CBSE Class 09 Mathematics

Sample Paper 03 (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. Simplify the following expression: $(\sqrt{8} - \sqrt{2})(\sqrt{8} + \sqrt{2})$

OR

Simplify: $(625)^{\frac{-1}{4}}$

2. Rewrite the polynomial in standard form: $2 + t - 3t^3 + t^4 - t^2$
3. The distances (in km) of 40 female engineers from their residence to their place of work were found as follows: 5 3 10 20 25 11 13 7 12 31 19 10 12 17 18 11 32 17 16 2 7 9 7 8 3 5 12

15 18 3 12 14 2 9 6 15 15 7 6 2. Find the probability that an engineer lives: at least 7 km from her place of work.

4. Draw a line segment 5.8 cm long and draw its perpendicular bisector.
5. The base of an isosceles triangle is 10 cm and one of its equal side is 13 cm. Find its area using Heron's Formula.

OR

The perimeter of an isosceles triangle is 42 cm and its base is $1\frac{1}{2}$ times each of the equal sides. Find the height of the triangle. (Given, $\sqrt{7}$ = 2.64.)

6. Write the name of each part of the plane formed by Vertical and horizontal lines.
7. Is $\frac{\sqrt{28}}{\sqrt{343}}$ a rational number?

OR

Find three rational numbers between $\frac{1}{4}$ and $\frac{1}{5}$.

8. Write the equation in the form ax + by + c = 0 and indicate the values of a, b, c in case: $\frac{x}{3} - \frac{y}{2} = 5$
9. Find the volume of a sphere whose diameter is 14 cm.

OR

The curved surface area of a right circular cylinder of height 14 cm is 88cm^2. Find the diameter of the base of the cylinder.

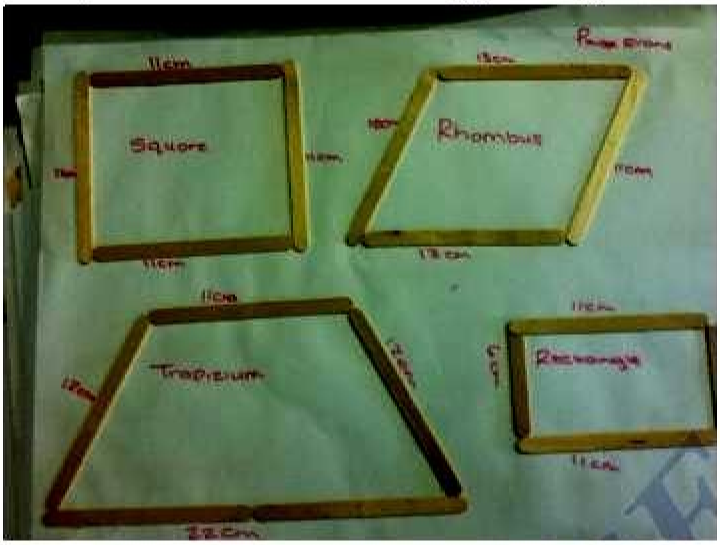
10. Factorise: $2x^2 + 3x - 90$.
11. Find the co-ordinate where the equation 2x + 3y = 6 intersects x-axis.
12. Evaluate: $(99)^2$.
13. Find the length of a chord which is at a distance of 12 cm from the centre of a circle of radius 13 cm.
14. Write as an equation in two variables: $y = \frac{3}{2}x$
15. Write two solutions for equation: $x + \pi y = 4$
16. Examine the number rational or irrational: $3 + \sqrt{3}$.

OR

If a = 3 and b = - 2, find the values of: $a^a + b^b$

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

During Maths Lab Activity each student was given four broomsticks of lengths 8 cm, 8 cm, 5 cm, 5 cm to make different types of quadrilaterals.



Using the above information answer the following questions:

i. How many quadrilaterals can be formed using these sticks?

a. Only One type of quadrilaterals can be formed

b. Two types of quadrilaterals can be formed

c. Three types of quadrilaterals can be formed

d. Four types of quadrilaterals can be formed

ii. Name the types of quadrilaterals formed.

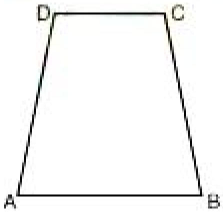
a. Rectangle, parallelogram, kite

b. Rectangle, parallelogram, Trapizum

c. Rectangle, parallelogram, Square

d. Rectangle, Square, kite

iii. In a trapezium ABCD, DC || AB and $\angle A = \angle B = 45^\circ$, the teacher asked the student to find $\angle D$. Naresh answered it is________ .



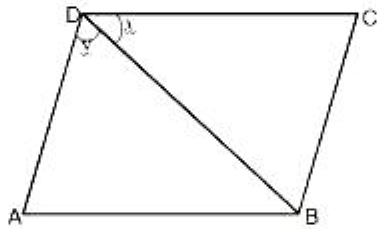
a. 105°

b. 108°

c. 135^{o}

d. 125^{o}

iv. While discussing the properties of a parallelogram teacher asked about the relation between two angles x and y of a parallelogram as shown in fig. The teacher gave them 4 options as (if BC < CD) :



a. x > y

b. x < y

c. x = y

d. none of these

v. P, Q, R, and S are respectively the mid-points of sides AB, BC, CD, and DA of quadrilateral ABCD in which AC = BD and AC ⊥ BD, PQRS is a

a. Square.

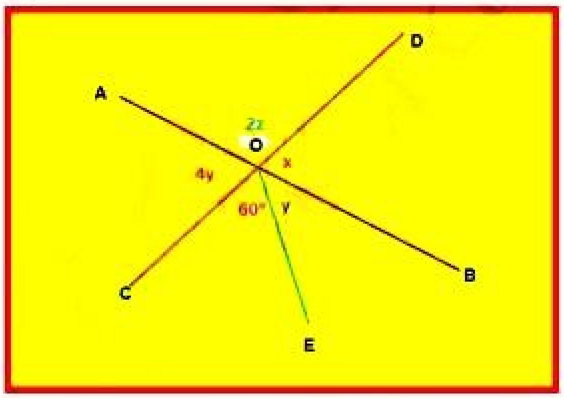
b. Rhombus.

c. Kite

d. Parallelogram

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

Maths teacher draws a straight line AB shown on the blackboard as per the following figure.



i. Now he told Raju to draw another line CD as in the figure

ii. The teacher told Ajay to mark ∠AOD as 2z

iii. Suraj was told to mark ∠AOC as 4y

iv. Clive Made and angle $\angle COE = 60°$

v. Peter marked $\angle BOE$ and $\angle BOD$ as y and x respectively

Now answer the following questions:

i. What is the value of x?

  a. 48°

  b. 96°

  c. 100°

  d. 120°

ii. What is the value of y?

  a. 48°

  b. 96°

  c. 100°

  d. 24°

iii. What is the value of z?

  a. 48°

  b. 96°

  c. 42°

  d. 120°

iv. What should be the value of $x + 2z$?

  a. 148°

  b. 360°

  c. 180°

  d. 120°

v. What is the relation between y and z?

  a. $2y + z = 90°$

  b. $2y + z = 180°$

  c. $4y + 2z = 120°$

  d. $y = 2z$

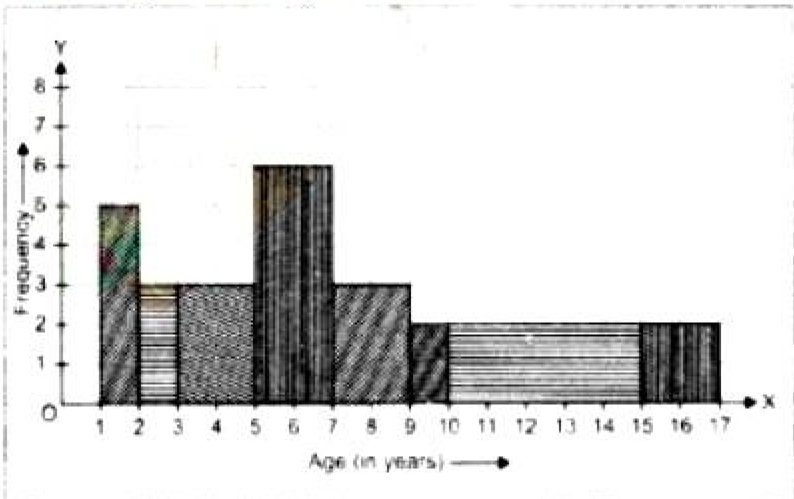
19. **Read the Source/Text given below and answer any four questions:**

In an effort to provide high-quality and safe playgrounds for kids, our reputable manufacturers adhere to the playground safety guidelines set forth by the Indian Consumer Product Safety Commission (CPSC) and the Indian Society for Advancement of

Materials and Processing Engineering (ISAMPE). These organizations set the guidelines for determining the types of playground equipment that is appropriate for kids within specific age groups: 2-3 years, 3-5 years, 5-7 years, 7-10 years, 10-15 years, and 15-17 years. A random survey of the number of children of various age groups playing in a park was found as follows:

Age (in years)	Number of children
1 - 2	5
2 - 3	3
3 - 5	6
5 - 7	12
7 - 10	9
10 - 15	10
15 - 17	4

the histogram is as given below:



i. In this question, the class sizes are different. So, calculate the adjusted frequency for each class by using the following formula:

Frequency density or adjusted frequency for class =

a. $\frac{Minimum\ class\ size}{Class\ size\ of\ this\ class} \times Its\ Frequency$

b. $\frac{Minimum\ class\ mark}{Class\ size\ of\ this\ class} \times Its\ Frequency$

c. $\frac{Minimum\ Frequency}{Class\ size\ of\ this\ class} \times Its\ class\ size$

d. $\frac{Minimum\ class\ mark}{Class\ mark\ of\ this\ class}$

ii. In this question the minimum class size is

a. 0

b. 1

c. 2

d. 3

iii. The class limits of third class interval 3-5

a. lower limit =5, upper limit = 3

b. lower limit =5, upper limit = 7

c. lower limit = 3, upper limit = 5

d. lower limit =7, upper limit = 5

iv. Adjusted Frequency for class interval 5-7 and 7-10

a. 3, 6

b. 3, 3

c. 6, 6

d. 6, 3

v. Find the class mark of class 15 - 17

a. 16

b. 12

c. 25

d. 2

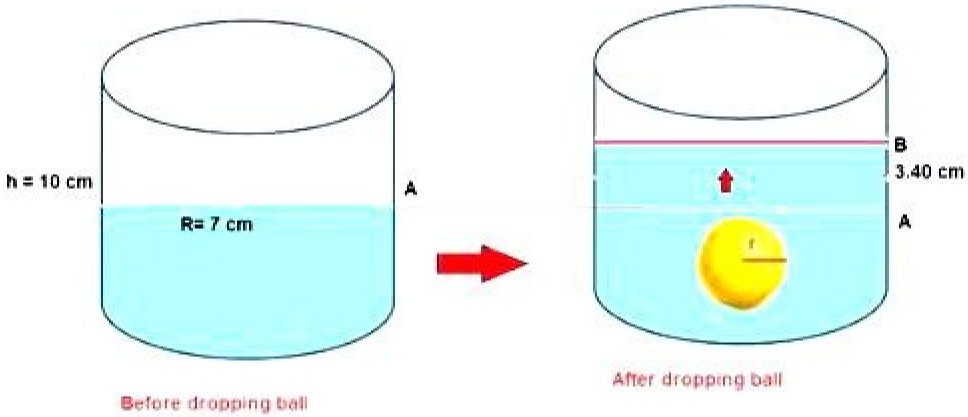
20. **Read the passage given below and answer any four questions:**

Dev was doing an experiment to find the radius r of a sphere. For this he took a cylindrical container with radius R = 7 cm and height 10 cm.

He filled the container almost half by water as shown in the left figure. Now he dropped the yellow sphere in the container.

Now he observed as shown in the right figure the water level in the container raised from

A to B equal to 3.40 cm.

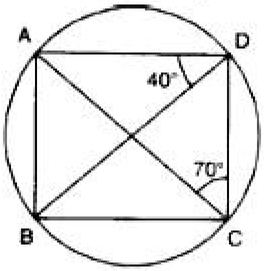


i. What is the approximate radius of the sphere?
   a. 7 cm
   b. 5 cm
   c. 4 cm
   d. 3 cm
ii. What is the volume of the cylinder?
   a. 700 cm^3
   b. 500 cm^3
   c. 1540 cm^3
   d. 2000 cm^3
iii. What is the volume of the sphere?
   a. 700 cm^3
   b. 600 cm^3
   c. 500 cm^3
   d. 523.8 cm^3
iv. How many litres water can be filled in the full container?(Take 1 litre = 1000 cm^3)
   a. 1.50
   b. 1.44
   c. 1.54
   d. 2
v. What is the surface area of the sphere?
   a. 314.3 m^2
   b. 300 m^2
   c. 400 m^2

d. 350 m^2

Part - B

21. In the given figure, ABCD is a cyclic quadrilateral such that, $\angle ADB = 40^\circ$ and $\angle DCA = 70^\circ$, then find the measure of $\angle DAB$.



22. Simplify: $\left(\frac{15^{1/3}}{9^{1/4}}\right)^{-6}$.

OR

Rationalise the denominator of $\frac{1}{\sqrt{2}}$

23. Prove that: $\frac{0.87\times0.87\times0.87+0.13\times0.13\times0.13}{0.87\times0.87-0.87\times0.13+0.13\times0.13} = 1$

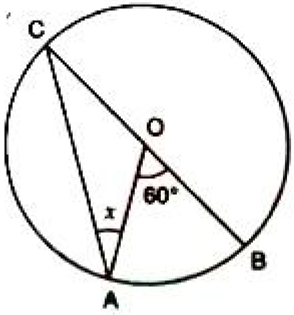
24. The dimensions of a cinema hall are 100 m, 50 m and 18 m. How many persons can sit in the hall, if each requires 150 m^3 of air ?

25. Find the area of a triangle whose sides are respectively 150 cm, 120 cm and 200 cm.

OR

Find area of triangle with two sides as 18cm & 10cm and the perimeter is 42cm.

26. If O is the centre of the circle, find the value of angle x in given figure:



27. Show that the angles of an equilateral triangle are 60° each.

28. Construct an equilateral triangle whose side is 4 cm.

OR

Draw a line segment 6.4 cm long and draw its perpendicular bisector. Measure the length of each part.

29. Take a triangle ABC with A (3, 0), B (-2, 1), C (2, 1). Find its mirror image.

30. Factorize: $6x^2 + 5x - 6$

OR

Factorize: $(a + b)^3 + (b + c)^3 + (c + a)^3 - 3(a + b)(b + c)(c + a)$

31. The sides of a triangular plot are in the ratio of 3 : 5 : 7 and its perimeter is 300 m. Find its area.

32. Express: $2.0\overline{15}$ in the $\frac{p}{q}$ form, where p and q are integers and $q \neq 0$.

33. In a $\triangle ABC$, $\angle A - \angle B = 33^\circ$ and $\angle B - \angle C = 18^\circ$. Find the angles of the triangle.

34. Draw the graph of the equation 2x + 3y = 11. From your graph, find the value of y when
    a. x = 7
    b. x = - 8

OR

Draw the graph of the equation y - x = 2.

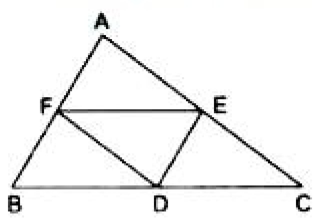
35. Following frequency distribution gives the weights of 38 students of a class:

Weight in kg	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75
Number of students	9	5	14	3	1	2	2	1	1

Find the probability that the weight of a student in the class is:
   i. at most 60 kg
   ii. at least 36 kg
   iii. not more than 50 kg

Also define two events in this context, one having probability 0 and the other having probability 1.

36. In the adjoining figure, D, E, F are the midpoints of the sides BC, CA and AB respectively, of $\triangle$ ABC. Show that $\angle$EDF = $\angle$A, $\angle$DEF = $\angle$B and $\angle$DFE = $\angle$C.



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Solution

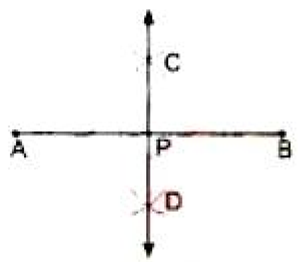
Part - A

1. It is given that,
$(\sqrt{8} - \sqrt{2})(\sqrt{8} + \sqrt{2})$
$= (\sqrt{8})^2 - (\sqrt{2})^2$ [Using Identity, $(a - b)(a + b) = a^2 - b^2$]
$= 8 - 2$
$= 6.$
Thus, $(\sqrt{8} - \sqrt{2})(\sqrt{8} + \sqrt{2}) = 6$

OR

We have, $(625)^{\frac{-1}{4}} = \frac{1}{(625)^{\frac{1}{4}}} = \left(\frac{1}{625}\right)^{\frac{1}{4}} = \left\{\left(\frac{1}{5}\right)^4\right\}^{\frac{1}{4}} = \left(\frac{1}{5}\right)^{4\times\frac{1}{4}} = \left(\frac{1}{5}\right)^1 = \frac{1}{5}$

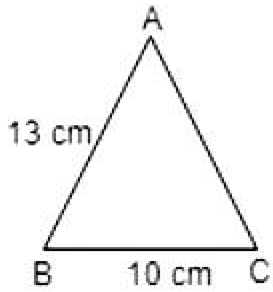
2. $2 + t - 3t^3 + t^4 - t^2$ in standard form: $t^4 - 3t^3 - t^2 + t + 2$
3. Number of female engineers living at least 7 km away from her place of work = 30
Probability that a female engineer lives at least 7 km away from her place of work $= \frac{30}{40}$
$= 0.75$
4. Steps of Construction



   i. Draw a line segment AB = 5.8 cm.
   ii. Taking A as centre and radius more than half of AB, draw one arc above and other arc below line AB.
   iii. Similarly, with B as centre draw two arcs cutting the previous drawn arcs and name the points obtained as C and D respectively.
   iv. Join CD, intersecting AB at point P.

Then, line CD is the required perpendicular bisector of AB.

And AP = PB = 2.9 cm

5. 

a = 13, b = 10 cm, c = 13 cm.

$s = \frac{a+b+c}{2}$

$= \frac{13+10+13}{2} = 18\,\text{cm}$

$\therefore$ Area of the isosceles triangle $= \sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{18(18-13)(18-10)(18-13)}$

$= \sqrt{18(5)(8)(5)} = \sqrt{(9 \times 2)(5)(4 \times 2)(5)}$

$= 3 \times 5 \times 2 \times 2 = 60\ \text{cm}^2$

OR

Let the equal sides of the isosceles triangle be a cm each.

$\therefore$ Base of the triangle, $b = \frac{3}{2}a\text{cm}$

Perimeter of triangle = 42cm

$\Rightarrow$ a+a+ $\frac{3}{2}$a = 42

$\Rightarrow \frac{7}{2}$a = 42 ==> a =12 cm

and $b = \frac{3}{2}(12)\text{cm}$ = 18 cm

Area of triangle = 71.42 cm^2

$\Rightarrow \frac{1}{2} \times$ Base $\times$ Height = 71.42

$\Rightarrow$ Height $= \frac{71.42 \times 2}{18}$

= 7.94 cm

6. Its called Quadrants.

Note: 1st, 2nd, 3rd, 4th Quadrants are formed between horizontal and vertical lines.

7. $\frac{\sqrt{28}}{\sqrt{343}} = \sqrt{\frac{4}{49}} = \frac{2}{7}$, which is a rational number.

OR

$\frac{1}{4}=\frac{1}{4}\times\frac{20}{20}=\frac{20}{80}$ and $\frac{1}{5}=\frac{1}{5}\times\frac{16}{16}=\frac{16}{80}$

Now, $\sqrt{2}\times\sqrt{3}\frac{18}{80}\left(=\frac{9}{40}\right),\frac{19}{80}$ are three rational numbers lying between and $\frac{1}{4}$ and $\frac{1}{5}$.

8. We have $\frac{x}{3}-\frac{y}{2}$ = 5 ⇒ 2x - 3y = 30

   This is of the form ax + by + c = 0, where a = 2, b = -3 and c = -30

9. D = 14 cm

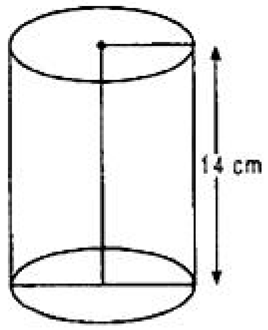
   ⇒ r = 7 cm

   ∴ volume = $\frac{4}{3}\pi r^3$

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

   = 1437.33 cm^3

OR



Given: Height of cylinder (h) = 14 cm, Curved Surface Area = 88 cm^2

Let radius of base of right circular cylinder = r cm

$2\pi rh$ = 88

$\Rightarrow 2\times\frac{22}{7}\times r\times 14=88$

$\Rightarrow r=88\times\frac{7}{22}\times\frac{1}{14}\times\frac{1}{2}$

⇒ r = 1 cm

Diameter of the base of the cylinder = 2r = 2 × 1 = 2 cm

10. $2x^2$ + 3x - 90

    = $2x^2$ - 12x + 15x - 90

    = 2x (x - 6) + 15 (x - 6)

    = (x - 6) (2x + 15)

    This is the required factorisation.

11. The y-coordinate is 0.

$\therefore\ 2x + 3(0) = 6$

$\Rightarrow x = 3$

$\therefore$ the co-ordinate of the point is $(3, 0)$.

12. We have,

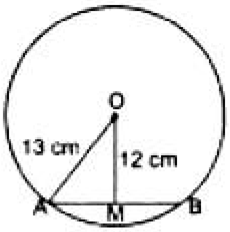
$(99)^2$

$= (100 - 1)^2$ [$\because (a - b)^2 = a^2 - 2ab + b^2$]

$= (100)^2 - 2(100)(1) + (1)^2$

$= 10000 - 200 + 1$

$= 9801$

13. 

Let AB be a chord of a circle with centre O and it is given that the radius of circle = 13 cm.

Construction: Draw OM $\perp$ AB and join OA.

In the right triangle OMA, we have,

$OA^2 = OM^2 + AM^2$ (by pythagoreous theorem)

$\Rightarrow 13^2 = 12^2 + AM^2$

$\Rightarrow AM^2 = 169 - 144 = 25$

$\Rightarrow AM = 5$ cm.

As the perpendicular from the centre of a chord bisects the chord. Therefore,

$AB = 2AM = 2 \times 5 = 10$ cm.

Hence the length of the chord is = 10 cm.

14. The equation is $3x - 2y + 0 = 0$

15. We have $x + \pi y = 4$

At $x = 0$,

$\pi y = 4$

$= y = \frac{4}{\pi}$

Thus, $x = 0$, $y = \frac{4}{\pi}$ is a solution

At $y = 0$,

$= x + 0 = 4$

$= x = 4$

Thus, x = 4, y = 0 is a solution.

16. The given number $3 + \sqrt{3}$, is irrational.

    Reason: Sum of a rational and an irrational is irrational.

OR

we have to find , $a^a + b^b$

Now putting the values of 'a' and 'b', we get;

$= 3^3 + (-2)^{-2}$

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

$= 27 + \frac{1}{4}$

$= \frac{109}{4}$

17. i. (c) Three type of quadrilaterals can be formed
    ii. (a) Rectangle, parallelogram, kite
    iii. (c) 135^o
    iv. (b) $x < y$
    v. (a) Square
18. i. (b) 96°
    ii. (d) 24°
    iii. (c) 42°
    iv. (c) 180°
    v. (a) $2y + z = 90°$
19. i. (a) $\frac{Minimum\ class\ size}{Class\ size\ of\ this\ class} \times Its\ Frequency$
    ii. (b) 1
    iii. (c) lower limit = 3,upper limit = 5
    iv. (d) 6,3
    v. (a) 16
20. i. (b) 5 cm
    ii. (c) 1540 cm^3
    iii. (d) 523.8 cm^3
    iv. (c) 1.54

v. (a) 314.3 cm²

Part - B

21. $\angle\text{BCA} = \angle\text{ADB} = 40^\circ$ [angles in same segment of a circle are equal]

Now, $\angle\text{BCD} = 70^\circ + 40^\circ = 110^\circ$

$\angle\text{DAB} + \angle\text{BCD} = 180^\circ$

$\angle\text{DAB} + 110^\circ = 180^\circ$

$\angle\text{DAB} = 180^\circ - 110^\circ$

$\Rightarrow \angle DAB = 70^\circ$

22. $\left(\frac{15^{\frac{1}{3}}}{9^{\frac{1}{4}}}\right)^{-6}$

$= \left(\frac{9\overline{4}}{15^{\frac{1}{3}}}\right)^{6}$

$= \left(\frac{3^{2\times\frac{1}{4}}}{15^{\frac{1}{3}}}\right)^{6}$

$= \left(\frac{3^{\frac{1}{2}}}{15^{\frac{1}{3}}}\right)^{6}$

$= \frac{3^{\frac{1}{2}\times 6}}{15^{\frac{1}{3}\times 6}}$

$= \frac{3^3}{15^2} = \frac{27}{225}$

OR

$\frac{1}{\sqrt{2}} = \frac{1}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$ (Rationalize the denominator)

$= \frac{\sqrt{2}}{2}$ (since $\sqrt{2}\cdot\sqrt{2} = 2$)

In this form, it is easy to locate $\frac{1}{\sqrt{2}}$ on the number line. It is halfway between 0 and $\sqrt{2}$

23. We have,

$\frac{0.87\times0.87\times0.87+0.13\times0.13\times0.13}{0.87\times0.87-0.87\times0.13+0.13\times0.13}$

$= \frac{(0.87)^3+(0.13)^3}{(0.87)^2-0.87\times0.13+(0.13)^2}$

$= \frac{a^3+b^3}{a^2-ab+b^2}$, where $a = 0.87$ and $b = 0.13$

$$= \frac{(a+b)(a^2-ab+b^2)}{(a^2-ab+b^2)} = a+b = (0.87+0.13) = 1$$

24. For cinema hall : l = 100 m, b = 50 m, h = 18 m

Volume of the cinema hall = lbh

= 100 × 50 × 18

= 90000 m^3

Volume occupied by 1 person = 150 m^3

Number of persons who can sit in the hall $= \frac{volume\ of\ the\ hall}{volume\ occupied\ by\ one\ person}$

$= \frac{9000}{150}$ = 600

∴ 600 persons can sit in the hall.

25. Let a = 150 cm, b = 120 cm and c = 200 cm

If 's' denotes semi-perimeter then 2s = a + b + c

⇒ s = $\frac{1}{2}$ (a + b + c)

= $\frac{1}{2}$ (200 + 120 + 150)

= 235 cm

Now, area of triangle = $\sqrt{s(s-a)(s-b)(s-c)}$

= $\sqrt{235(235-150)(235-120)(235-200)}$

= $\sqrt{235 \times 85 \times 115 \times 35}$

= 8966.56 cm^2

OR

Let a=18 cm, b=10 cm

Perimeter =42cm

$\therefore a+b+c = 42cm$

So, C=14 cm

$\therefore$ S$= \frac{a+b+c}{2} = \frac{18+10+14}{2}$ = 21 cm

new area of triangles $= \sqrt{21(21-18)\,(21-10)\,(21-14)}$

$= \sqrt{21 \times 3 \times 11 \times 7}$

$=21\sqrt{11}\ sq$ cm

26. We have, ∠AOB = 60°

By degree measure theorem,

∠AOB = 2 ∠ACB

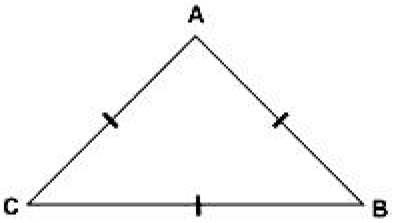
$60^\circ = 2\angle ACB$

$\angle ACB = 30^\circ$

$\therefore x = 30^\circ$.

27. Let ABC is an equilateral triangle. We know that all the sides of an equilateral triangle are equal.

$\therefore AB = BC = CA$ ....(1)



To prove :- $\angle A = \angle B = \angle C = 60^\circ$

Proof :-

In ΔABC we have:-

AB = AC [from (1)]

$\Rightarrow \angle C = \angle B$ ....(2)

[$\because$ Angles opposite to equal sides of a triangle are equal]

Again from (1),

BC = AC

$\Rightarrow \angle A = \angle B$ .....(3)

[$\because$ Angles opposite to equal sides of a triangle are equal] .

From (2) & (3) ;

$\Rightarrow \angle A = \angle B = \angle C$ ....(4)

Now,

$\angle A + \angle B + \angle C = 180^\circ$ [$\because$ Angle sum property of a triangle]

$\Rightarrow \angle A + \angle A + \angle A = 180^\circ$ [From (4)]

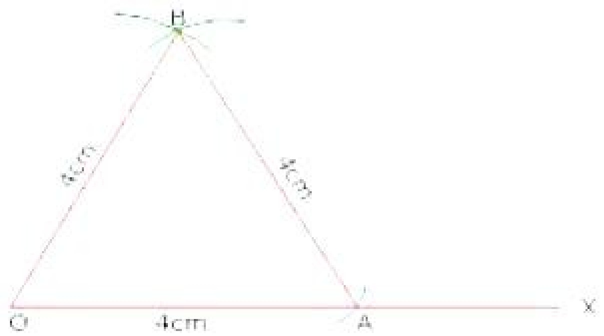
$\Rightarrow 3\angle A = 180^\circ$ |

$\Rightarrow \angle A = \frac{180^\circ}{3} = 60^\circ$

$\therefore \angle A = \angle B = \angle C = 60^\circ$[from (4)].

Hence, each angle of an equilateral triangle is equal to 60°.

28. Steps of Construction:

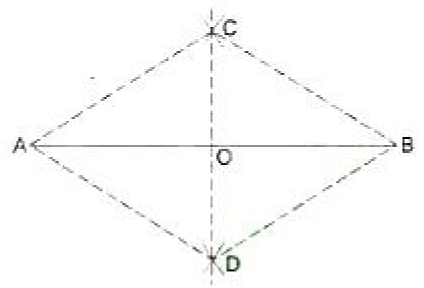


i. Draw a ray OX
ii. Taking O as a centre draw an arc of radius 4cm which cut OX at A.
iii. Now taking O and A as a centre now draw two arcs with radius of 4 cm which intersect each other at B
iv. Join OB and AB
v. ΔOAB is required triangle.

OR

Draw a line segment AB = 6.4 cm.

i. With A as a center and a radius equal to more than half of AB, draw two arcs, one above $\overline{AB}$ and the other below $\overline{AB}$.



ii. With B as a center and the same radius, draw two arcs, cutting the previously drawn arcs at points C and D respectively.
iii. Join $\overline{CD}$, intersecting $\overline{AB}$ at a point O. Then, $\overline{CD}$ is the required perpendicular bisector of $\overline{AB}$ at the point O. On measuring, we find that OA = 3.2 cm and OB = 3.2 cm.
Also, $\angle$AOC = $\angle$BOC = 90°.
Justification:
Join AC, AD, BC, and BD.
In $\triangle$CAD and $\triangle$CBD, we have
AC = BC (arcs of equal radii)

AD = BD (arcs of equal radii)

CD = CD (common)

SSS(SIide-Side-Side) criteria

$\therefore \triangle CAD \cong \triangle CBD$

$\therefore \angle ACO = \angle BCO$ (c.p.c.t.).

Now, in $\triangle AOC$ and $\triangle BOC$, we have

AC = BC (arcs of equal radii)

$\angle ACO = \angle BCO$ (proved above)

CO = CO (common)

SAS(SIide-Angle-Side) criteria

$\therefore \triangle AOC \cong \triangle BOC$.

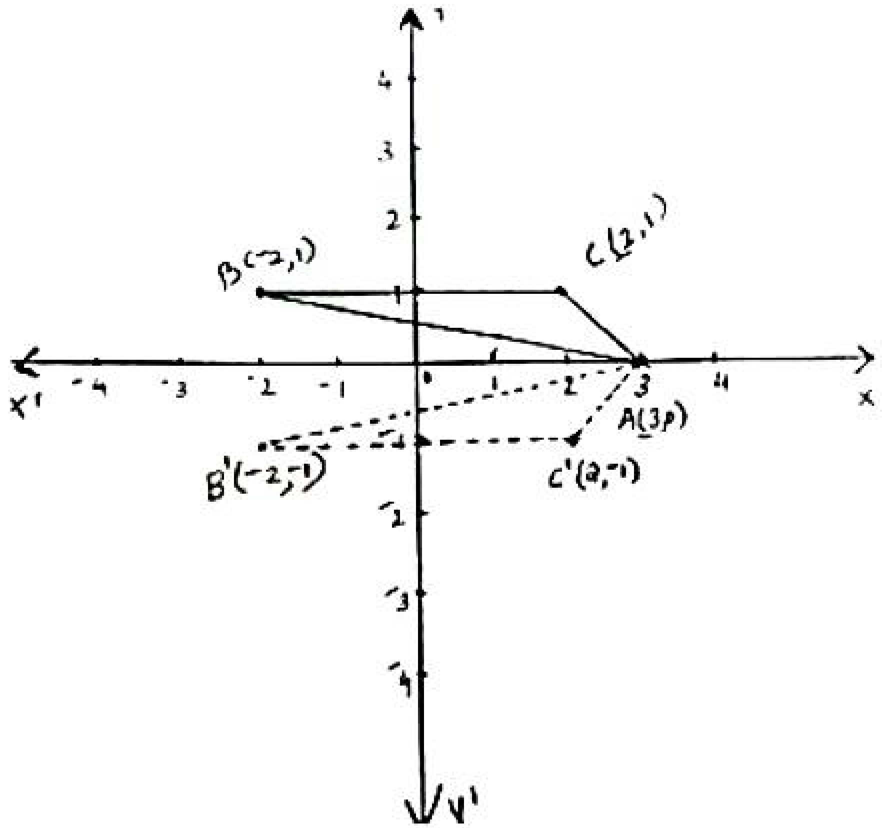
Hence, AO = BO and $\angle AOC = \angle BOC$.

But, $\angle AOC + \angle BOC = 180^\circ$ (linear pair axiom)

$\therefore \angle AOC = \angle BOC = 90^\circ$.

Hence, COD is the perpendicular bisector of $\angle AOB$.

29. Mirror image of A (3, 0), B (-2, 1) and (2, 1) are A' (3, 0), B' (-2, -1), C' (2, -1) respectively.



30. $6x^2 + 5x - 6$

$6x^2+5x-6=6x^2+9x-4x-6$
$=3x\,(2x+3)-2\,(2x+3)$
$=(3x-2)\,(2x+3)\,.$
Therefore, we conclude that on factorizing the polynomial
$6x^2+5x-6\ we\ get\,(3x-2)\,(2x+3)$

OR

We have,

$(a + b)^3 + (b + c)^3 + (c + a)^3 - 3(a + b)(b + c)(c + a)$

[Using $x^3 + y^3 + z^3 - 3xyz = (x + y + z)(x^2 + y^2 + z^2 - xy - yz - xz)$]

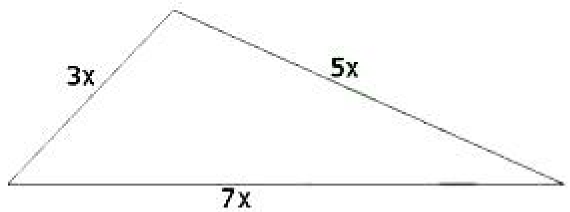
$= \{(a + b) + (b + c) + (c + a)\} \{(a + b)^2 + (b + c)^2 + (c + a)^2 - (a + b) (b + c) - (b + c) (c + a) - (c + a) (a + b)\}$

$= (2a + 2b + 2c) \{(a^2 + 2ab + b^2) + (b^2 + 2bc + c^2) + (c^2 + 2ca + a^2) - (ab + ac + b^2 + bc) - (bc + ab + c^2 + ac) - (ac+ bc + a^2 + ab)\}$

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

$= 2(a + b + c)(a^2+a^2+b^2+b^2+c^2+c^2-a^2-b^2-c^2 + 2ab+2bc+2ac-3ab-3bc-3ac)$

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

31. 

Suppose that the sides in metres are 3x, 5x and 7x.

Then, we know that 3x + 5x + 7x = 300 (Perimeter of the triangle)

Therefore, 15x = 300, which gives x = 20.

So the sides of the triangles are 3×20 m, 5×20 m and 7×20 m

i.e., 60m, 100m and 140m.

We have s = $\frac{60+100+140}{2}$ = 150 m

and area will be = $\sqrt{150(150-60)(150-100)(150-140)}$

= $\sqrt{150\times 90\times 50\times 10}$

= $1500\sqrt{3}$ m^2

32. Let x = $2.0\overline{15}$

Then, $x = 2.0151515...$

$10x = 20.151515...$

$10x = 20 + 0.151515..$ ...(i)

Let $y = 0.151515...$ ...(ii)

100y = 15.151515... (iii)

Subtracting (ii) from (iii), we get

$100_{y\text{ - }y}$ = 15.1515... - 0.151515...

99y = 15

$y = \frac{15}{99} \Rightarrow \quad y = \frac{5}{33}$

Now $10x = 20 + \frac{5}{33} \Rightarrow 10x = \frac{660+5}{33}$

$\Rightarrow 10x = \frac{665}{33}$

$\Rightarrow x = \frac{665}{330} \Rightarrow x = \frac{133}{66}$.

33. We are given that $\angle A - \angle B = 33^\circ$ and $\angle B - \angle C = 18^\circ$

$\Rightarrow \angle A = (33^\circ + \angle B)$ and $\angle C = (\angle B - 18^\circ)$

We know that the sum of the angles of a triangle is 180^o.$\because$ $\angle A + \angle B + \angle C = 180^\circ$

$\Rightarrow (33^\circ + \angle B) + \angle B + (\angle B - 18^\circ) = 180^\circ$ [using (i)]

$\Rightarrow 3\angle B = 165^\circ \Rightarrow \angle B = 55^\circ$

$\therefore \angle A = (33^\circ + \angle B) = (33^\circ + 55^\circ) = 88^\circ$

$\therefore \angle C = (\angle B - 18^\circ) = (55^\circ - 18^\circ) = 37^\circ$

$\therefore \angle A = 88^o$, $\angle B = 55^o$ and $\angle C = 37^o$.

34. We have

2x + 3y = 11 $\Rightarrow y = \frac{(11-2x)}{3}$ ...(i)

Substituting x = 1, we get y = $\frac{(11-2\times1)}{3} = \frac{9}{3}$ = 3

Substituting x = 4, we get y = $\frac{(11-2\times4)}{3} = \frac{3}{3}$ = 1

Substituting x = -2, we get y = $\frac{(11-2\times(-2)\}}{3} = \frac{15}{3}$ = 5

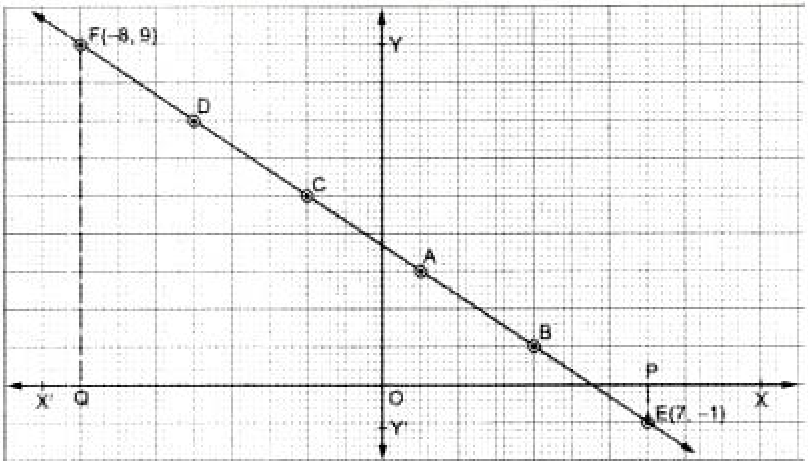
Substituting x = -5, we get y = $\frac{\{11-2\times(-5)\}}{3} = \frac{21}{3}$ = 7

Thus, we have the following table:

x	1	4	-2	-5
y	3	1	5	7

On a graph paper, draw lines X' OX and YOY' as the x-axis and the y-axis respectively.

On this graph paper, plot the points A(1, 3), B(4, 1), C(-2, 5) and D(-5, 7). Join AB, AC and CD to get the straight line BACD. Produce it in both ways to get the required graph.



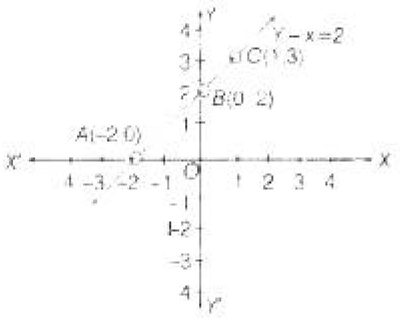
a. On the x-axis, we take a point P for which x = 7, i.e., OP = 7.
   From P, draw PE ⊥ X'OX, meeting DCAB produced at E(7, -1).
   ∴ (x = 7 ⇒ y = -1). Thus, when x = 7, then y = -1.
b. On the x-axis, we take a point Q on LHS of the y-axis, such that OQ = x = - 8.
   From Q, draw Q F⊥ X'O X, meeting BACD produced above at F (-8, 9).
   ∴ (x = -8 ⇒ y = 9). Thus, when x = - 8, then y = 9

OR

Given linear equation can be written as y = 2 + x ...(i)
When x = - 2, then from Eq. (i), we get y = 2 - 2 = 0
When x = 0, then from Eq. (i), we get y = 2
When x = 1, then from Eq. (i), we get y = 2 + 1 = 3
Thus, we get the table

x	0	- 2	1
y	2	0	3

Draw the coordinate axes XOX' and YOY', and plot the points A (- 2,0), B (0, 2) and C (1, 3) by taking a suitable scale. On joining the points A, B and C, we get a straight line AC. Thus, the line AC represents the required graph of the given linear equation in two variables.



35. Total number of students = 38

It is to note there that the class intervals are in inclusive form. This means that the lower and upper limits both are included in a class interval.

i. Number of students whose weight is at most 60 kg i.e. 60 kg or less = 9+5+14+3+1+2 = 34

$\therefore$ Probability that the weight of a student is at most 60 kg = $\frac{34}{38} = \frac{17}{19}$

ii. Number of students whose weight is at least 36 kg = 5+14+3+1+2+2+1+1 = 29

$\therefore$ Probability that the weight of a student is at least 36 kg = $\frac{29}{38}$

iii. Number of students whose weight is not more than 50 kg = 9+5+14+3 = 31

$\therefore$ Probability that the weight of a student is not more than 50 kg= $\frac{31}{38}$

There is no student whose weight is less than 31 kg. Therefore, if we define an event A as the weight of student less than 31 kg,

Then, P(A) = 0

If we define the event B as the weight of a student at least 31 kg,

Then, P(B) = $\frac{38}{38}$ = 1

36. Here, in $\triangle$ABC, D, E, F are the midpoints of the sides BC, CA and AB and respectively.

By midpoint theorem, as F and E are the midpoints of sides AB and AC, FE || BC

Similarly, DE || FB and FD || AC.

Therefore, AFDE, BDEF, and DCEF are all parallelograms.

We know that the opposite angles in a parallelogram are equal.

$\therefore$ In a parallelogram AFDE, we have,

$\angle$A = $\angle$EDF

In a parallelogram BDEF, we have,

$\angle$B = $\angle$DEF

In a parallelogram DCEF, we have,

$\angle$C = $\angle$DFE Hence proved.