**CBSE Class 09 Mathematics**

**Sample Paper 09 (2020-21)**

**Maximum Marks: 80**

**Time Allowed: 3 hours**

**General Instructions:**

i. This question paper contains two parts A and B.
ii. Both Part A and Part B have internal choices.

**Part – A consists 20 questions**

i. Questions 1-16 carry 1 mark each. Internal choice is provided in 5 questions.
ii. Questions 17-20 are based on the case study. Each case study has 5 case-based sub-parts. An examinee is to attempt any 4 out of 5 sub-parts.

**Part – B consists 16 questions**

i. Question No 21 to 26 are Very short answer type questions of 2 mark each,
ii. Question No 27 to 33 are Short Answer Type questions of 3 marks each
iii. Question No 34 to 36 are Long Answer Type questions of 5 marks each.
iv. Internal choice is provided in 2 questions of 2 marks, 2 questions of 3 marks and 1 question of 5 marks.

**Part - A**

1. Solve the equation: $3(2^x + 1) - 2^{x+2} + 5 = 0$

   OR

   If x, y, z are positive real numbers, show that $\sqrt{x^{-1}y} \times \sqrt{y^{-1}z} \times \sqrt{z^{-1}x} = 1$.

2. Identify the $3x^2 + 5$ polynomials, on the basis of degree.
3. On one page of a telephone directory, there are 200 phone numbers. The frequency distribution of their unit's digits is given below:

| Unit's digit | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | 19 | 22 | 23 | 19 | 21 | 24 | 23 | 18 | 16 | 15 |

One of the numbers is chosen at random from the page. What is the probability that the unit's digit of the chosen number is 5?

4. Construct a right triangle when one side is 3.5 cm and the sum of the other side and hypotenuse is 5.5 cm.
5. Find the area of a triangle, two sides of which are 8 cm and 11 cm and the perimeter is 32 cm.

OR

In a four-sided field, the length of the longer diagonal is 128 m. The lengths of the perpendiculars from the opposite vertices upon this diagonal are 22.7 m and 17.3 m. Find the area of the field.

6. Find the surface area of a sphere of radius 14 cm.
7. Solve the equation for x: $2^{3x-7} = 256$

OR

Write the decimal form and state the kind of decimal expansion: $2\frac{5}{12}$

8. Express of the equation in the form ax + by + c = 0 and indicate the values of a, b, c in case: x = 6
9. A hemispherical bowl has inner diameter 11.2 cm. Find the volume of milk it can hold.

OR

Find the total surface area of a cone, if its slant height is 21 m and diameter of its base is 24 m.

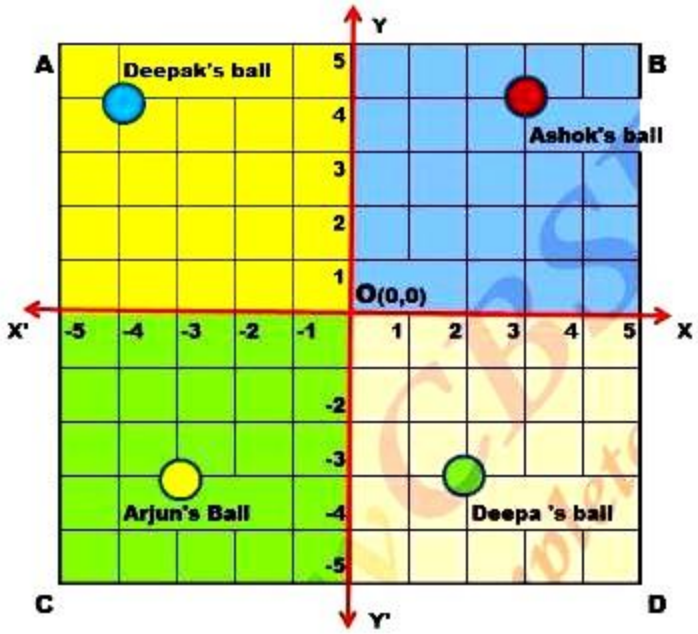
10. Factorize: $10x^4y - 10xy^4$
11. Show that (x = 1, y = 1) as well as (x = 2, y = 5) is a solution of 4x - y - 3 = 0.
12. Simplify the following: $\frac{7.83\times7.83-1.17\times1.17}{6.66}$
13. If the supplement of an angle is three times its complement, find the angle.

14. Express of the equation in the form ax + by + c = 0 and indicate the values of a, b, c in case: 4y = 7
15. The cost of 5 pencils is equal to the cost of 2 ballpoints. Write a linear equation in two variables to represent this statement. (Take the cost of a pencil to be ₹ x and that of a ballpoint to be ₹ y).
16. Simplify $(6+\sqrt{6})(6-\sqrt{6})$.

OR

Multiply $3\sqrt{5}$ by $2\sqrt{5}$.

17. **Read the Source/Text given below and answer any four questions:**




There is a square park ABCD in the middle of Saket colony in Delhi. Four children Deepak, Ashok, Arjun and Deepa went to play with their balls. The colour of the ball of Ashok, Deepak, Arjun and Deepa are red, blue, yellow and green respectively.
All four children roll their ball from centre point O in the direction of **XOY, X'OY, X'OY' and XOY'**. Their balls stopped as shown in the above image.
Answer the following questions:

i. What are the coordinates of the ball of Ashok?
   a. (4, 3)
   b. (3, 4)
   c. (4, 4)

d. (3, 3)

ii. What are the coordinates of the ball of Deepa?

a. (2, -3)

b. (3, 2)

c. (2, 3)

d. (2, 2)

iii. What the line XOX' is called?

a. y-axis

b. ordinate

c. x-axis

d. origin

iv. What the point **O (0, 0)** is called?

a. y-axis

b. ordinate

c. x-axis

d. origin

v. What is the ordinate of the ball of Arjun?

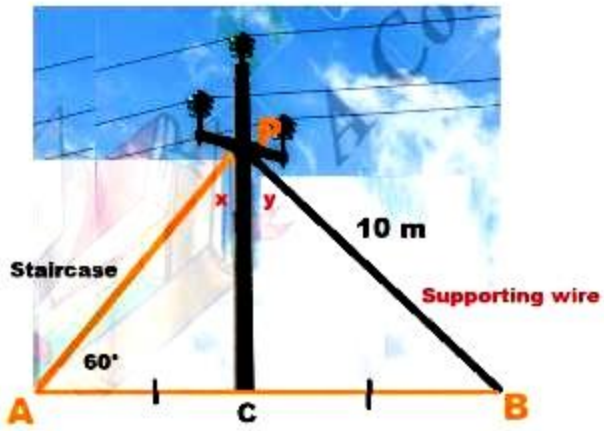
a. -3

b. 3

c. 4

d. 2

18. **Read the Source/Text given below and answer any four questions:**




As shown In the village of Surya there was a big pole PC. This pole was tied with a strong wire of 10 m length.

Once there was a big spark on this pole, thus wires got damaged very badly. Any small

fault was usually repaired with the help of a rope which normal board electricians were carrying on bicycles.

This time electricians need a staircase of 10 m so that it can reach at point P on the pole and this should make 60° with line AC.

**Answer the following questions:**

i. In the $\Delta$PAC and $\Delta$PBC which side is common?
   a. PC
   b. AB
   c. AC
   d. BC

ii. In the $\Delta$PAC and $\Delta$PBC which angles are given to be equal?
   a. $\angle A = \angle x$
   b. $\angle B = \angle x$
   c. $\angle B = \angle y$
   d. None

iii. In the figure, $\Delta$PAC and $\Delta$PBC are congruent due to which criteria?
   a. RHS
   b. SAS
   c. SSS
   d. ASA

iv. What is the value of $\angle$PBC?
   a. 30°
   b. 60°
   c. 90°
   d. 45°

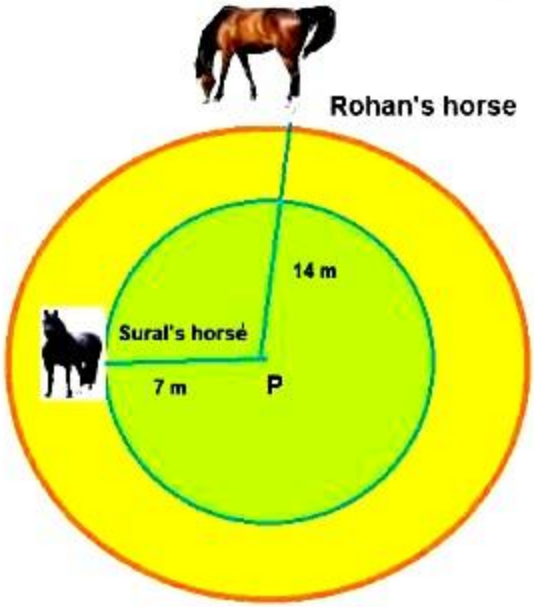
v. What is the value of $\angle$x?
   a. 45°
   b. 60°
   c. 90°
   d. 30°

19. **Read the Source/Text given below and answer any four questions:**

Rohan and Suraj were close friends, One day they were riding horses from Delhi to Faridabad. The names of their horses were Saku and Fareed respectively. The day was

very sunny. On the way, they stopped for resting in a park. They tied their horses to a tree in the park. The length of ropes of Rohans's horse is 14 m and that of the horse of Suraj is 7 m as shown in the figures.

Both the friends slept in the park under a green tree for some time. During this period both the horses took 10 rounds along with the tree they were tied.




**Answer the following questions**

i. The ratio of distance walked in 10 rounds by the horses of Rohan and Suraj is:
   i. 2:1
   ii. 1:2
   iii. 3:1
   iv. 1:3

ii. The ratio of area of the grass the horses of Rohan and Suraj could graze:
   a. 2:1
   b. 1:2
   c. 4:1
   d. 1:4

iii. What is the distance walked by Rohan's horse in 5 rounds:
   a. 220 m
   b. 100 m
   c. 440 m
   d. 110 m

iv. What we call the the length of rope in terms of circle?

a. Diameter
b. Radius
c. Chord
d. Tangent

v. What we call the the distance walked by a horse in one round?
a. Area
b. Radius
c. Circumference
d. diameter

20. **Read the Source/Text given below and answer any four questions:**

Over the past 200 working days, the number of defective parts produced by a machine in a factory is given in the following table:

| Number of defective parts | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Days | 50 | 32 | 22 | 18 | 12 | 12 | 10 | 10 | 10 | 8 | 6 | 6 | 2 | 2 |

Determine the probability that tomorrow's output will have

i. no. defective part
a. 0.25
b. 0
c. 0.50
d. 0.025

ii. at least one defective part
a. 0.50
b. 0.75

c. 0.32

d. 0.01

iii. not more than 5 defective parts

a. 0.12

b. 0.75

c. 0.73

d. 0.60

iv. more than 13 defective parts

a. 0

b. 1

c. -1

d. 0.2

v. at most 3 defective parts

a. -0.12

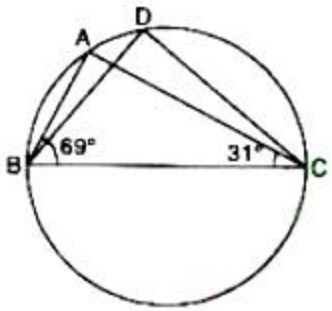
b. 0.50

c. 0.18

d. 0.61

**Part - B**

21. In given figure, $\angle ABC = 69°$, $\angle ACB = 31°$, find $\angle BDC$.




22. Rationalize the denominator of $\frac{1}{4+2\sqrt{3}}$

OR

Simplify :$36^{1/3}. 6^{1/3}$

23. If $x^2 + \frac{1}{x^2} = 79$, find the value of $x + \frac{1}{x}$

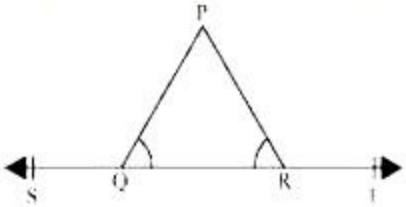
24. A hemispherical bowl is made of steel, 0.25 cm thick. The inner radius of the bowl is 5 cm. Find the outer curved surface area of the bowl.

25. The base of an isosceles triangle measures 24 cm and its area is 192 $cm^2$. Find its perimeter.

OR

Find the area of an isosceles triangles, the measure of one of its equal sides being 10 cm and the third side is 6 cm.

26. Show that the diagonals of a rhombus are perpendicular to each other.
27. In the given figure, $\angle PQR = \angle PRQ$, then prove that $\angle PQS = \angle PRT$




28. Construct an equilateral triangle, given its side and justify the construction.

OR

Construct a $\triangle ABC$ in which BC = 5 cm, AB = 3.8 cm and AC = 2.6 cm. Bisect the largest angle of this triangle.

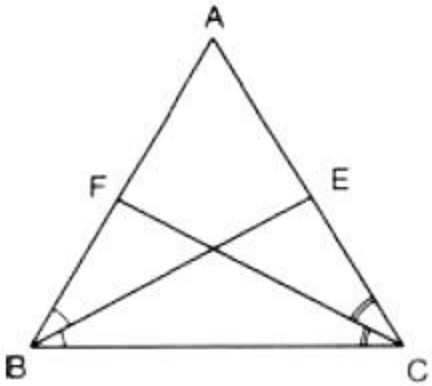
29. A metal pipe is 77 cm long. The inner diameter of a cross section is 4 cm, the outer diameter being 4.4 cm. [See fig.]. Find its:
    i. Inner curved surface area
    ii. Outer curved surface area
    iii. Total surface area

30. Find the value of k, if x - 1 is a factor of p(x) in $p(x) = kx^2 - \sqrt{2}x + 1$

OR

Find the product: $(a - b - c)(a^2 + b^2 + c^2 + ab + ac - bc)$

31. A field is in the shape of a trapezium having parallel sides 90 m and 30 m. These sides meet the third side at right angles. The length of the fourth side is 100 m. If it costs Rs.4 to plough 1 $m^2$ of the field, find the total cost of ploughing the field.
32. Express 0.8888... in the form p/q.
33. In Fig., AB = AC. BE and CF are respectively the bisectors of $\angle B$ and $\angle C$. Prove that $\triangle EBC \cong \triangle FCB$




34. The heights of 75 students in a school are given below:

| Height (in cm) | 130-136 | 136-142 | 142-148 | 148-154 | 154-160 | 160-166 |
|---|---|---|---|---|---|---|
| Number of students | 9 | 12 | 18 | 23 | 10 | 3 |

Draw a histogram to represent the above data.

OR

Draw the graph of the equation $3x + 4y = 12$ and find the co-ordinates of the points of intersection of the equation with the co-ordinate axes.

35. Three coins are tossed simultaneously 100 times with the following frequencies of different outcomes:

| Outcome | No head | One head | Two heads | Three heads |
|---|---|---|---|---|
| Frequency | 14 | 38 | 36 | 12 |

If the three coins are simultaneously tossed again, compute the probability of:

i. 2 heads coming up.

ii. 3 heads coming up.

iii. at least one head coming up.

iv. getting more heads than tails.

v. getting more tails than heads.

36. Each side of a rhombus is 10 cm long and one of its diagonals measures 16 cm. Find the length of the other diagonal and hence find the area of the rhombus.

**CBSE Class 09 Mathematics**

**Sample Paper 09 (2020-21)**

**Solution**

**Part - A**

1. We have,

   $3(2^x + 1) - 2^{x+2} + 5 = 0$

   $\Rightarrow 3 \times 2^x + 3 - 2^x \times 2^2 + 5 = 0$

   $\Rightarrow 3 \times 2^x - 4 \times 2^x + 8 = 0$

   $\Rightarrow (3 - 4)2^x + 8 = 0$

   $\Rightarrow -2^x + 8 = 0 \Rightarrow 2^x = 8 \Rightarrow 2^x = 2^3 \Rightarrow x = 3$

   OR

   Here the given expression is:

   $\sqrt{x^{-1}y} \times \sqrt{y^{-1}z} \times \sqrt{z^{-1}x}$

   $= \sqrt{\frac{y}{x}} \times \sqrt{\frac{z}{y}} \times \sqrt{\frac{x}{z}}$

   $= \left(\frac{y}{x}\right)^{1/2}\left(\frac{z}{y}\right)^{1/2}\left(\frac{x}{z}\right)^{1/2}$

   $= \frac{y^{1/2}}{x^{1/2}} \times \frac{z^{1/2}}{y^{1/2}} \times \frac{x^{1/2}}{z^{1/2}}$

   $= x^{1/2-1/2} \times y^{1/2-1/2} \times z^{1/2-1/2}$

   $= x^0 \times y^0 \times z^0$

   $= 1 \times 1 \times 1$

   = 1 = RHS

   Hence proved

2. We have $3x^2 + 5$

   Here, degree of polynomial $3x^2 + 5$ is 2. Hence, it is a quadratic polynomial.

3. We have Total phone numbers on the directory page = 200

   Number of numbers with units digit 5 = 24

   Let E be the event that the units digit of selected number is 5.

   Therefore, Required probability = P(E) = $\frac{24}{200}$ = 0.12

4. Given : In right triangle ABC, BC = 3.5 cm, $\angle B = 90^o$ and AB + AC = 5.5

Required : To construct the right triangle ABC.

Steps of construction :

i. Draw the base BC = 3.5 cm.

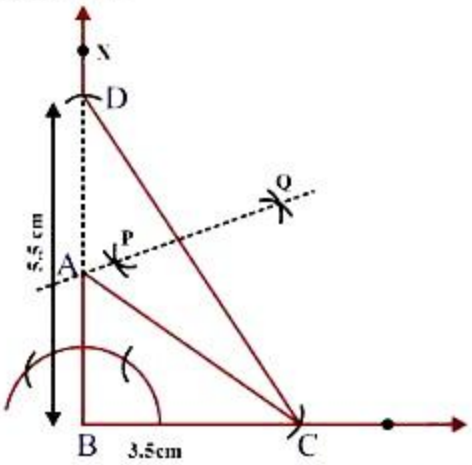
ii. At the point B, make an angle, say XBC = $90^o$

iii. Cut a line segment BD equal to AB + AC = 5.5 cm. on the ray BX.

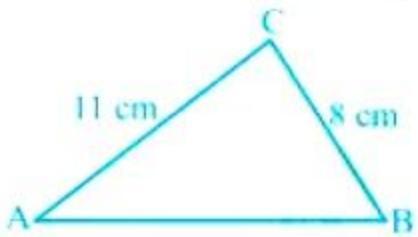
iv. Join DC.

v. Draw the perpendicular bisector PQ of CD to intersect BD at a point A.

vi. Join AC.




ABC is the required right triangle.

5. 


Let a, b, c be the sides of the given triangle and 2s be its perimeter such that

a = 8 cm, b = 11 cm and 2s = 32 cm i.e. s = 16 cm

Now,

a + b + c = 2s

$\Rightarrow$ 8 + 11 + c = 32

$\Rightarrow$ c = 13

$\therefore$ s - a = 16 - 8 = 8, s - b = 16 - 11 = 5 and s - c = 16 - 13 = 3

Hence, Area of given triangle = $\sqrt{s(s-a)(s-b)(s-c)}$

= $\sqrt{16 \times 8 \times 5 \times 3}$ = $8\sqrt{30}$ $cm^2$

OR

Let ABCD be the field, and let AC be its longer diagonal.

Let BL $\perp$ AC and DM $\perp$ AC.

Then, AC = 128 m, BL = 22.7 m and DM = 17.3 m.

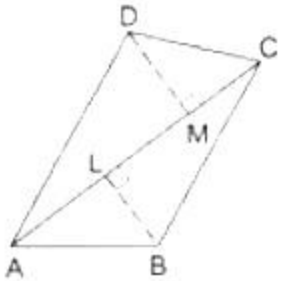
$\therefore$ area of the field = area of $\triangle$ADC + area of $\triangle$ABC

$= \left\{\frac{1}{2} \times AC \times BL\right\} \text{m}^2 + \left\{\frac{1}{2} \times AC \times DM\right\} \text{m}^2$

$= \left\{\frac{1}{2} \times AC \times (BL + DM)\right\} \text{m}^2$

$= \left[\frac{1}{2} \times 128 \times (22.7 + 17.3)\right] \text{m}^2$

$= (64 \times 40)\ \text{m}^2 = 2560\ \text{m}^2$




6. r = 14 cm

   Surface area of a sphere $= 4\pi r^2$

   $= 4 \times \frac{22}{7} \times (14)^2$

   $= 4 \times 22 \times 17 \times 2$

   $= 2464\ \text{cm}^2$

7. We have,

   $2^{3x-7} = 256$

   $\Rightarrow 2^{1x} \times 2^{-7} = 2^8$

   $\Rightarrow 2^{1x} = \frac{2^8}{2^{-7}}$

   $\Rightarrow 2^{1x} = 2^{8+7}$

   $\Rightarrow 2^{1x} = 2^{15}$

   $\Rightarrow 3x = 15$

   $\Rightarrow x = 5$

OR

$2\frac{5}{12} = \frac{29}{12}$

$$
\begin{array}{r}
2.4166 \\
12\overline{)\,29.0000} \\
24 \\
\hline
50 \\
48 \\
\hline
20 \\
12 \\
\hline
80 \\
72 \\
\hline
8
\end{array}
$$

$\therefore 2\frac{5}{12}$ = 2.41666..... $= 2.41\overline{6}$

Hence, it has non-terminating recurring decimal expansion.

8. We have x = 6

   $\Rightarrow$ x - 6 = 0

   $\Rightarrow$ 1x + 0y - 6 = 0

   $\Rightarrow$ x + 0y - 6 = 0

   On comparing this equation with ax + by + c = 0, we obtain

   a = 1, b = 0 and c = -6

9. Diameter of the hemispherical bowl = 11.2 cm

   $\therefore$ Radius of the hemispherical bowl = 5.6 cm

   Hence, Volume of the bowl = $\frac{2}{3}\pi r^3 = \frac{2}{3} \times \frac{22}{7} \times 5.6 \times 5.6 \times 5.6$ cm$^3$

   $\Rightarrow$ Volume of the bowl = 367.96 cm$^3$ = 367.96 ml [$\because$ 1 cm$^3$ = 1 ml]

   Hence, the bowl can hold 367.96 ml of milk.

   OR

   Slant height (l) = 21 m

   Diameter of base = 24 m

   $\therefore$ Radius of base (r) = $\frac{24}{2}$ m = 12 m

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

   = $\frac{22}{7} \times 12 \times (21 + 12)$

   = $\frac{22}{7} \times 12 \times 33 = \frac{8712}{7}$

   = $1244\frac{4}{7}\ m^2$

10. The given expression may be rewritten as

$10xy(x^3 - y^3)$

$= 10xy(x - y)(x^2 + xy + y^2)$

$\therefore [x^3 - y^3 = (x - y)(x^2 + xy + y^2)]$

$\therefore 10x^4y - 10xy^4 = 10xy(x - y)(x^2 + xy + y^2)$

11. Given equation is 4x - y - 3 = 0

    If we put x = 1 and y = 1 in the given equation, we have

    $4 \times 1 - 1 - 3 = 0$

    Therefore, x = 1 , y = 1 is a solution of 4x - y - 3 = 0

    If we put x = 2 y = 5 in the equation 4x - y - 3 = 0 we have

    4 x 2 - 5 - 3 = 8 - 8 = 0

    Therefore, x = 2 , y = 5 is also a solution of 4x - y - 3 = 0

    Hence, (x = 1, y = 1) as well as (x = 2, y = 5) are solutions of 4x - y - 3 = 0.

12. We have,

    $\frac{7.83 \times 7.83 - 1.17 \times 1.17}{6.66}$

    $= \frac{(7.83 + 1.17)(7.83 - 1.17)}{6.66}$ [$\because a^2 - b^2 = (a + b)(a-b)$]

    $= \frac{(9.00)(6.66)}{6.66}$

    = 9

13. Supplement of an angle = 180 - x

    Complement of an angle = 90 - x

    According to question,

    180 - x = 3(90 - x)

    180 - x = 270 - 3x

    -x + 3x = 270 - 180

    2x = 90

    $x = \frac{90}{2}$

    x = 45

14. We have $4y = 7 \Rightarrow 0x + 4y - 7 = 0$

    On comparing this equation with ax + by + c = 0, we obtain

    a = 0, b = 4 and c = -7

15. Let the cost of one pencil be ₹ x and that of one ballpoint be ₹ y.

    Then, Cost of 5 pencils = ₹ 5x

    Cost of 2 ballpoints = ₹ 2y

According to given statement, we have 5x = 2y $\Rightarrow$ 5x - 2y = 0

16. We have ,$(6+\sqrt{6})(6-\sqrt{6}) = (6)^2 - (\sqrt{6})^2 \left[\because (a+b)(a-b) = a^2 - b^2\right]$
= (36-6) = 30.

OR

$3\sqrt{5} \times 2\sqrt{5} = (3 \times 2)(\sqrt{5} \times \sqrt{5})$=6×5 = 30

17. i. (b) (3,4)
ii. (a) (2,-3)
iii. (c) x-axis
iv. (d) Origin
v. (a) -3

18. i. (a) PC
ii. (b) $\angle B = \angle x$
iii. (a) RHS
iv. (d) 60°
v. (d) 30°

19. i. (a) 2:1
ii. (c) 4:1
iii. (c) 440 m
iv. (b) Radius
v. (c) Circumference

20. i. (a) 0.25
ii. (b) 0.75
iii. (c) 0.73
iv. (a) 0
v. (d) 0.61

**Part - B**

21. From the given figure, in $\triangle$ABC, we can write

$\angle$ABC + $\angle$ACB + $\angle$BAC = 180$^o$ ( by angle sum property)

$69^o + 31^o + \angle BAC = 180^o$

$\Rightarrow \angle$BAC = 180° -100° = 80°

$\angle$BDC = $\angle$BAC (Angles in the same segment)

$\therefore \angle BDC = 80°$

22. $\frac{1}{4+2\sqrt{3}} \times \frac{4-2\sqrt{3}}{4-2\sqrt{3}} = \frac{4-2\sqrt{3}}{(4)^2-(2\sqrt{3})^2}$

$\frac{4-2\sqrt{3}}{16-(2\sqrt{3})^2} = \frac{4-2\sqrt{3}}{16-4\times3} = \frac{4-2\sqrt{3}}{16-12}$

$\frac{4-2\sqrt{3}}{4} = \frac{2(2-\sqrt{3})}{4}$

$= \frac{2-\sqrt{3}}{2}$

OR

$36^{1/3}. 6^{1/3} = (36 \times 6)^{1/3}$

$= (216)^{1/3} = (6^3)^{1/3}$

$= 6^{3 \times 1/3} = 6^1 = 6$

23. We have,

$(x + \frac{1}{x})^2 = x^2 + \frac{1}{x^2} + 2 \times x \times \frac{1}{x}$

$\Rightarrow (x + \frac{1}{x})^2 = x^2 + \frac{1}{x^2} + 2$

$\Rightarrow (x + \frac{1}{x})^2 = 79 + 2$ [$\because x^2 + \frac{1}{x^2} = 79$]

$\Rightarrow (x + \frac{1}{x})^2 = 81$

$\Rightarrow x + \frac{1}{x} = \pm 9$

24. Inner radius of bowl $(r)$ = 5 cm

Thickness of steel $(t)$ = 0.25 cm

$\therefore$ Outer radius of bowl (R) = $r + t$ = 5 +0.25 = 5.25 cm

$\therefore$ Outer curved surface area of bowl = $2\pi R^2 = 2 \times \frac{22}{7} \times 5.25 \times 5.25$

$= 2 \times \frac{22}{7} \times \frac{21}{4} \times \frac{21}{4}$

$= \frac{693}{4}$

$= 173.25\ cm^2$

25. Let $\triangle$ABC be an isosceles triangle and let AL $\perp$ BC

$\therefore \frac{1}{2} \times BC \times AL = 192 cm^2$

$\Rightarrow \frac{1}{2} \times 24 cm \times h = 192 cm^2$

$\Rightarrow h = \left(\frac{192}{12}\right) cm = 16 cm$

Now, $BL = \frac{1}{2}(BC) = \left(\frac{1}{2} \times 24\right) cm$ = 12 cm and AL = 16 cm.

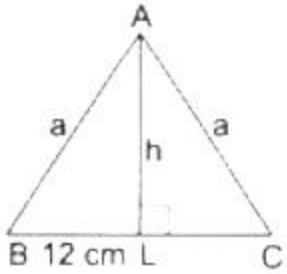
In $\triangle$ABL $AB^2 = BL^2 + AL^2$

$\Rightarrow a^2 = BL^2 + AL^2$

$\therefore a = \sqrt{BL^2 + AL^2} = \sqrt{(12)^2 + (16)^2}\text{cm} = \sqrt{144 + 256}\text{cm}$

$\Rightarrow a = \sqrt{400}\text{cm} = 20\text{cm}$

Hence, perimeter = (20 + 20 + 24) cm = 64 cm.




OR

For isosceles triangles two of it`s sides are equal so sides are a=10, b=10, c=6

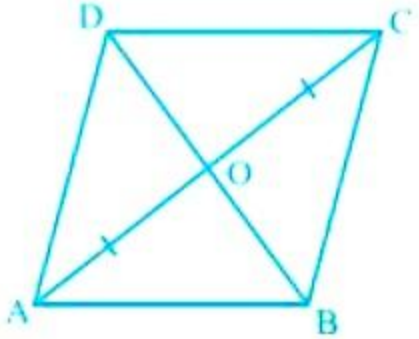
S=$\frac{10+10+6}{2} = \frac{26}{2} = 13cm$

$\therefore$ Area if tringle=$\sqrt{13\,(13-10)\,(13-10)\,(13-6)}$ sq cm

$= \sqrt{13 \times 3 \times 3 \times 7}$ sq cm

$= 3\sqrt{91}$ sq cm

26.




Consider the rhombus ABCD.

You know that AB = BC = CD = DA

Now, in $\triangle AOD$ and $\triangle COD$, OA = OC (Diagonals of a parallelogram bisect each other)

OD = OD (Common)

AD = CD

Therefore, $\triangle AOD \cong \triangle COD$ (SSS congruence rule)

This gives, $\angle AOD = \angle COD$ (CPCT)

But, $\angle AOD + \angle COD = 180°$ (Linear pair)

So, $2\angle AOD = 180°$

or, $\angle AOD = 90°$

So, the diagonals of a rhombus are perpendicular to each other.

27. We need to prove that ∠PQS = ∠PRT

We are given that ∠PQR = ∠PRQ

From the given figure, we can conclude that ∠PQS and ∠PQR, and ∠PRQ and ∠PRT form a linear pair.

We know that sum of the angles of a linear pair is $180^\circ$

$\therefore \angle PQS + \angle PQR = 180^\circ$, and ...(i)

$\angle PRQ + \angle PRT = 180^\circ$. ...(ii)

From equation (i) and (ii), we can conclude that

$\angle PQS + \angle PQR = \angle PRQ + \angle PRT.$

But, ∠PQR = ∠PRQ

∴ ∠PQS = ∠PRT

Hence, proved.

28. Given: side = (say) 6 cm of an equilateral triangle.

Required: To construct the equilateral triangle and justify the construction.

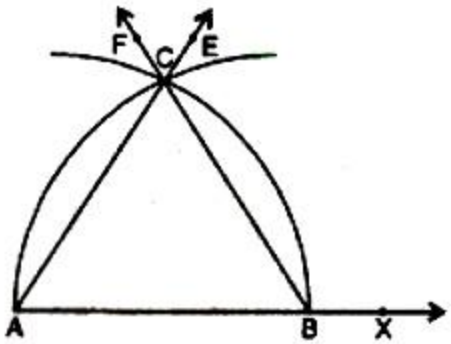
Steps of construction :

i. Take a ray AX with initial point A. From AX, cut off AB = 6 cm.

ii. Taking A as centre and radius (= 6 cm) draw an arc of a circle, which intersects AX, say at a point B.

iii. Taking B as centre and with the same radius as before, draw an arc intersecting the previously drawn arc, say at point C.

iv. Draw the ray AE passing through C.




v. Draw the ray BF passing through C.

△ABC is the required triangle with side = 6 cm.

Justification :

AB = BC . . .[By construction]

AB = AC . . .[By construction]

∴ AB = BC = CA

$\therefore$ $\triangle$ABC is an equilateral triangle.

OR

**GIVEN**

- BC = 5 cm, AB = 3.8 cm and base AC = 2.6 cm

**TO CONSTRUCT**

- $\triangle$ABC and angle bisector of largest angle

**STEP OF CONSTRUCTION**

i. Draw line segment AC = 2.6 cm.

ii. With A as centre and radius 3.8 cm, draw an arc.

iii. With C as centre and radius 5 cm, draw an arc to intersect the previous arc at B.

iv. Join AB and BC.

Thus, $\triangle$ABC is the required triangle.

Largest side = BC = 5 cm

$\Rightarrow$ Largest angle = $\angle$A

Steps of construction:

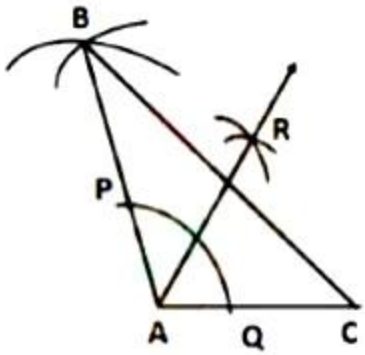
i. With A as centre and any radius, draw an arc, which intersects AB at P and AC at Q.

ii. With P as centre and radius more than half of PQ, draw an arc.

iii. With Q as centre and the same radius, draw an arc to intersect the previous arc at R.

iv. Join AR and extend it.

Thus, $\angle$A is bisected by ray AR.




29. i. Length of the pipe = 77 cm, Inner diameter of cross-section = 4 cm

$\Rightarrow$ Inner radius of cross-section = 2 cm

Inner curved surface area of pipe = $2\pi rh = 2 \times \frac{22}{7} \times 2 \times 77$

$= 2 \times 22 \times 2 \times 11$ = 968 $cm^2$

ii. Length of pipe = 77 cm, Outer diameter of pipe = 4.4 cm

$\Rightarrow$ Outer radius of the pipe = 2.2 cm

Outer surface area of the pipe = $2\pi rh = 2 \times \frac{22}{7} \times 2.2 \times 77 = 44 \times 2.2 \times 11$ = 1064.8 $cm^2$

iii. Now there are two circles of radii 2 cm and 2.2 cm at both the ends of the pipe.

$\therefore$ Area of two edges of the pipe = 2 (Area of outer circle – area of inner circle)

$=2\left(\pi R^2 - \pi r^2\right)$

$= 2\pi$ ($R^2$ - $r^2$)

$=2 \times \frac{22}{7}\left[(2.2)^2 - (2)^2\right]$

$=\frac{44}{7}$ (4.84 - 4)

$=\frac{44}{7} \times 0.84$

= 5.28 $cm^2$

$\therefore$ Total surface area of pipe

= Inner curved surface area + Outer curved surface area + Area of two edges

= 968 + 1064.8 + 5.28 = 2038.08$cm^2$

30. $p(x) = kx^2 - \sqrt{2}x + 1$

We know that according to the factor theorem

$p(a) = 0$, if $x - a$ is a factor of $p(x)$

We conclude that if $(x-1)$ *is a factor of* $p(x) = kx^2 - \sqrt{2}x + 1$, then $p(1) = 0$

$p(1) = k(1)^2 - \sqrt{2}(1) + 1 = 0$, or

$k - \sqrt{2} + 1 = 0$

$k = \sqrt{2} - 1.$

Therefore, we can conclude that the value of k is $\sqrt{2} - 1$.

OR

We have,

$(a - b - c)(a^2 + b^2 + c^2 + ab + ac - bc)$

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

$= (x + y + z)(x^2 + y^2 + z^2 - xy - xz - yz)$, where $a = x$, $-b = y$ and $-c = z$

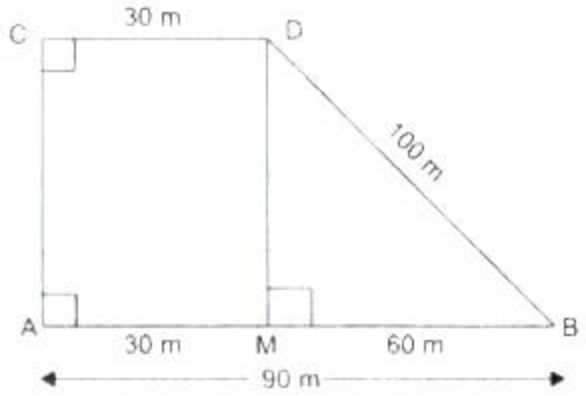
$= x^3 + y^3 + z^3 - 3xyz$

$= a^3 + (-b)^3 + (-c)^3 - 3a\,(-b)\,(-c) = a^3 - b^3 - c^3 - 3abc$

31. The two-parallel sides are AB = 90 cm and CD = 30 m. DM $\perp$ AB

Now, MB = AB – AM = 90 m – 30 m = 60 m.

BD = 100 m




In right triangle DMB, we have $\angle M = 90°$

By using Pythagoras theorem

$DB^2 = DM^2 + MB^2$

$DM^2 = DB^2 - MB^2$

$= (100)^2 - (60)^2$

$DM^2 = 10{,}000 - 3600 = 6400$

$\Rightarrow DM = +\sqrt{6400} = 80\text{m}$

$\therefore$ The area of the field ABDC which is trapezium in shape $= \frac{1}{2}\times$ (Sum of the parallel sides) $\times$ height

$= \frac{1}{2} \times (90 + 30) \times 80m^2$

$= \frac{1}{2} \times 120 \times 80 = 4800m^2$

Total cost of ploughing the field at the rate of ₹ 4 per $m^2$ = ₹ (4800 × 4) = ₹ 19,200.

Hence the total cost of ploughing the field is ₹ 19200.

32. $\text{Let } x = 0.8888$

$x = 0.\overline{8} \ldots . (1)$

$10x = 10 \times 0.8888$ (multiplying both sides by 10)

$10x = 8.8888$

$10x = 8.\overline{8} - - - - (2)$

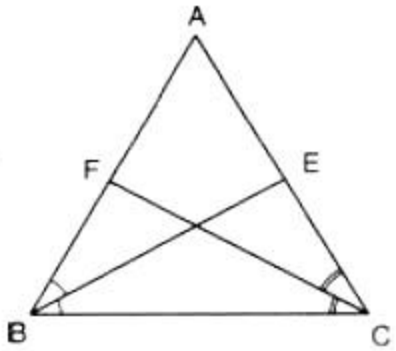
$10x - x = 8.\overline{8} - 0.\overline{8}$

[subtracting (1) from (2)]

$9x = 8$

$x = \frac{8}{9}$

33.




Given: In Fig., AB = AC. BE and CF are respectively the bisectors of ∠B and ∠C.

To Prove: △EBC ≅ △FCB

Proof: In △ABC, we have

AB = AC [Given]

⇒ ∠ACB = ∠ABC

⇒ ∠ECB = ∠FBC [∵ ∠ACB = ∠ECB and ∠ABC = ∠FBC] ...(i)

Again, ∠ACB = ∠ABC

⇒ $\frac{1}{2}$ ∠ACB = $\frac{1}{2}$ ∠ABC

⇒ ∠FCB = ∠EBC [∵ CF and BE are bisectores of ∠ACB and ABC respectively] ...(ii)

Now, in △EBC and △FCB, we have,

∠ECB = ∠FBC [From (i)]

BC = BC [Common]

and, ∠FCB = ∠EBC

△EBC ≅ △FCB [By ASA criterion of congruence]

Hence Proved.

34.

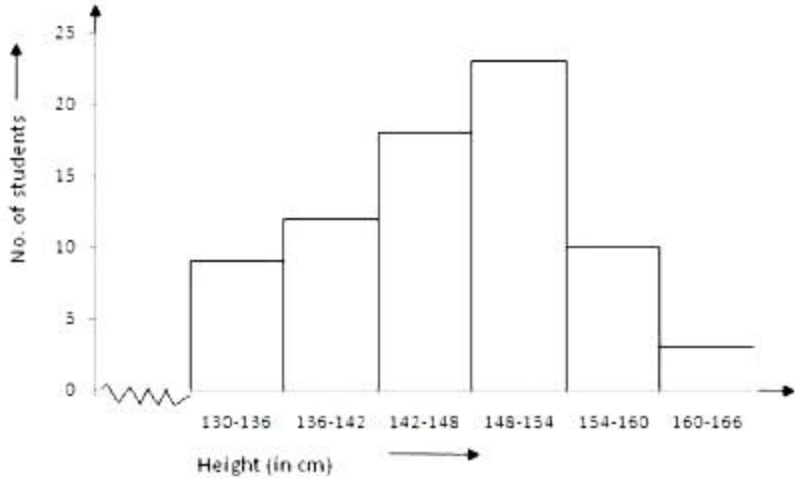
| Height (in cm) | 130-136 | 136-142 | 142-148 | 148-154 | 154-160 | 160-166 |
|---|---|---|---|---|---|---|
| Number of students | 9 | 12 | 18 | 23 | 10 | 3 |

Clearly, the given frequency distribution is in the exclusive form.

We take class intervals, i.e. height (in cm ) along x-axis and frequencies i.e. number of

student s along y-axis . So we get the required histogram.

Since the scale on X-axis starts at 130, a kink(break) is indicated near the origin to show that the graph is drawn to scale beginning at 130.




OR

3x + 4y = 12

Express y in terms of x.such that it is in the form of

y = mx + c

4y = 12-3x

y = $\frac{12-3x}{4}$ ....(i)

For graph,

Let x = 2, put in (i)

$y = \frac{12-3(2)}{4} = \frac{12-6}{4} = \frac{6}{4} = \frac{3}{2} = 1.5$

Let x = 4, put in (i)

$y = \frac{12-3(4)}{4} = \frac{12-12}{4} = \frac{0}{4} = 0$

When line meet x-axis,y = 0

$\therefore\ 3x + 4(0) = 12$

$3x = 12 \Rightarrow x = \frac{12}{3} = 4$

When line meet y-axis, x = 0

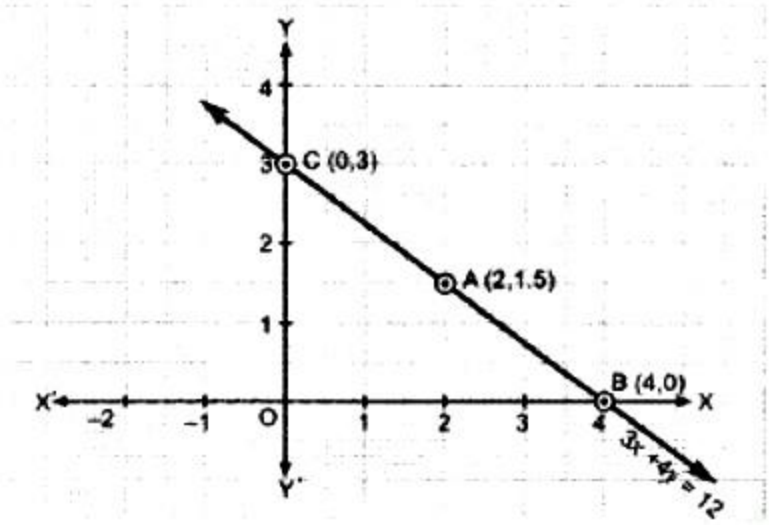
Then 3 (0) + 4y = 12 therefore y = 3

∴ Point of intersection of x-axis is (4, 0).

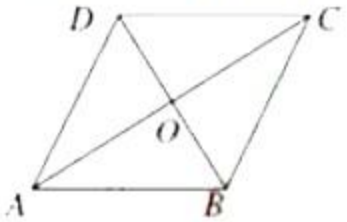
| x | 2 | 4 | 0 |
|---|---|---|---|
| y | 1.5 | 0 | 3 |
| | | | |

| | A | B | C |
|---|---|---|---|

∴ Point of intersection with x-axis is (4, 0) and point of intersection with y-axis is (0,3)




35. Total number of outcomes = 100
    i. Probability of 2 heads coming up = $\frac{Favourable\ outcome}{Total\ outcome} = \frac{36}{100} = 0.36$
    ii. Probability of 3 heads coming up = $\frac{Favourable\ outcome}{Total\ outcome} = \frac{12}{100} = 0.12$
    iii. Probability of at least one head coming up = $\frac{Favourable\ outcome}{Total\ outcome} = \frac{38+36+12}{100} = \frac{86}{100} =$ 0.86
    iv. Probability of getting more heads than tails = $\frac{Favourable\ outcome}{Total\ outcome} = \frac{36+12}{100} = \frac{48}{100} = 0.48$
    v. Probability of getting more tails than heads = $\frac{Favourable\ outcome}{Total\ outcome} = \frac{14+38}{100} = \frac{52}{100} = 0.52$
36. Let ABCD be rhombus.




We know that rhombus is type of parallelogram whose all sides are equal.

∴ AB = BC = CD = DA = 10 cm

Let the diagonals AC and BD intersect each other at O, where AC = 16 cm and let BD = x

We know that the diagonals of a rhombus are perpendicular bisectors of each other.

∴ △AOB is a right angle triangle, in which

OB = BD ÷ 2 = x ÷ 2 and

OA = AC ÷ 2 = 16 ÷ 2 = 8 cm.

Now, $AB = OA^2 + OB^2$... by pythagoras theorem

$\therefore 10^2 = (\frac{x}{2})^2 + 8^2$

ie. $100 - 64 = \frac{x^2}{4}$

$36 \times 4 = x^2$

$\therefore x^2 = 144$

$\therefore x = 12$ cm

We know that area of rhombus is,

Area of rhombus = $\frac{1}{2} \times$ ( Diagonal1) × ( Diagonal2)

Area of ABCD = $\frac{1}{2} \times AC \times BD$

$= \frac{1}{2} \times 16 \times 12$

$= 96 \text{ cm}^2$

Hence, the area of rhombus is $96 \text{ cm}^2$