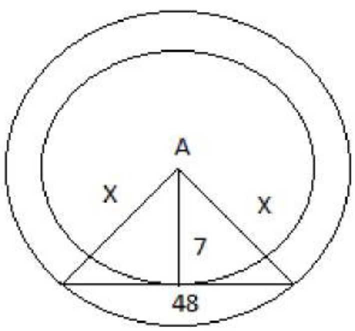
AP = AR, ... (ii) [tangents from A]

BR = BQ. ... (in) [tangents from B]

Now, XP = XQ ⇒ XA + AP = XB + BQ

XA + AR = XB + BR [using (ii) and (iii)]

OR



Let us take r = x

Now using Pythagoras theorem

$(x)^2 = 24^2 + 7^2$

$(x)^2 = 576 + 49$

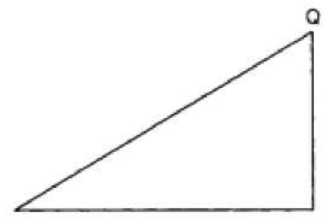
$(x)^2 = 625$

Therefore, x = 25 cm.

r = 25 cm.

Section C

26.



In, $\triangle OPQ$ by Pythagoras theorem

$OQ^2 = OP^2 + PQ^2$

$\Rightarrow (PQ+1)^2 = OP^2 + PQ^2$ [$\because OQ - PQ = 1 \Rightarrow OQ = 1 + PQ$]

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

$\Rightarrow 2PQ + 1 = 49$

$\Rightarrow 2PQ = 48$

$\Rightarrow PQ = 24$ cm

$\therefore OQ - PQ = 1$cm $\Rightarrow$ OQ - 24 = 1 $\Rightarrow$ OQ = 25 cm

Now, $\sin Q = \frac{OP}{OQ} = \frac{7}{25}$

and, $\cos Q = \frac{PQ}{OQ} = \frac{24}{25}$

27. Let the speed of the train be x km/h and the time taken by train to travel the given distance be t hours and the distance to travel be d km.

Since, Speed = $\frac{\text{Distance travelled}}{\text{Time taken to travel that distance}} \Rightarrow x = \frac{d}{t} \Rightarrow$ d = xt ....(1)

According to the question,

x + 10 = $\frac{d}{t-2}$ $\Rightarrow$ (x + 10)(t - 2) = d

$\Rightarrow$ xt + 10t - 2x - 20 = d

$\Rightarrow$ -2x + 10t = 20 .....(2) [Using eq. (1)]

Again, x - 10 = $\frac{d}{t+3}$ $\Rightarrow$ (x - 10)(t + 3) = d

$\Rightarrow$ xt - 10t + 3x - 30 = d

$\Rightarrow$ 3x - 10t = 30 .....(3) [Using eq. (1)]

Adding equations (2) and (3), we obtain:

x = 50

Substituting the value of x in equation (2), we obtain:

(-2) $\times$ (50) + 10t = 20 $\Rightarrow$-100 + 10t = 20

$\Rightarrow$10t = 120

t = 12

From equation (1), we obtain:

d = xt = 50 $\times$ 12 = 600

Thus, the distance covered by the train is 600 km.

28. We can prove $7\sqrt{5}$ irrational by contradiction.

Let us suppose that $7\sqrt{5}$ is rational.

It means we have some co-prime integers *a* and *b* (*b*≠ 0)

such that

$7\sqrt{5} = \frac{a}{b}$

$\Rightarrow \sqrt{5} = \frac{a}{7b}$ ....(1)

R.H.S of (1) is rational but we know that $\sqrt{5}$ is irrational.

It is not possible which means our supposition is wrong.

Therefore, $7\sqrt{5}$ cannot be rational.

Hence, it is irrational.

OR

HCF (highest common factor) : The largest positive integer that divides given two positive integers is called the Highest Common Factor of these positive integers.

We need to find H.C.F. of 56 and 88.

By applying Euclid's Division lemma

88 = 56 $\times$ 1 + 32.

Since remainder ≠ 0, apply division lemma on 56 and remainder 32

56 = 32 $\times$ 1 + 24.

Since remainder ≠ 0, apply division lemma on 32 and remainder 24

32 = 24 $\times$ 1+ 8.

Since remainder ≠ 0, apply division lemma on 24 and remainder 8

24 = 8 $\times$ 3 + 0. Therefore, H.C.F. of 56 and 88 = 8

29. Given, AB = 4 cm,

DE = 6 cm,

EF = 9 cm and FD = 12 cm

Also, $\triangle$ABC $\sim$ $\triangle$DEF We have,

$\therefore \frac{AB}{ED} = \frac{BC}{EF} = \frac{AC}{DF}$

$\Rightarrow \frac{4}{6} = \frac{BC}{9} = \frac{AC}{12}$

$\Rightarrow \frac{4}{6} = \frac{BC}{9} = \frac{AC}{12}$

By taking first two terms, we have

$\Rightarrow \frac{4}{6} = \frac{BC}{9}$

$\Rightarrow BC = \frac{(4\times9)}{6} = 6cm$

And by taking last two terms, we have,

$\Rightarrow BC = \frac{(4\times9)}{6} = 6cm$

$\Rightarrow \frac{6}{9} = \frac{AC}{12}$

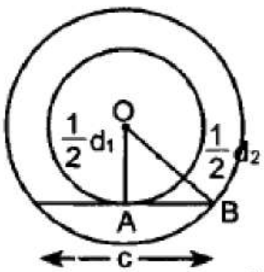
$\Rightarrow AC = \frac{6\times12}{9} = 8cm$

Now,

Perimeter of $\triangle$ABC = AB + BC + AC

= 4 + 6 + 8 = 18 cm

Thus, the perimeter of the triangle is 18 cm.

30. 

Radius of bigger circle = $\frac{1}{2}d_2$

Radius of smaller circle = $\frac{1}{2}d_1$

In right angled $\triangle$OAB,

By using **Pythagorean** theorem ,

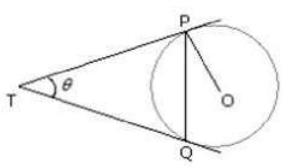
$OB^2 = AB^2 + OA^2$

$\Rightarrow \left(\frac{1}{2}d_2\right)^2 = \left(\frac{1}{2}c\right)^2 + \left(\frac{1}{2}d_1\right)^2$

$\Rightarrow \frac{1}{4}d_2^2 = \frac{1}{4}c^2 + \frac{1}{4}d_1^2$

$\Rightarrow d_2^2 = c^2 + d_1^2$

OR



Given A circle with centre O and an external point T and two tangents TP and TQ to the circle, where P, Q are the points of contact.

To Prove: $\angle$PTQ = 2$\angle$OPQ

Proof: Let $\angle$PTQ = θ

Since TP, TQ are tangents drawn from point T to the circle.

TP = TQ

$\therefore$ TPQ is an isoscles triangle

$\therefore$ $\angle$TPQ = $\angle$TQP = $\frac{1}{2}$ (180^o - θ) = 90^o - $\frac{\theta}{2}$

Since, TP is a tangent to the circle at point of contact P

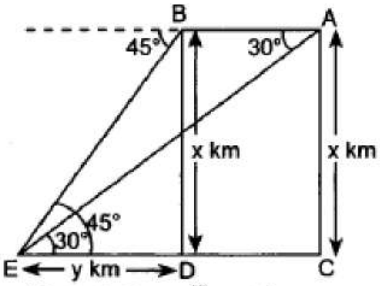
$\therefore$ $\angle$OPT = 90^o

$\therefore$ $\angle$OPQ = $\angle$OPT - $\angle$TPQ = 90^o - (90^o - $\frac{1}{2}$ θ) = $\frac{\theta}{2}$= $\frac{1}{2}$$\angle$PTQ

Thus, $\angle$PTQ = 2$\angle$OPQ

31. Distance covered in 15 seconds $= AB$

Speed $= 1200\ km/hr.$



$\therefore \text{AB} = 1200 \times \frac{15}{3600} = 5\text{km}$

$AB = DC = 5km$

Let height = x km

In rt. $\triangle$BDE,

$\frac{BD}{ED} = \tan 45^\circ \Rightarrow \frac{x}{y} = 1 \Rightarrow x = y$

In rt. $\triangle$ACE,

$\frac{AC}{EC} = \tan 30^\circ \Rightarrow \frac{x}{y+5} = \frac{1}{\sqrt{3}}$

$\Rightarrow \quad \frac{x}{x+5} = \frac{1}{\sqrt{3}}$

$\Rightarrow \quad \sqrt{3}x = x + 5 \Rightarrow (\sqrt{3} - 1)x = 5$

$\therefore \quad x = \frac{5}{\sqrt{3}-1} = \frac{5(\sqrt{3}+1)}{2} = 6.83\text{km}$

Section D

32. Let shorter side of rectangle = x metres

Let diagonal of rectangle = (x +60) metres

Let longer side of rectangle = (x +30) metres

According to pythagoras theorem,

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

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

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

Comparing equation $x^2 - 60x - 2700 = 0$ with standard form $ax^2 + bx + c = 0$,

We get $a = 1$, $b = -60$ and $c = -2700$

Applying quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4a}}{2a}$

$x = \frac{60 \pm \sqrt{(60)^2 - 4(1)(-2700)}}{2 \times 1}$

$\Rightarrow x = \frac{60 \pm \sqrt{3600+10800}}{2} \Rightarrow$

$\Rightarrow x = \frac{60 \pm \sqrt{1400}}{2} = \frac{60 \pm 120}{2} \Rightarrow 4$

$x = \frac{60+120}{2}, \frac{60-120}{2}$

$\Rightarrow x = 90, -30$

We ignore -30. Since length cannot be in negative.

Therefore x =90 which means length of shorter side =90 metres

And length of longer side = x +30 = 90+30=120 metres

Therefore, length of sides are 90 and 120 in metres.

OR

Let perimeter of first square = x metres

Let perimeter of second square = (x +24) metres

Length of side of first square = $\frac{x}{4}$ metres {Perimeter of square = 4 × length of side}

Length of side of second square = $\left(\frac{x+24}{4}\right)$ metres

Area of first square = side × side = $\frac{x}{4} \times \frac{x}{4} = \frac{x^2}{16} m^2$

Area of second square = $\left(\frac{x+24}{4}\right)^2 m^2$

According to given condition:

$\frac{x^2}{16} + \left(\frac{x+24}{4}\right)^2 = 468 \Rightarrow \frac{x^2}{16} + \frac{x^2+576+48x}{16} = 468$

$\Rightarrow \frac{x^2+x^2+576+48x}{16} = 468 \Rightarrow 2x^2 + 576 + 48x = 468 \times 16$

$\Rightarrow 2x^2 + 48x + 576 = 7488 \Rightarrow 2x^2 + 48x - 6912 = 0$

$\Rightarrow x^2 + 24x - 3456 = 0$

Comparing equation $x^2 + 24x - 3456 = 0$ with standard form $ax^2 + bx + c = 0$,

We get a = 1, b = 24 and c = -3456

Applying Quadratic Formula $x = \frac{-b\pm\sqrt{b^2-4ac}}{2a}$

$x = \frac{-24\pm\sqrt{(24)^2-4(1)(-3456)}}{2\times 1}$

$\Rightarrow x = \frac{-24\pm\sqrt{576+13824}}{2}$

$\Rightarrow x = \frac{-24\pm\sqrt{14400}}{2} = \frac{-24\pm 120}{2}$

$\Rightarrow x = \frac{-24+120}{2}, \frac{-24-120}{2}$

$\Rightarrow$ x = 48, -72

Perimeter of square cannot be in negative. Therefore, we discard x = -72

Therefore, perimeter of first square = 48 metres

And, Perimeter of second square = x + 24 = 48 + 24 = 72 metres

$\Rightarrow$ Side of First square $= \frac{\text{Perimeter}}{4} = \frac{48}{4} = 12\text{m}$

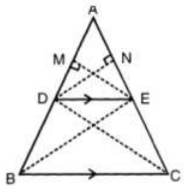
And, Side of second Square $= \frac{\text{Permeter}}{4} = \frac{72}{4} = 18\text{m}$

33. Given: ABC is a triangle in which DE $\parallel$ BC.

To prove: $\frac{AD}{BD} = \frac{AE}{CE}$

Construction: Draw $DN \perp AE$ and $EM \perp AD$., Join BE and CD.

Proof :



In $\triangle ADE$,

Area of $\Delta ADE = \frac{1}{2} \times AE \times DN$ ...(i)

In ΔDEC,

Area of $\Delta DCE = \frac{1}{2} \times CE \times DN$ ...(ii)

Dividing equation (l) by equation (ii),

$\Rightarrow \frac{\text{area }(\Delta ADE)}{\text{area }(\Delta DEC)} = \frac{\frac{1}{2}\times AE\times DN}{\frac{1}{2}\times CE\times DN}$

$\Rightarrow \frac{\text{area }(\Delta ADE)}{\text{area }(\Delta DEC)} = \frac{AE}{CE}$ ...(iii)

Similarly, In ΔADE,

Area of $\Delta ADE = \frac{1}{2} \times AD \times EM$ ...(iv)

In ΔDEB,

Area of $\Delta DEB = \frac{1}{2} \times EM \times BD$ ...(v)

Dividing equation (iv) by equation (v),

$\Rightarrow \frac{\text{area }(\Delta ADE)}{\text{area }(\Delta DEB)} = \frac{\frac{1}{2}\times AD\times EM}{\frac{1}{2}\times BD\times EM}$

$\Rightarrow \frac{\text{area }(\Delta ADE)}{\text{area }(\Delta DEB)} = \frac{AD}{BD}$ ...(vi)

ΔDEB and ΔDEC lie on the same base DE and between two parallel lines DE and BC.

$\therefore$ Area (ΔDEB) = Area (ΔDEC)

From equation (iii),

$\Rightarrow \frac{\text{area }(\Delta ADE)}{\text{area }(\Delta DEB)} = \frac{AE}{CE}$. ......(vii)

From equation (vi) and equation (vii),

$\frac{AE}{CE} = \frac{AD}{BD}$

$\therefore$ If a line is drawn parallel to one side of a triangle to intersect the other two sides in two points, then the other two sides are divided in the same ratio.

34. Let the radii of the two circlular plots be r_1 and r_2, respectively.

Then, $r_1 + r_2 = 14$ [$\because$ Distance between the centres of two circlular plots = 14 cm,given]....(i)

Also, Sum of Areas of the plots = 130π

$\therefore \pi r_1^2 + \pi r_2^2 = 130\pi \Rightarrow r_1^2 + r_2^2 = 130$ ...(ii)

Now, from equation (i) and equation (ii),

$\Rightarrow (14 - r_2)^2 + r_2^2 = 130$

$\Rightarrow 196 - 2r_2 + 2r_2^2 = 130$

$\Rightarrow 66 - 2r_2 + 2r_2^2 = 0$

Solving the quadratic equation we get,

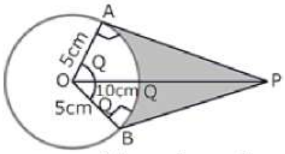
$r_2 = 3$ or $r_2 = 11$,

but from figure it is clear that, $r_1 > r_2$

$\therefore r_1 = 11$ cm and $r_2 = 3$ cm

The value depicted by the farmers are of cooperative nature and mutual understanding.

OR



$\cos\theta = \frac{OA}{OP} = \frac{5}{10} = \frac{1}{2}$

$\Rightarrow \theta = 60^o$

$\Rightarrow \angle AOB = 2 \times \theta = 120^o$

$\therefore$ ARC AB = $\frac{120\times\ 2\times\pi\times 5}{360} cm = \frac{10\pi}{3} cm \left[\because l = \frac{\theta}{360} \times 2\pi r\right]$

Length of the belt that is in contact with the rim of the pulley

= Circumference of the rim - length of arc AB

= $2\pi \times 5$ cm - $\frac{10\pi}{3}$cm

= $\frac{20\pi}{3}$cm

Now, the area of sector OAQB = $\frac{120\times\pi\times5\times5}{360} cm^2 = \frac{25\pi}{3} cm^2 \left[\because Area = \frac{\theta}{360} \times \pi r^2\right]$

Area of quadrilateral OAPB = 2(Area of $\triangle$OAP) = $25\sqrt{3}$ cm^2

$\left[\because AP = \sqrt{100\ - 25} = \sqrt{75}\ = 5\sqrt{3}\ cm\right]$

Hence, shaded area = $25\sqrt{3} - \frac{25\pi}{3} = \frac{25}{3}[3\sqrt{3}\ - \pi]\ cm^2$

35.

Class intervals	Frequency (f)	Cumulative frequency (cf/F)
0-100	2	2
100-200	5	7
200-300	x	7 + x
300-400	12	19 + x
400-500	17	36 + x
500-600	20	56 + x
600-700	y	56 + x + y
700-800	9	65 + x + y
800-900	7	72 + x + y
900-1000	4	76 + x + y
		Total = 76 + x + y

We have,

N = Σf_i = 100

⇒ 76 + x + y = 100

⇒ x + y = 24

It is given that the median is 525. Clearly, it lies in the class 500 - 600

∴ l = 500, h = 100, f = 20, F = 36 + x and N = 100

Now, Median = l + $\frac{\frac{N}{2}-F}{f}$ × h

⇒ 525 = 500 + $\frac{50-(36+x)}{20}$ × 100

⇒ 525 - 500 = (14 - x)5

⇒ 25 = 70 - 5x

⇒ 5x = 45

⇒ x = 9

Putting x = 9 in x + y = 24, we get y = 15

Hence, x = 9 and y = 15

Section E

36. **Read the text carefully and answer the questions:**

Rohan makes a project on coronavirus in science for an exhibition in his school. In this Project, he picks a sphere which has volume 38808 cm^3 and 11 cylindrical shapes each of Volume 1540 cm^3 with 10 cm length.

(i) Given Volume of cylinder = 1540cm^3.

Surface covered by cylindrical shapes on sphere is area of circular base of cylinder

Volume of cylinder = $\pi r^2 h$ = 1540

$\Rightarrow 1540 = \frac{22}{7} \times r^2 \times 10$

$\Rightarrow r^2 = \frac{1540\times7}{22\times10} = 49$

⇒ r = 7 cm

Surface area covered by cylindrical shapes = 11πr^2

$\Rightarrow S = 11 \times \frac{22}{7} \times 7 \times 7$

⇒ S = 1694 cm^2

Surface covered by cylindrical shapes on sphere = 1694cm^2

(ii) Volume of sphere = 38808cm^3

Volume of sphere $= \frac{4}{3} \times \pi \times r^3$

$\Rightarrow 38808 = \frac{4}{3} \times \frac{22}{7} \times r^3$

$\Rightarrow r^3 = \frac{38808\times3\times7}{22\times4} = 21^3$

⇒ r = 21 cm

⇒ Diameter = 42 cm

(iii) Given Volume of Sphere = 38808 cm^3 and Volume of each cylinder = 1540cm^3

Total volume of shape = volume of sphere + 11 × volume of cylinder

= 38808 + 11 × 1540

= 38808 +16940

= 55748 cm^3

OR

For cylinder height = h = 10cm and radius = r = 7cm

Curved surface area of cylinder = 2πrh

$\Rightarrow CSA = 2 \times \frac{22}{7} \times 7 \times 10$

⇒ CSA = 440 cm^2

37. **Read the text carefully and answer the questions:**

Suman is celebrating his birthday. He invited his friends. He bought a packet of toffees/candies which contains 360 candies. He arranges the candies such that in the first row there are 3 candies, in second there are 5 candies, in third there are 7 candies and so on.

(i) Let there be 'n' number of rows

Given 3, 5, 7... are in AP

First term a = 3 and common difference d = 2

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

$\Rightarrow 360 = \frac{n}{2}[2 \times 3 + (n-1) \times 2]$

$\Rightarrow 360 = n[3 + (n - 1) \times 1]$

$\Rightarrow n^2 + 2n - 360 = 0$

$\Rightarrow (n + 20)(n - 18) = 0$

$\Rightarrow n = -20$ reject

$n = 18$ accept

(ii) Since there are 18 rows number of candies placed in last row (18^{th} row) is

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

$\Rightarrow a_{18} = 3 + (18 - 1)2$

$\Rightarrow a_{18} = 3 + 17 \times 2$

$\Rightarrow a_{18} = 37$

(iii) If there are 15 rows with same arrangement

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

$\Rightarrow S_{15} = \frac{15}{2}[2 \times 3 + (15 - 1) \times 2]$

$\Rightarrow S_{15} = 15[3 + 14 \times 1]$

$\Rightarrow S_{15} = 255$

There are 255 candies in 15 rows.

OR

The number of candies in 12th row.

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

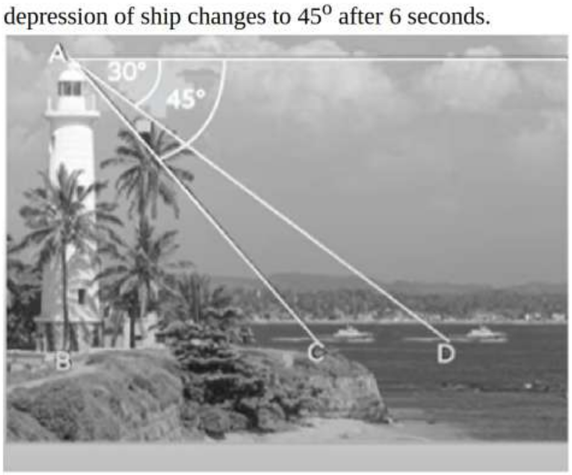
$\Rightarrow a_{12} = 3 + (12 - 1)2$

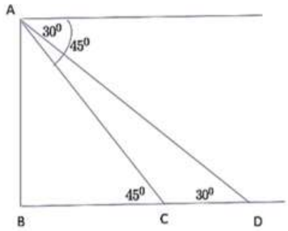
$\Rightarrow a_{12} = 3 + 11 \times 2$

$\Rightarrow a_{12} = 25$

38. **Read the text carefully and answer the questions:**

An observer on the top of a 40m tall light house (including height of the observer) observes a ship at an angle of depression 30^o coming towards the base of the light house along straight line joining the ship and the base of the light house. The angle of depression of ship changes to 45^o after 6 seconds.



(i) 

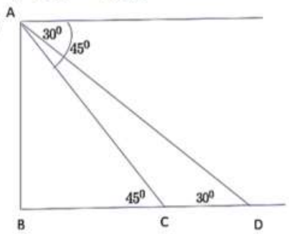
The distance of ship from the base of the light house after 6 seconds from the initial position when angle of depression is 45^{o}.

In $\triangle$ABC

tan 45^{o} = $\frac{AB}{BC}$

$\Rightarrow 1 = \frac{40}{BC}$

$\Rightarrow$ BC = 40 m

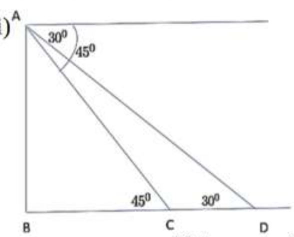
(ii) 

The distance between two positions of ship after 6 seconds

CD = BD - BC

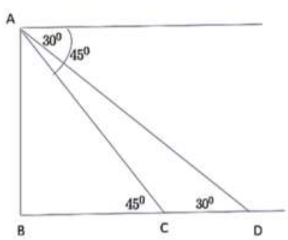
$\Rightarrow$ CD = $40\sqrt{3}$ - 40 = $40(\sqrt{3}$ - 1)

$\Rightarrow$ CD = 29.28 m

(iii) 

Speed of ship = $\frac{Distance}{Time} = \frac{29.28}{6}$ = 4.88 m/sec

OR



The distance of ship from the base of the light house when angle of depression is 30^{o}.

In $\triangle$ABD

tan 30^{o} = $\frac{AB}{BD}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{40}{BD}$

$\Rightarrow$ BD = $40\sqrt{3}$ m