CBSE Class 09 Mathematics

Sample Paper 04 (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. Examine, whether $\sqrt{3}+\sqrt{2}$ is rational or irrational.

OR

Find:$125^{\frac{-1}{3}}$

2. Find the zero of the polynomial: g(x) = 5 - 4x
3. Can the experimental probability of an event be a negative number? If not, why?
4. Construct a triangle with base of length 5 cm, the sum of the other two sides 7 cm and one

base angle of 60^o.

5. 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 length of each side of the triangle. (Given, $\sqrt{7}$ = 2.64.)

OR

Find the area of an equilateral triangle having altitude h cm.

6. Write the Co-ordinates of a point which lies on the x-axis and is at a distance of 4 units to the right of origin. Draw its graph.
7. Express 7.010 in the form $\frac{p}{q}$

OR

Find a rational number between $\frac{1}{3}$ and $\frac{1}{2}$

8. Draw the graph of linear equation in two variables: y = 2x
9. Find the ratio between the total surface area of a cylinder to its curved surface area, given that its height and radius are 7.5 cm and 3.5 cm.

OR

The diameter of a garden roller is 1.4 m and it is 2 m long. How much area will it cover in 5 revolutions? (Use π = $\frac{22}{7}$).

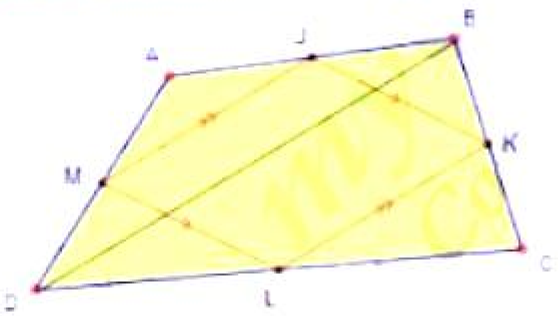
10. Is it polynomial? In case of a polynomial, write its degree: x^{100} - 1
11. Express the following linear equation in the form ax + by + c = 0:
    x - $\frac{y}{2}$ - 5 = 0
12. Factories $x^2 + y - xy - x$
13. Two circles of radii 5 cm and 3 cm intersect at two points and the distance between their centers is 4 cm. Find the length of the common chord.
14. Write the equation in the form ax + by + c = 0 and indicate the values of a, b, c in case: 4y - 3 = $\sqrt{2}x$
15. Write the equation of a line parallel to y-axis and passing through the point (-3, - 7)
16. Without actual division, Find the rational number terminating decimal $\frac{5}{12}$

OR

If $(13)^{\sqrt{x}} = 4^4 - 3^4 - 6$, find x

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

A class teacher gave students coloured paper in the shape of a quadrilateral. She asks him to make a parallelogram from it using paper folding



i. One angle of a quadrilateral is 108° and the remaining three angles are equal, then each of the three equal angles

a. 90°

b. 74°

c. 84°

d. 72°

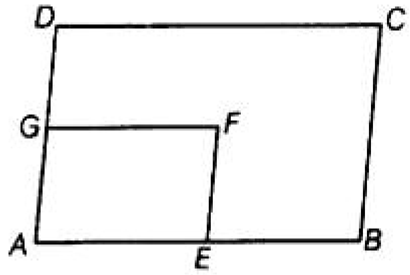
ii. How can a parallelogram be formed by using paper folding?

a. By finding diagonals of the quadrilateral.

b. By joining mid pts. of sides of a quadrilateral
c. By finding angle bisectors
d. None of these

iii. The quadrilateral formed by joining the mid-points of the sides of a quadrilateral PQRS, taken in order, is a rectangle, if
   a. PQRS is a rectangle
   b. PQRS is a parallelogram
   c. diagonals of PQRS are perpendicular
   d. diagonals of PQRS are equal

   In the figure, ABCD and AEFG are two parallelograms. If $\angle C = 60°$, then $\angle F$ is



   a. 30^{o}
   b. 60^{o}
   c. 90^{o}
   d. 120^{o}

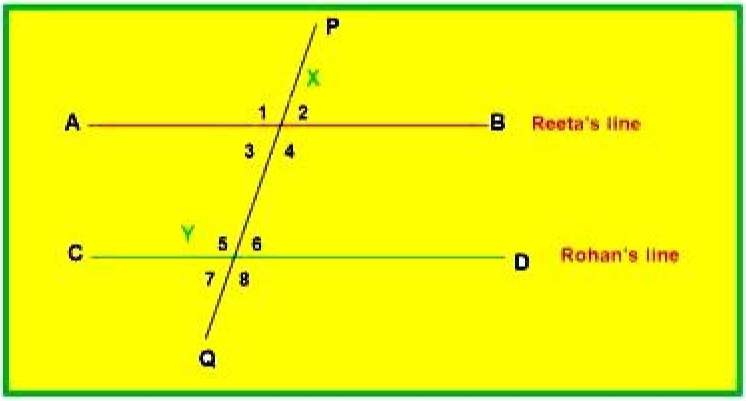
iv. Which of the following is not true for a parallelogram?
   a. Opposite sides are equal
   b. Opposite angles are equal
   c. Opposite angles are bisected by the diagonals
   d. Diagonals bisect each other

v. The angles of the quadrilateral are in the ratio 2:5:4:1?
   Which of the following is true?
   a. The largest angle in the quadrilateral is 150^{o}
   b. The smallest angle is 30^{o}
   c. The second-largest angle in the quadrilateral is 80^{o}
   d. Both the largest angle in the quadrilateral is 150^{o} and The smallest angle is 30^{o}

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

Reeta and Rohan were playing a game on parallel lines and the angles formed with the transverse line(ie alternate angles, corresponding angle and interior angles).

First Reeta drew a straight line AB, then Rohan drew another straight line CD||AB. Further, a transverse line PQ was drawn which intersects lines AB and CD at points X and Y respectively.



Now they did toss with a coin and Rohan won the toss. Following were the rules of the game:

i. Toss winner will ask a question and others will answer.
ii. If the answer is correct then person answering will ask question else questioner will ask next question.
iii. Who wins the last question he/she will be the winner.
iv. Total of 5 questions will be asked.

Based on the above paragraph please answer these questions:

i. Which is the alternate angle to $\angle 6$?
   a. $\angle 1$
   b. $\angle 2$
   c. $\angle 3$
   d. $\angle 4$
ii. Which is the corresponding angle to $\angle 1$?
   a. $\angle 4$
   b. $\angle 5$
   c. $\angle 6$
   d. $\angle 7$
iii. If $\angle 4 = 120°$ then what is measure of $\angle 6$?
   a. 80°
   b. 120°

c. 100°

d. 60°

iv. What is the sum of ∠3 and ∠5?

a. 180°

b. 160°

c. 100°

d. 60°

v. ∠5 is equal to which of the following pair of angles?

a. ∠7 and ∠8

b. ∠6 and ∠7

c. ∠4 and ∠8

d. ∠7 and ∠8

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

The following data given the weight (in grams) of 30 oranges picked from a basket:

106, 107, 76, 109, 187, 95, 125, 92, 70, 139, 128, 100, 88, 84, 99, 113, 204, 141, 136, 123, 90, 115, 110, 97, 90, 107, 75, 80, 118, 82.

Frequency distribution table:

Class Interval	Tally marks	Frequency
60 - 80	|||	3
80 - 100	~~||||~~ ~~||||~~	10
100 - 120	~~||||~~ ||||	9
120 - 140	~~||||~~	5
140 - 160	|	1
160 - 180	-	0
180 - 200	|	1
200 - 220	|	1
Total	**30**	**30**

i. Class Size of given class data
   a. 20
   b. 10
   c. 30
   d. 15
ii. Classmark of forth class
   a. 70
   b. 130
   c. 20
   d. 15
iii. The number of oranges, whose weight is more than 180 g.
   a. 1
   b. 3
   c. 2
   d. 4
iv. The number of oranges, whose weight is less than 100 g.
   a. 10
   b. 3
   c. 5
   d. 13
v. the range of data is
   a. 70
   b. 204
   c. 134
   d. 274

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

Once four friends Rahul, Arun, Ajay and Vijay went for a picnic at a hill station. Due to peak season, they did not get a proper hotel in the city. The weather was fine so they decided to make a conical tent at a park. They were carrying 300 m^2 cloth with them. As shown in the figure they made the tent with height 10 m and diameter 14 m. The remaining cloth was used for the floor.

i. How much Cloth was used for the floor?

a. 31.6 m^2

b. 16 m^2

c. 10 m^2

d. 20 m^2

ii. What was the volume of the tent?

a. 300 m^3

b. 160 m^3

c. 513.3 m^3

d. 500 m^3

iii. What was the area of the floor?

a. 50 m^2

b. 100 m^2

c. 150 m^2

d. 154 m^2

iv. What was the total surface area of the tent?

a. 400 m^2

b. 422.4 m^2

c. 300 m^2

d. 400 m^2

v. What was the latent height of the tent?

a. 12 m

b. 12.2 m

c. 15 m

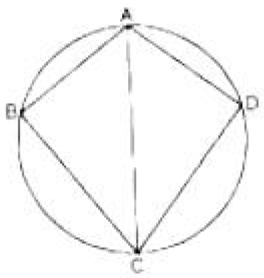
d. 17 m

Part - B

21. In the figure,

i. $\angle BAC = 70^o$ and $\angle DAC = 40^o$, then find $\angle BCD$

ii. $\angle BAC = 60^o$ and $\angle BCA = 60^o$, then find $\angle ADC$



22. Classify the number as rational or irrational: 2 - $\sqrt{5}$

OR

Simplify: $(3\sqrt{5}-5\sqrt{2})(4\sqrt{5}+3\sqrt{2})$

23. Write in the expanded form: $\left(\frac{a}{bc}+\frac{b}{ca}+\frac{c}{ab}\right)^2$

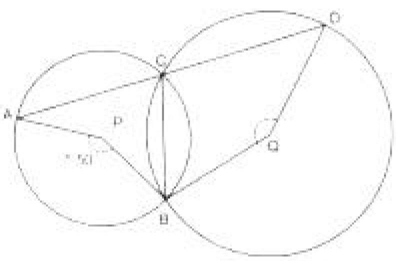
24. The length of a diagonal of a cube is $\sqrt{12}$ cm. What is its edge ?

25. Find the perimeter and area of a triangle whose sides are of length 2cm, 5cm and 5cm.

OR

Find the area of triangle whose side is 42m, 56m and 70m?

26. In a given figure, P and Q are centres of two circles intersecting at B and C. ACD is a straight line. Then, $\angle BQD$ =



27. ABCD is a parallelogram, if the two diagonals are equal, find the measure of $\angle ABC$.
28. Construct an angle of $22\frac{1}{2}^{\circ}$.

OR

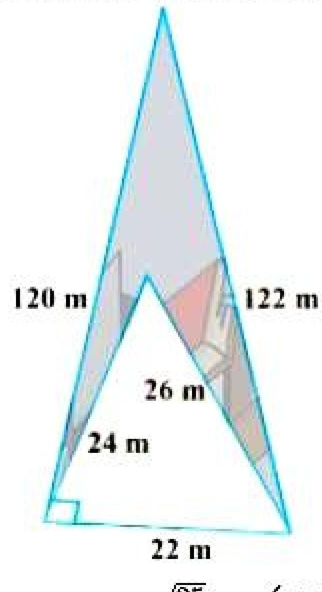
Construct a right-angled triangle whose hypotenuse measures 5 cm and the length of one of whose sides containing the right angle measures 4.5 cm.

29. Draw the graphs of y = x and y = -x in the same graph. Also find the co-ordinates of the point where the two lines intersect.
30. Using factor theorem factorise: $f(x) = x^2 - 5x + 6$

OR

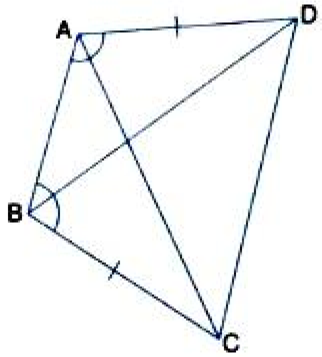
Simplify: $(a + b + c)^2 + (a - b + c)^2 + (a + b - c)^2$

31. Calculate the area of the shaded region in Fig.



32. Simplify: $\frac{\sqrt{25}}{\sqrt[3]{64}} + \left(\frac{256}{625}\right)^{-1/4} + \frac{1}{\left(\frac{64}{125}\right)^{2/3}}$
33. ABCD is a quadrilateral in which AD = BC and $\angle DBA = \angle CBA$. (See figure). Prove that: BD

= AC



34. Draw the graph of the equation $x + 2y - 3 = 0$. From your graph, find the value of y when
   i. $x = 5$
   ii. $x = -5$

OR

Draw the graphs of the linear equations $4x - 3y + 4 = 0$ and $4x + 3y - 20 = 0$. Find the area bounded by these lines and x-axis.

35. A tyre manufacturing company kept a record of the distance covered before a tyre to be replaced. Following table shows the results of 1000 cases.

Distance in km	Less than 400	400 to 900	900 to 1400	More than 1400
Number of tyres	210	325	385	80

If you buy a tyre of this company, what is the probability that:

   i. it will need to be replaced before it has covered 400 km?
   ii. it will last more than 900 km?
   iii. it will need to be replaced after it has covered somewhere between 400 km and 1400 km?
   iv. it will not need to be replaced at all?
   v. It will need to be replaced?

36. ABCD is a rectangle and P, Q, R and S are the mid-points of the sides AB, BC, CD and DA respectively. Show that the quadrilateral PQRS is a rhombus.

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Solution

Part - A

1. We know that , $\sqrt{2}$ is an irrational number. Also, $\sqrt{3}$ is an irrational number. The sum of two irrational numbers is irrational.
   $\therefore \sqrt{3}+\sqrt{2}$ is an irrational number.

OR

$125^{\frac{-1}{3}}$

We know that $a^{-n}=\frac{1}{a^n}$

We conclude that $125^{\frac{-1}{3}}$ can also be written as $\frac{1}{125^{\frac{1}{3}}}$, or $\left(\frac{1}{125}\right)^{\frac{1}{3}}$

We know that $a^{\frac{1}{n}}=\sqrt[n]{a}$, where $a>0.$

We know that $\left(\frac{1}{125}\right)^{\frac{1}{3}}$ can also be written as

$\sqrt[3]{\left(\frac{1}{125}\right)}=\sqrt[3]{\left(\frac{1}{5}\times\frac{1}{5}\times\frac{1}{5}\right)}=\frac{1}{5}$.

Therefore, the value of $125^{\frac{-1}{3}}$ will be $\frac{1}{5}$.

2. Put g(x) = 0
   5 - 4x = 0
   -4x = -5
   x = $\frac{5}{4}$
   x = $\frac{5}{4}$ is the zero of the polynomial g(x).
3. The experimental probability of an event cannot be a negative number since the number of trials in which the event can happen cannot be negative, and the number of trials is always positive.
4. Given : In $\triangle$ABC, base BC = 5 cm., AB + AC = 7 cm and $\angle$ABC = 60^0
   Required : To construct the $\triangle$ABC.
   Steps of construction :
   i. Draw BC = 5 cm.

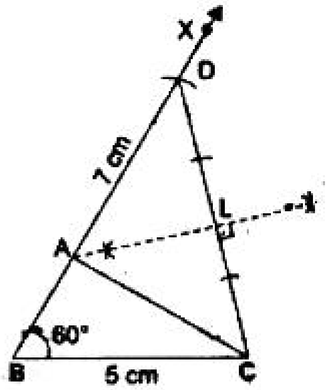
ii. At B construct $\angle CBX = 60^0$

iii. On BX, cut off BD = 7 cm.

iv. Join CD

v. Draw the perpendicular bisector of CD, which intersects BD at some point name it A.

vi. Join AC.



ABC is the required triangle.

5. 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 = 42 cm

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

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

$\Rightarrow \frac{7a}{2} = 42$

$\Rightarrow$ a = 12

So, equal sides of the triangle are 12 cm each.

Also,

Base $= \frac{3}{2}a = \frac{3}{2} \times 12 = 18\text{cm}$

OR

The altitude of an equilateral triangle, having side a is given by

Altitude = $\frac{\sqrt{3}}{2}$ a

Substituting the given value of altitude h, we get

h = $\frac{\sqrt{3}}{2}$ a

a = $\frac{2}{\sqrt{3}}$ h

Area of an equilateral triangle, say A having each side a cm is given by

$A = \frac{\sqrt{3}}{4} a^2$

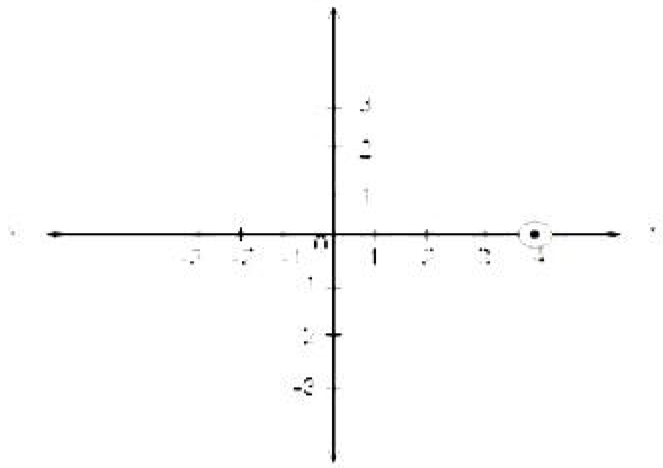
Area of the given equilateral triangle having each equal side equal to $\frac{2}{\sqrt{3}}$ h is given by;

$A = \frac{\sqrt{3}}{4}\left(\frac{2}{\sqrt{3}}h\right)^2$

$A = \frac{\sqrt{3}}{4} \times \frac{4}{3}h^2$

$A = \frac{h^2}{\sqrt{3}}$ cm^2

6. The point will be (4, 0).



7. Given decimal is 7.010

Now we have to express the given decimal number into $\frac{p}{q}$ form

Let $\frac{p}{q}$ = 7.010

$\Rightarrow \frac{p}{q} = \frac{7010}{1000}$

$\Rightarrow \frac{p}{q} = \frac{701}{100}$

Thus, 7.010 = $\frac{701}{100}$ is required $\frac{p}{q}$ form.

OR

$\frac{1}{3} = \frac{1\times8}{3\times8} = \frac{8}{24}$

$\frac{1}{2} = \frac{1\times12}{1\times12} = \frac{12}{24}$

∴required rational number lying between $\frac{1}{3}$ and $\frac{1}{2}$ is $\frac{9}{24}$

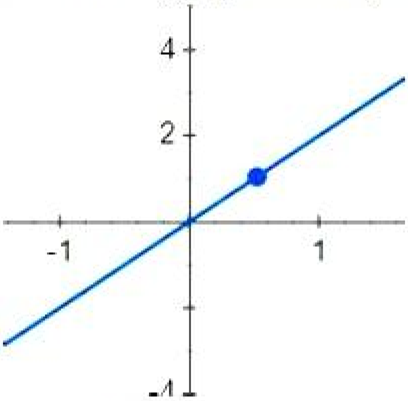
8. Here, y = 2x

Clearly, for x = 0, we have y = 0

and for x = 1 we have y = 2

So, the line passes through (0, 0) and (1, 2)

Hence the graph can be plotted as:



9. For cylinder,

Total surface area = $2\pi r(h + r)$

Curved surface area = $2\pi rh$

$\Rightarrow \frac{Total\ surface\ area}{Curved\ surface\ area} = \frac{2\pi r(h+r)}{2\pi rh} = \frac{h+r}{h}$

$\Rightarrow \frac{Total\ surface\ area}{Curved\ surface\ area} = \frac{7.5+.35}{7.5} = \frac{11}{7.5} = \frac{11\times 10}{75} = \frac{22}{15}$ = 22 : 15

OR

We observe that

Area covered = Curved surface × Number of revolutions.

Here, r = $\frac{1.4}{2}$ m = 0.7 m and h = 2m.

∴ Curved surface = $2\pi rh\ m^2 = 2 \times \frac{22}{7} \times 0.7 \times 2 = 8.8\ m^2$

Hence, Area covered = Curved surface × No. of revolutions = $(8.8 \times 5)m^2 = 44\ m^2$

10. $x^{100} - 1$

The given expression is an expression having only non-negative integral powers of x. Therefore, it is a polynomial. The highest power of x is 100. Therefore, it is a polynomial of degree 100.

11. We have,

$x - \frac{y}{2} - 5 = 0$

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

a = 1, b = $\frac{-1}{2}$ and c = -5

12. $x^2 + y - xy - x$

$x^2 - x + y - xy = x^2 - x - xy + y$

= x (x – 1) – y (x – 1)

$= (x - 1)(x - y)$

13. Let two circles with centres O and O' intersect each other at points A and B. On joining A and B, AB is a common chord.

Radius OA = 5 cm, Radius O'A = 3 cm,

Distance between their centers OO' = 4 cm

In triangle AOO',

$5^2 = 4^2 + 3^2 \Rightarrow 25 = 16 + 9$

$\Rightarrow 25 = 25$

Hence AOO' is a right triangle, right angled at O'.

Since, perpendicular drawn from the center of the circle bisects the chord.

Hence O' is the mid-point of the chord AB. Also O' is the centre of the circle II.

Therefore, length of chord AB = Diameter of circle II

$\therefore$ Length of chord $AB = 2 \times 3 = 6$ cm

14. We have $4y - 3 = \sqrt{2}x \Rightarrow \sqrt{2}x - 4y + 3 = 0$

This is of the form $ax + by + c = 0$, where $a = \sqrt{2}$, $b = -4$ and $c = 3$

15. Equation of a line parallel to y-axis passing through (a, b) is x = a

Thus, equation of a line passing through the point (-3, -7) and parallel to *y*-axis is x = -3

16. Denominator 12 has factors = $2 \times 2 \times 3$

So, 12 has factors other than 2 and 5, thus $\frac{5}{12}$ is not a terminating decimal.

OR

$(13)^{\sqrt{x}} = 4^4 - 3^4 - 6 = 256 - 81 - 6 = 169 = (13)^2$

$(13)^{\sqrt{x}} = 13^2$

Comparing both sides, we get

$\therefore \sqrt{x} = 2$

Squaring, x = 4

17. i. (c) 84^o

ii. (b) By joining mid pts. of sides of a quadrilateral

iii. (b) 60^o

iv. (c) Opposite angles are bisected by the diagonals

v. (d) (a) and (b) both

18. i. (a) $\angle 3$

ii. (b) $\angle 5$

iii. (d) $60°$

iv. (a) $180°$

v. (c) $\angle 4$ and $\angle 8$

19. i. (a) 20

ii. (b) 130

iii. (c) 2

iv. (d) 13

v. (c) 134

20. i. (a) 31.6 m^2

ii. (c) 513.3 m^3

iii. (d) 154 m^2

iv. (b) 422.4 m^2

v. (b) 12.2 m

Part - B

21. i. $\angle BCD = 180^o - \angle BAD$ ($\therefore$ Opposite angles of a cyclic quadrilateral are supplementary)

$= 180^o - (\angle BAC + \angle DAC)$

$= 180^o - (70^o + 40^o) = 70^o$

ii. $\angle CBA = 180^o - (\angle BAC + \angle BCA)$ ($\therefore$Opposite angles of a cyclic quadrilateral are supplementary)

$= 180^o - (60^o + 20^o) = 100^o$

$\angle ADC = 180o - \angle CBA$

$= 180^o - 100^o = 80^o$

22. $2 - \sqrt{5}$

$\because$ 2 is a rational number and $\sqrt{5}$ is an irrational number.

($\because$ The difference of a rational number and an irrational number is irrational.)

$\therefore 2 - \sqrt{5}$ is an irrational number.

OR

$(3\sqrt{5} - 5\sqrt{2})(4\sqrt{5} + 3\sqrt{2})$

$= 3\sqrt{5}(4\sqrt{5} + 3\sqrt{2}) - 5\sqrt{2}(4\sqrt{5} + 3\sqrt{2})$

$= 12 \times 5 + 9\sqrt{10} - 20\sqrt{10} - 15 \times 2$

$= 60 + 9\sqrt{10} - 20\sqrt{10} - 30$

$= 30 - 11\sqrt{10}$

23. We have,

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

Here, $a = \frac{a}{bc}, b = \frac{b}{ca}, c = \frac{c}{ab}$

$\left(\frac{a}{bc} + \frac{b}{ca} + \frac{c}{ab}\right)^2 = \left(\frac{a}{bc}\right)^2 + \left(\frac{b}{ca}\right)^2 + \left(\frac{c}{ab}\right)^2 + 2$

$\left(\frac{a}{bc}\right)\left(\frac{b}{ca}\right) + 2\left(\frac{b}{ca}\right)\left(\frac{c}{ab}\right) + 2\left(\frac{c}{ab}\right)\left(\frac{a}{bc}\right)$

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

24. Let the length of the edge of the cube be a m.

Length of a diagonal of the cube $= \sqrt{a^2 + a^2 + a^2}$

$= \sqrt{3a^2} = \sqrt{3}a$ cm.

According to the question,

$\sqrt{3}a = \sqrt{12}$

$\Rightarrow$ a = $\frac{\sqrt{12}}{\sqrt{3}} = \sqrt{\frac{12}{3}} = \sqrt{4} = 2$

∴ The length of the edge of the cube is 2 cm.

25. Here, a = 2cm, b = 5cm and c = 5cm

∴ Perimeter = a+ b+ c = (2 + 5 + 5) = 12 cm

S = semi perimeter

$\frac{12}{2}$ =6 cm

using Heron's formula,

∴ Area of triangle = $\sqrt{s\ (s-a)\ (\mathrm{s}-\mathrm{b})\ (\mathrm{s}-\mathrm{c})}$ sq cm

= $\sqrt{6\ (6-2)\ (6-5)\ (6-5)}$ sq cm

=$\sqrt{24}$ sq cm

= 4.9 sq cm

OR

S = $\frac{42+56+70}{2}$ m

= $\frac{168}{2}$ m $= 84$ m

∴ Area of Δ ABC = $\sqrt{s\ (\mathrm{s}-\mathrm{a})\ (\mathrm{s}-\mathrm{b})\ (\mathrm{s}-\mathrm{c})}$

$= \sqrt{84\ (84-42)\ (84-56)\ (84-70)}$ sq m

$= 42 \times 28$ sq m

$= 1176$sq m

26. $\angle ACB = \frac{1}{2} \angle APB = \frac{1}{2} \times 150^o = 75^o$

(Angle at the centre is double the angle at the circumference subtended by the same chord)

$\angle ACB + \angle BCD = 180^o$ (Straight line)

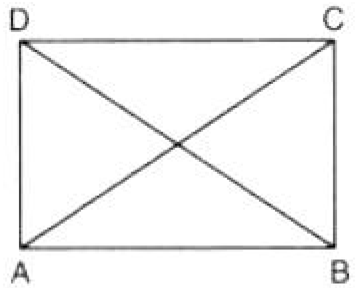
Also, $\angle BCD = \frac{1}{2}$ reflex $\angle BQD = \frac{1}{2}(360^o - x^o)$ [let $\angle BQD = x^o$]

(Angle at the center is double the angle at the circumference subtended by the same chord)

$\Rightarrow 105^o = 180^o - \frac{x}{2}$

$\therefore x^o = 2(180^o - 105^o) = 2(75^o) = 150^o$

$\Rightarrow \angle BQD = x^o = 150^o$

27. 

Given: ABCD is a parallelogram and AC = DB

To find: $\angle ABC$.

Solution: Since ABCD is a parallelogram. Therefore,

Consider $\triangle ABD$ and $\triangle ACB$, we have

AD = BC [$\because$ Opposite sides of a parallelogram are equal]

BD = AC [$\because$ Opposite sides of a parallelogram are equal]

and, AB = AB [Common]

$\triangle ABD \cong \triangle ACB$ [By SSS criterion of congruence]

$\Rightarrow \angle BAD = \angle ABC$ [CPCT] ...(i)

Now, AD || BC and transversal AB intersects them at A and B respectively.

The sum of the interior angles on the same side of a transversal is 180°.

$\therefore \angle BAD + \angle ABC = 180^o$

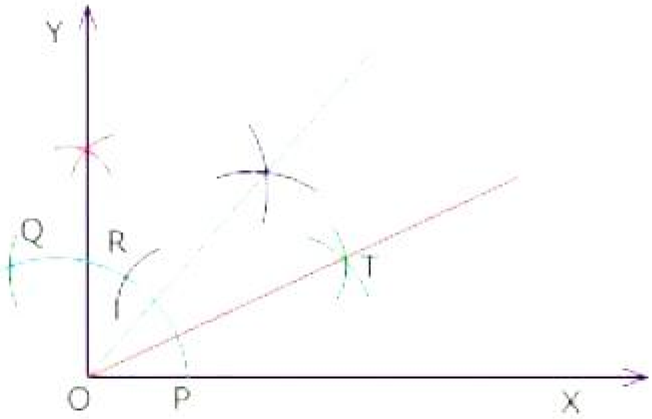
$\Rightarrow \angle ABC + \angle ABC = 180^o$ [Using (i)]

$\Rightarrow 2\angle ABC = 180^{\circ}$

$\Rightarrow \angle ABC = 90^{\circ}$

Hence, the measure of $\angle ABC$ is 90°.

28. Steps of construction:



i. Draw ray OX
ii. Draw $\angle XOY = 90^{\circ}$
iii. Bisect $\angle XOY$
iv. Then, $\angle ROP = 45^{\circ}$
v. Now bisect angle $\angle ROP$
vi. Then, $\angle TOP$ is required angle $= 22\frac{1}{2} = \frac{45^{\circ}}{2}$

OR

GIVEN

- hypotenuse measures 5 cm and the length sides containing the right angle measures 4.5 cm.

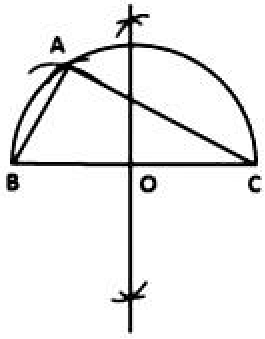
TO CONSTRUCT

- right-angled triangle

STEP OF CONSTRUCTION

i. Draw a line segment BC = 5 cm.
ii. Find the midpoint O of BC.
iii. With O as centre and radius OB, draw a semicircle on BC.
iv. With B as centre and radius equal to 4.5 cm, draw an arc, cutting the semicircle at A.
v. Join AB and AC.

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



29. y = x

We have, y = x

Let x = 1 : y = 1

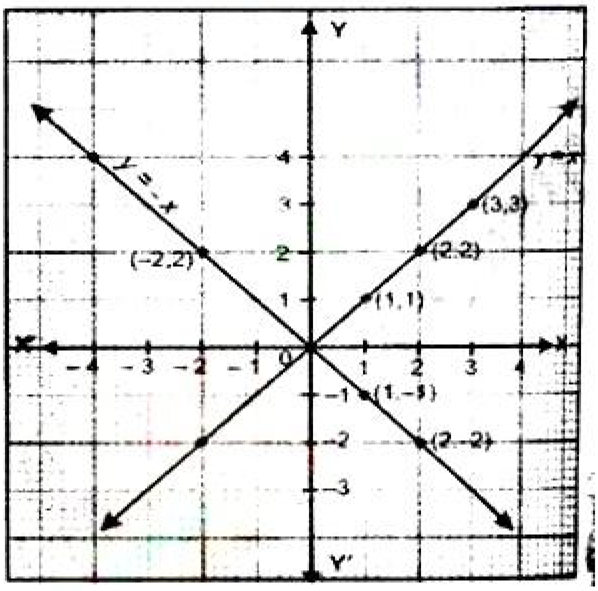
Let x = 2 : y = 2

Let x = 3 : y = 3

Thus, we have the following table :

x	1	2	3
y	1	2	3

By plotting the points (1, 1), (2, 2) and (3, 3) on the graph paper and joining them by a line, we obtain the graph of y = x.



y = -x

We have, y = -x

Let x = 1 : y = -1

Let x = 2 : y = -2

Let x = -2 : y = -(-2) = 2

Thus, we have the following table exhibiting the abscissa and ordinates of the points of the line represented by the equation y = -x.

x	1	2	-2
y	-1	-2	2

Now, plot the points (1, -1), (2, -2) and (-2, 2) and join them by a line to obtain the line represented by the equation y = -x.

The graphs of the lines y = x and y = -x are shown in figure.

Two lines intersect at O (0, 0).

30. $f(x) \ = \ x^2 - \ 5x \ + \ 6$

Put x = 1 f(1) = $1^2 - 5 \times 1 + 6 = 2 \neq 0$

$Put x = 2 f(2) = 2^2 - 5 \times 2 + 6 = 4 - 10 + 6 = 0$

$\therefore x - 2 \ is \ factor \ of \ f(x)$

Therefore, to find the other factor, we divide the given polynomial by x - 2,

$$x - 3$$

$$x - 2 \overline{) \ x^2 - 5x + 6}$$

$$x^2 - 2x$$

$$- \quad +$$

$$\overline{-3x + 6}$$

$$\underline{-3x + 6}$$

$$0$$

Therefore, $x^2 - 5x + 6 = (x - 2)(x - 3)$

OR

on using the identity,

$(x + y + z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2xz$

Therefore,we have,

$(a + b + c)^2 + (a - b + c)^2 + (a + b - c)^2$

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

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

2ac}

= $3a^2 + 3b^2 + 3c^2 + 2ab - 2bc + 2ca$

31. For the triangle having the sides 122 m, 120 m and 22 m:

$s = \frac{122+120+22}{2} = 132$

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

$= \sqrt{132(132-122)(132-120)(132-22)}$

$= \sqrt{132 \times 10 \times 12 \times 110}$

= 1320 m^2

For the triangle having the side 22m, 24m and 26m:

$s = \frac{22+24+26}{2} = 36$

Area of the triangle $= \sqrt{36(36-22)(36-24)(36-26)}$

$= \sqrt{36 \times 14 \times 12 \times 10}$

$= 24\sqrt{105}$

= 24×10.25 m^2 (approx.)

= 246 cm^2

Therefore, the area of the shaded portion.

= Area of larger triangle - Area of smaller (shaded) triangle.

= (1320 - 246) m^2

= 1074 m^2

32. Given, $\frac{\sqrt{25}}{\sqrt[3]{64}} + \left(\frac{256}{625}\right)^{-1/4} + \frac{1}{\left(\frac{64}{125}\right)^{2/3}}$

$= \frac{\sqrt{5\times5}}{\sqrt[3]{4\times4\times4}} + \left(\frac{625}{256}\right)^{1/4} + \left(\frac{125}{64}\right)^{2/3}$

$= \frac{5}{4} + \left(\frac{5^4}{4^4}\right)^{1/4} + \left(\frac{5^3}{4^3}\right)^{2/3}$

$= \frac{5}{4} + \left(\frac{5}{4}\right)^{4\times\frac{1}{4}} + \left(\frac{5}{4}\right)^{3\times\frac{2}{3}}$

$= \frac{5}{4} + \frac{5}{4} + \left(\frac{5}{4}\right)^2 = \frac{5}{4} + \frac{5}{4} + \frac{25}{16}$

$= \frac{20+20+25}{16} = \frac{65}{16}$

33. Since

$\Delta ABD \cong \Delta BAC$

$\therefore$ BD=AC[By C.P.C.T.]

34. Given equation: x + 2y - 3 = 0 Or, x + 2y = 3

When y = 0, x + 0 = 3 ⇒ x = 3

When y = 1, x + 2 = 3 ⇒ x = 3-2 = 1

When y = 2, x + 4 = 3 ⇒ x = 3 - 4 = -1

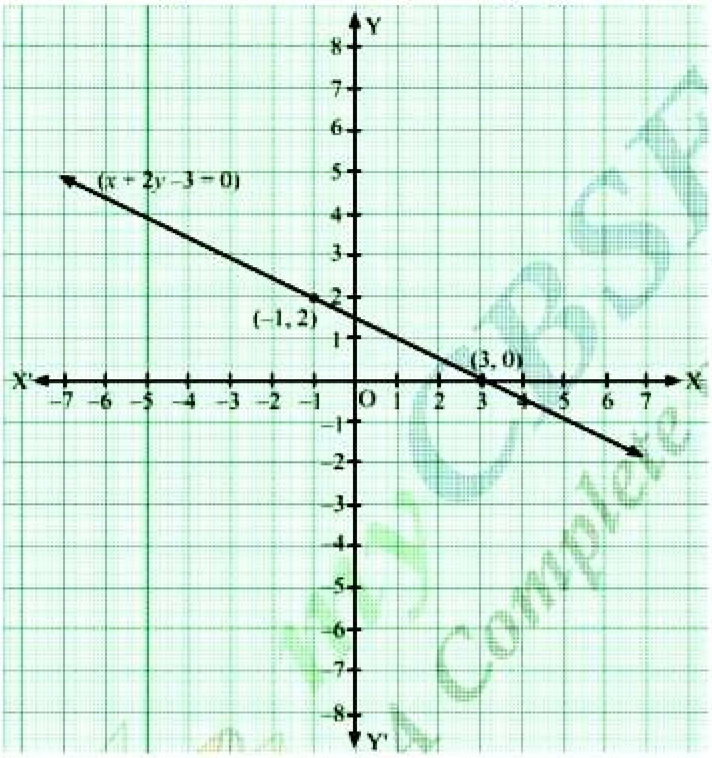
Thus, we have the following table:

x	3	1	-1
y	0	1	2

Now plot the points (3,0) ,(1,1) and (-1,2) on the graph paper.

Join the points and extend the line in both the directions.

The line segment is the required graph of the equation.



When x = 5,

$y = \frac{3-x}{2}$

$y = \frac{3-x}{2}$

$y = -1$

Similarly, from the graph we can see that when $x = -5$, y = -1. Hence the required results

OR

We have,

4x - 3y + 4 = 0

⇒ 4x = 3y - 4

⇒ x = $\frac{3y-4}{4}$

Putting y = 0, we get x = $\frac{3\times0-4}{4}$ = -1

Putting y = 4, we get x = $\frac{3\times4-4}{4}$ = 2

Thus, we have the following table for the points on the line 4x - 3y + 4 = 0

x	-1	2
y	0	4

We have,

4x + 3y - 20 = 0

⇒ 4x = 20 - 3y

⇒ x = $\frac{20-3y}{4}$

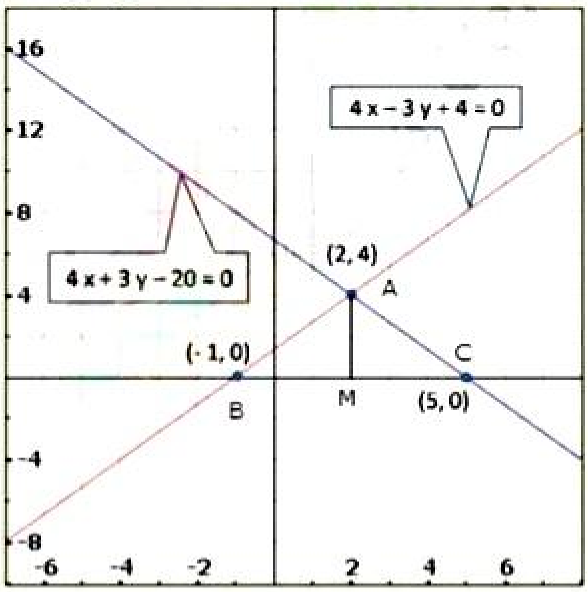
Putting y = 0, we get x = $\frac{20-3\times0}{4}$ = 5

Putting y = 4, we get x = $\frac{20-3\times4}{4}$ = 2

Thus, we have the following table for the points on the line 4x + 3y -20 = 0

x	5	2
y	0	4

The graphs of the two lines is shown below:



Clearly, two lines intersect at A(2, 4)

The graphs of the lines $4x - 3y + 4 = 0$ and $4x + 3y - 20 = 0$ intersect with x-axis at B(-1, 0) and C(5,0) respectively.

$\therefore$ Area of $\triangle ABC = \frac{1}{2}(\text{Base} \times \text{Height})$

$= \frac{1}{2}(BC \times AM)$

$= \frac{1}{2}(6 \times 4)$

$= 3 \times 4$

= 12 sq.units

$\therefore$ Area of $\triangle ABC$ = 12 sq.units.

35. We have,

Total number of trials = 1000

i. The number of tyres that needs to be replaced before it has covered 400 km = 210

$\therefore$ The probability that a tyre will need to be replaced before it has covered 400 km = $\frac{210}{1000} = 0.21$

ii. The number of tyres that last more than 900 km = 385 + 80 = 465

$\therefore$ Probability that a tyre will last more than 900 km = $\frac{465}{1000} = 0.465$

iii. The number of tyres which require replacement after covering the distance between 400 km

and 1400 km = 325 + 385 = 710

$\therefore$ The probability that a tyre will require replacement between 400 km and 1400 km = $\frac{710}{1000} = 0.71$

iv. The number of tyres that do not need to be replaced at all = 0

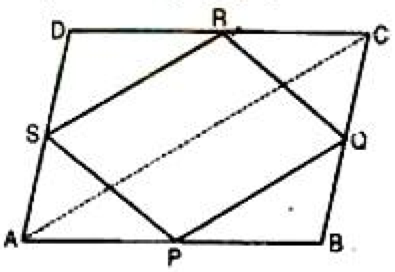
$\therefore$ The probability that a tyres do not need be replaced = $\frac{0}{1000} = 0$

v. Since all the tyres we have considered to be replaced, so

The probability that a tyre needs to be replaced = $\frac{1000}{1000} = 1$

36. Given: A rectangle ABCD in which P, Q, R and S are the mid-points of the sides AB, BC, CD and DA

respectively. PQ, QR, RS and SP are joined.



To prove: PQRS is a rhombus.

Construction: Join AC.

Proof: In $\triangle$ABC, P and Q are the mid-points of sides AB, BC respectively.

$\therefore$ PQ || AC and PQ = $\frac{1}{2}$ AC..........(i)

In $\triangle$ADC, R and S are the mid-points of sides CD, AD respectively.

$\therefore$ SR || AC and SR = $\frac{1}{2}$ AC..........(ii)

From eq. (i) and (ii), PQ || SR and PQ = SR..........(iii)

$\therefore$ PQRS is a parallelogram.

Now ABCD is a rectangle.[Given]

$\therefore$ AD = BC

$\Rightarrow \frac{1}{2}$ AD = $\frac{1}{2}$ BC $\Rightarrow$ AS = BQ..........(iv)

In triangles APS and BPQ,

AP = BP [P is the mid-point of AB]

$\angle$PAS = $\angle$PBQ [Each 90^{o}]

And AS = BQ [From eq. (iv)]

$\therefore$ $\triangle$APS $\cong$ $\triangle$BPQ[By SAS congruency]

$\Rightarrow$ PS = PQ [By C.P.C.T.].........(v)

From eq. (iii) and (v), we get that PQRS is a parallelogram.

Since, PS = PQ

$\Rightarrow$ Two adjacent sides are equal.

Hence, PQRS is a rhombus.