CBSE Class 09 Mathematics

Sample Paper 06 (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. Rationalise the denominator of the following: $\frac{1}{\sqrt{12}}$

   OR

   Simplify $(27)^{2/3}$.
2. Classify the polynomial as polynomial in one-variable or two variables etc: $x^2 - xy + 7y^2$
3. An Insurance company selected 2000 drivers at random in a particular city to find a relationship between age and accidents. The data obtained are given in the following table:

Age of drivers (In years)	Accidents in one year				
	0	1	2	3	over 3
18-29	440	160	110	61	35
30-50	505	125	60	22	18
Above 50	360	45	35	15	9

Find the probabilities of the events for a driver chosen at random from the city being 18-29 years of age and having exactly 3 accidents in one year

4. Whether the given reasons to show that the construction of $\triangle ABC$ is not possible: BC = 5 cm, $\angle B = 80°$, $\angle C = 90°$ and $\angle A = 60°$.
5. Find the base of an isosceles triangles whose area is 12cm and the length of one of the equal side is 5cm.

OR

The area of a trapezium is 475 cm^2 and the height is 19 cm. Find the lengths of its two parallel sides if one side is 4 cm greater than the other.

6. A solid metallic cuboid of dimensions (9 m × 8 m × 2 m) is melted and recast into solid cubes of edge 2 m. Find the number of cubes so formed.
7. Rationalise the donominator of the following $\frac{3}{\sqrt{5}}$

OR

Is $\sqrt{\frac{9}{27}}$ a rational number?

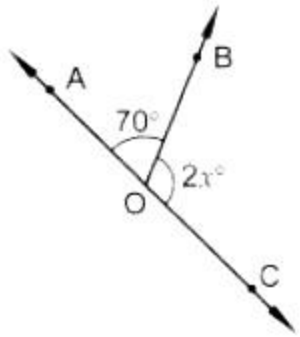
8. For what value of p the point (p, 2) lies on the line 3x + y = 11?
9. Find the edge of a cube whose surface area is 432 m^2.

OR

Find the lateral surface area and total surface area of a cube of edge 10 cm.

10. Is it polynomial? In case of a polynomial write its degree: $x^3 - 5x + 2$

11. Check whether $\left(\frac{1}{2}, -5\right)$ is the solution of the equation 2x - y = 6 or not.
12. Factorise: $x^2 + 3x + x + 3$
13. In Figure, AOC is a line, find x.

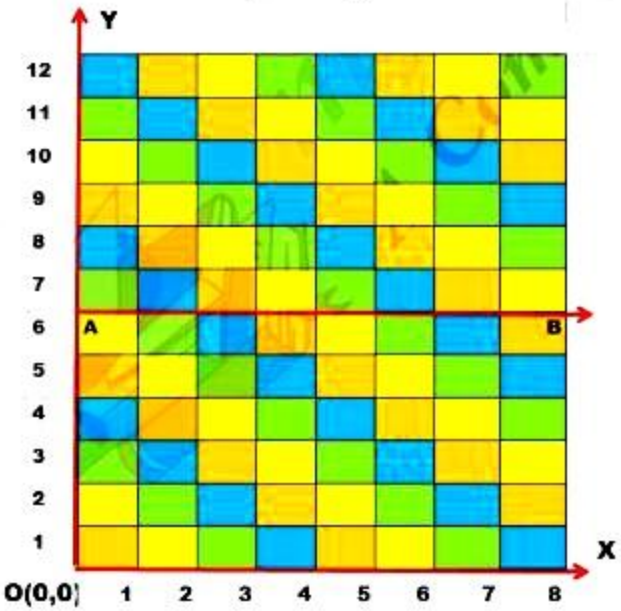


14. Express linear equation in the form ax + by + c = 0 and indicate the values of a, b and in case: -2x + 3y = 12
15. Express of the equations in the form ax + by + c = 0 and indicate the values of a, b, c in case: $2x - \frac{y}{5} + 6 = 0$
16. Simplify $(36)^{1/2}$.

OR

Which of the following rational numbers have terminating decimal representation
(i) $\frac{3}{5}$ (ii) $\frac{2}{13}$ (iii) $\frac{40}{27}$ (iv) $\frac{23}{7}$

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



Roshan decorated one of his bathroom wall with tiles as shown in the picture. He was having tiles of four colours orange, yellow, green and blue. He fitted the tiles in 8 columns

and 12 rows. The size of one tile was 1 foot × 1 foot and the area of each tile is 1 foot^2. He arranged the tile in such a way that colour of tiles in each row and column were in the pattern: **Orange-> Yellow-> green->Blue->Orange**->..... and so on.

Now answer the following questions:

i. Which colour tile was fitted at the point with coordinates (5, 3)?
   a. Orange
   b. Yellow
   c. Green
   d. Blue

ii. Which colour tile was fitted at the point with coordinates (7, 7)?
   a. Orange
   b. Yellow
   c. Green
   d. Blue

iii. Which colour tile was fitted at the point with coordinate (2,5)?
   a. Orange
   b. Yellow
   c. Green
   d. Blue

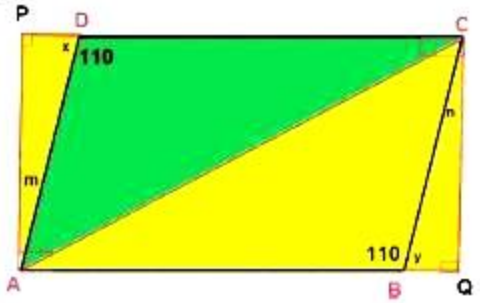
iv. What is the area of the tiles fitted in the rectangular part OABX?
   a. 50 foot^2
   b. 24 foot^2
   c. 12 foot^2
   d. 48 foot^2

v. What is the ordinate of top row tiles?
   a. 8
   b. 12
   c. 16
   d. 6

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

In the middle of the city, there was a park ABCD in the form of a parallelogram form so that AB=CD, AB||CD and AD = BC, AD || BC

Municipality converted this park into a rectangular form by adding land in the form of ΔAPD and Δ BCQ. Both the triangular shape of land were covered by planting flower plants.



Answer the following questions:

i. What is the value of ∠x?
   a. 110°
   b. 70°
   c. 90°
   d. 100°

ii. ΔAPD and Δ BCQ are congruent by which criteria?
   a. SSS
   b. SAS
   c. ASA
   d. RHS

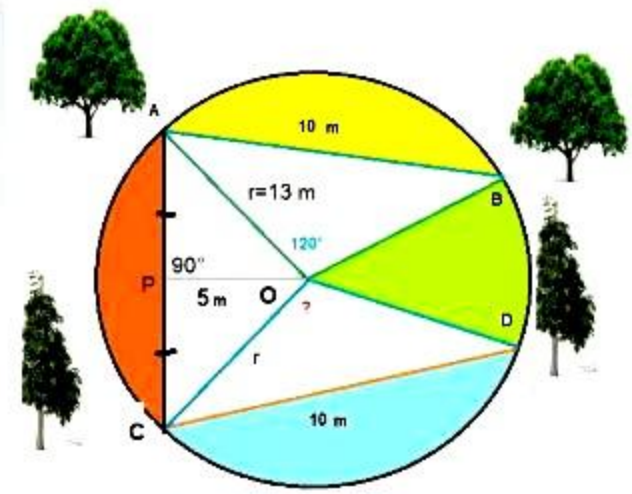
iii. PD is equal to which side?
   a. DC
   b. AB
   c. BC
   d. BQ

iv. ΔABC and ΔACD are congruent by which criteria?
   a. SSS
   b. SAS
   c. ASA
   d. RHS

v. What is the value of ∠m?
   a. 110°
   b. 70°
   c. 90°

d. 20°

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



A farmer has a circular garden as shown in the picture above. He has a different type of trees, plants and flower plants in his garden.

In the garden, there are two mango trees A and B at a distance of AB = 10 m. Similarly, he has two Ashoka trees at the same distance of 10 m as shown at C and D

AB subtends ∠AOB = 120° at the center O, The perpendicular distance of AC from center is 5 m. The radius of the circle is 13 m.

Now answer the following questions:

i. What is the value of ∠COD?
   a. 60°
   b. 120°
   c. 100°
   d. 80°

ii. What is the distance between mango tree A and Ashok tree C?
   a. 12 m
   b. 24 m
   c. 13 m
   d. 15 m

iii. What is the value of ∠OAB?
   a. 60°
   b. 120°
   c. 30°

d. 90°

iv. What is the value of ∠OCD?

a. 30°

b. 120°

c. 60°

d. 90°

v. What is the value of ∠ODC?

a. 90°

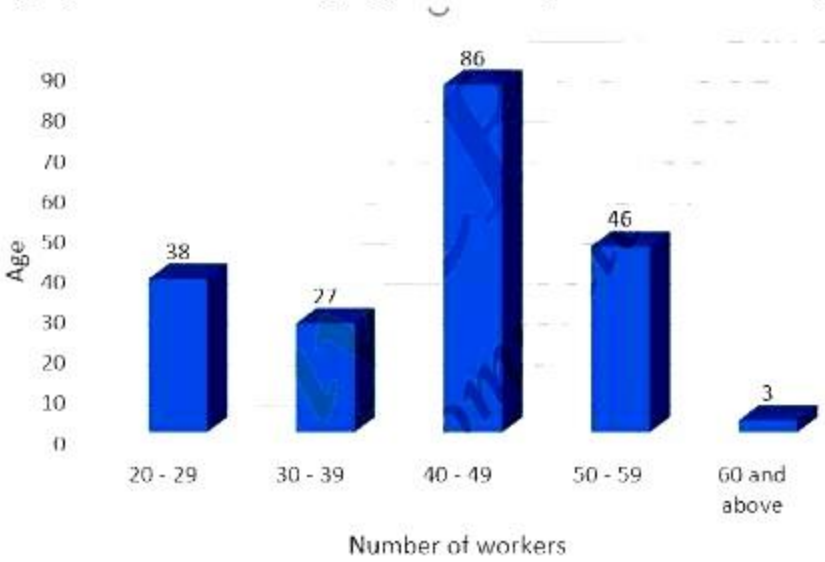
b. 120°

c. 60°

d. 30°

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

A recent survey by a labour organization of the state government of Odisha found that the wages of workers in a factory for different age groups are distributed as given in the bar graph. Read the bar graph carefully and answer the questions that follow.



If a person is selected at random, find the probability that the person is:

i. 40 years or more

a. 0.675

b. 0.576

c. 0.86

d. 0.10

ii. under 40 years

a. 0

b. 0.325

c. 0.531

d. 0.27

iii. having age from 30 to 39 years

a. 0.553

b. 0.513

c. 0.135

d. 0.125

iv. under 60 but above 39 years

a. 0.62

b. 0.66

c. 0.55

d. 0.02

v. not less than 20 years

a. 0

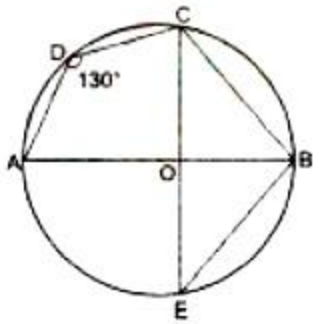
b. 1.03

c. 0.01

d. 1

Part - B

21. In the given figure, $\angle ADC = 130°$ and chord BC = chord BE. Find $\angle CBE$.

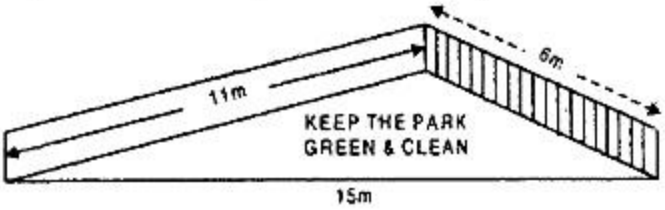


22. Prove that: $\frac{2^{30}+2^{29}+2^{28}}{2^{31}+2^{30}-2^{29}} = \frac{7}{10}$.

OR

Rationalise the denominator of: $\frac{4}{\sqrt{11}-\sqrt{7}}$.

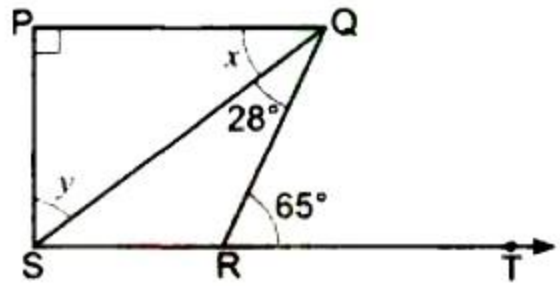
23. Use suitable identity to find the product: (x + 4)(x + 10)
24. It is required to make a closed cylindrical tank of height 1 m and base diameter 140 cm from a metal sheet. How many square meters of the sheet are required for the same?
25. There is slide in a park. One of its side walls has been painted in some colour with a message KEEP THE PARK GREEN AND CLEAN, (see figure). If the sides of the wall are 15 m, 11 m and 6 m, find the area painted in colour.



OR

The side of a triangular field is 52m, 56m, and 60m find the cost of levelling the field Rs 18 per meter if a space of 4 cm is to be left for entry gate.

26. ABCD is a rectangle and P, Q, R and S are mid-points of the sides AB, BC, CD and DA respectively. Show that quadrilateral PQRS is a rhombus.
27. In Fig., If $PQ \perp PS$, $PQ \| SR$, $\angle SQR = 28^\circ$ and $\angle QRT = 65^\circ$, then find the value of x and y.



28. Construct a $\triangle$ABC, in which BC = 10 cm $\angle$B = 45° and AB - AC = 5 cm. Give justification.

OR

Construct a triangle ABC in which BC = 7cm $\angle$B = 75° and AB + AC = 9cm.

29. The cost of preparing the walls of a room 12 m long at the rate of Rs.1.35 per square metre is Rs.340.20 and the cost of matting the floor at 85 paise per square metre is

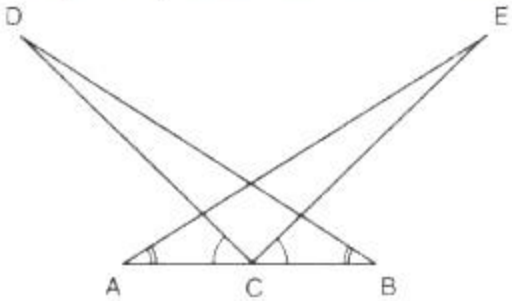
Rs.91.80. Find the height of the room.

30. Factorize:$8a^3 + b^3 + 12a^2b + 6ab^2$

OR

Using suitable identity expand $\left(\frac{5}{2}x + \frac{3}{4}\right)^3$

31. A traffic signal board indicating 'school ahead' is an equilateral triangle with side 'a' find the area of the signal board using heron's formula. Its perimeter is 180 cm, what will be Its area?
32. If $3^x = 5^y = (75)^z$, show that z = $\frac{xy}{2x+y}$.
33. In figure, AC = BC, ∠DCA = ∠ECB and ∠DBC = ∠EAC. Prov triangles DBC and EAC are congruent, and hence DC = EC and BD = AE.



34. 70 students from a locality use different modes of transport to go to school as given below:

Mode of transport	Car	Bus	Scooter	Bicycle	Rickshaw
Number of students	4	27	11	20	8

Draw the bar graph representing the above data.

OR

Draw the graphs of the following linear equations on the same graph paper:

2x + 3y = 12, x - y = 1

Find the coordinates of the vertices of the triangle formed by the two straight lines and y-axis.

35. Given below is the frequency distribution of daily wages (in Rs.) of 30 workers in a certain factory

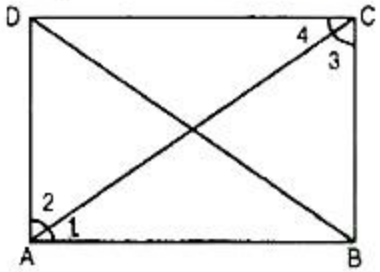
Daily wages (in Rs.)	110-130	130-150	150-170	170-190	190-210	210-230	230-250
Number of workers	3	4	5	6	5	4	3

A worker is selected at random. Find the probability that his wage is

i. less than Rs.150
ii. atleast Rs.210
iii. more than or equal to Rs. 150 but less than Rs.210
iv. in the interval Rs.190 - Rs.250

36. ABCD is a rectangle in which diagonal BD bisects $\angle B$ as well as $\angle D$. Show that:

i. ABCD is a square.
ii. Diagonal BD bisects both $\angle B$ as well as $\angle D$.



CBSE Class 09 Mathematics

Sample Paper 06 (2020-21)

Solution

Part - A

1. We have,

   $\frac{1}{\sqrt{12}} = \frac{1}{\sqrt{4\times3}} = \frac{1}{2\sqrt{3}} = \frac{1}{2\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$

   $= \frac{\sqrt{3}}{2(\sqrt{3})^2}$

   $= \frac{\sqrt{3}}{6}$

   $\therefore \frac{1}{\sqrt{12}} = \frac{\sqrt{3}}{6}$

   OR

   We have,

   $(27)^{2/3} = (3^3)^{2/3} = 3^{\left(3\times\frac{2}{3}\right)} = 3^2 = 9$

2. It is a polynomial in two variables as two variables x and y are involved.
3. Number of drivers who are 18-29 years old and have exactly 3 accidents in one year is 61.

   Therefore, P (driver is 18—29 years old with exactly 3 accidents) = $\frac{61}{2000}$

   $= 0.0305 = 0.031$
4. Given,

   BC = 5 cm, $\angle$B = 80°, $\angle$C = 50° and $\angle$A = 60°

   We know that the sum of the measures of three angles of a triangle is 180°.

   Here, we find that

   $\angle$A + $\angle$B + $\angle$C = 60° + 80° + 50° = 190° > 180°

   sum of triangle is more than 180°

   Hence, the construction of triangle ABC with given measurements is not possible.
5. $\therefore$ Area of an isosceles triangle = $\frac{a}{4}\sqrt{4b^2 - a^2}$, where a is thelength of base and b is the length of one of the equal side.

   $\therefore \frac{a}{4}\sqrt{4b^2 - a^2}$ = 12

   or $\frac{a}{4}\sqrt{100 - a^2}$ = 12

   Squaring both sides, we have

$a^2\left(100-a^2\right)$ = 144×16

$a^2\left(100-a^2\right)$= 2304

or a^4-100a^2+2304 = 0

$a^4-64a^2-36a^2+2304$

or $\left(a^2-64\right)\ \left(a^2-36\right)$ = 0

∴ Either a^2 = 64 i.e. a = $\pm$ 8

or

a^2 = 36 i.e. a = $\pm$ 6

∴ Required base = 8 cm or 6 cm

OR

Area of trapezium = $\frac{1}{2}$ × (Sum of the parallel side) × height

$\Rightarrow\ 475=\frac{1}{2}\times(x+x+4)\times 19cm$

$\Rightarrow\ 2x+4=\frac{950}{19}=50$

$\Rightarrow\ 2x=50-4=46; x=46\div 2=23$

Hence, the length of two parallel sides are 23 cm and (23 + 4) cm i.e., 23 cm and 27 cm.

6. Volume of a cuboid = (9 × 8 × 2) m^3 = 144 m^3

   Volume of each cube of edge 2 m = (2 m)^3 = 8 m^3

   Therefore Number of cubes formed = $\frac{\text{Volume of a cuboid}}{\text{Volume of each cube}}=\frac{144}{8}$=18 cubes.

7. We have,

   $\frac{3}{\sqrt{5}}=\frac{3}{\sqrt{5}}\times\frac{\sqrt{5}}{\sqrt{5}}$

   $=\frac{3\sqrt{5}}{(\sqrt{5})^2}$

   $=\frac{3\sqrt{5}}{5}$

   ∴ $\frac{3}{\sqrt{5}}=\frac{3\sqrt{5}}{5}$

OR

$\sqrt{\frac{9}{27}}=\frac{1}{\sqrt{3}}$, which is the quotient of a rational and an irrational number and therefore an irrational number.

8. The point $(p, 2)$ lies on $3x+y=11$

   $\therefore 3p+2=11$

$\Rightarrow p = \frac{9}{3} = 3$

9. Given,

   Surface area of cube = 432 m^2

   Let edge of cube = a m

   Surface area of cube = $6a^2 = 432$

   $\Rightarrow a^2 = \frac{432}{6} = 72$

   $\Rightarrow a = \sqrt{36 \times 2} = 6\sqrt{2}m$

   OR

   Given, edge a of cube = 10 cm

   Lateral surface = $4a^2$

   $= 4 \times 100 = 400\ cm^2$

   Total surface area = $6a^2$

   $= 6 \times 100 = 600\ cm^2$

10. Since $x^3 - 5x + 2$ is an expression having only non-negative integral powers of x.

    Therefore, it is a polynomial.

    The highest power of x is 3. Therefore, it is a polynomial of degree 3.

11. L.H.S = $(\frac{2}{2}) - (-5) = 6$

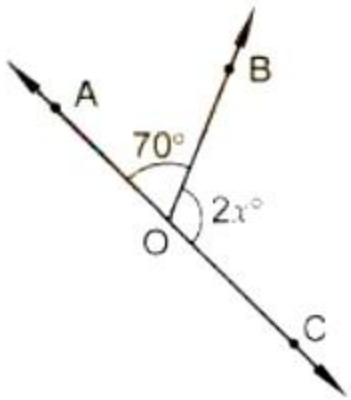
    = 6 = R.H.S

    Thus $(\frac{1}{2}, -5)$ is a solution

12. We have,

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

    $= x(x + 3) + (x + 3) = (x + 3)(x + 1)$

13. 

In the given figure, AOC is a straight line.

Thus, $\angle AOB + \angle BOC = 180^o$ [linear pair]

$\Rightarrow 70^o + 2x^o = 180^o$

$\Rightarrow 2x^o = 180^o - 70^o$

$\Rightarrow 2x^o = 110^o$

$\Rightarrow x = 55^o$

14. We have $-2x + 3y - 12 = 0$

    $= a = -2, b = 3, c = -12$

15. We have,

    $2x - \frac{y}{5} + 6 = 0$

    $10x - y + 30 = 0$

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

    $a = 10, b = -1$ and $c = 30$

16. $(36)^{1/2}=(6^2)^{1/2}=6^1 = 6$

OR

$(i)\frac{3}{5}$

17. i. (c) Green
    ii. (a) Orange
    iii. (b) Yellow
    iv. (d) 48 foot^2
    v. (b) 12

18. i. (b) 70°
    ii. (c) ASA
    iii. (d) BQ
    iv. (a) SSS
    v. (d) 20°

19. i. (b) 120°
    ii. (b) 24 m
    iii. (c) 30°
    iv. (a) 30°

v. (d) 30°

20. i. (a) 0.675

ii. (b) 0.325

iii. (c) 0.135

iv. (b) 0.66

v. (d) 1

Part - B

21. In the given figure consider the points A, B, C, and D which form a cyclic quadrilateral.

$\therefore \angle ADC + \angle ABC = 180°$ (because of property of opposite angles of cyclic quadrilateral)

$130° + \angle ABC = 180°$

$\angle ABC = 50°$

In $\triangle BOC$ and $\triangle BOE$, we have

BC = BE (Equal chords)

OC = OE (Radii)

OB = OB (Common)

Therefore, By SSS rule, we have

$\triangle BOC = \triangle BOE$

$\therefore \angle OBC = \angle OBE = 50°$ (by CPCT)

$\therefore \angle CBE = \angle CBO + \angle EBO = 50° + 50° = 100°$

22. $\frac{2^{30}+2^{29}+2^{28}}{2^{31}+2^{30}-2^{29}}$

$= \frac{2^{28}(2^2+2+1)}{2^{29}(2^2+2-1)}$

$= \frac{2^{28}(4+2+1)}{2^{29}(4+2-1)}$

$= \frac{7}{5} \times \frac{1}{2^{(29-28)}}$

$= \frac{7}{5\times 2}$

$= \frac{7}{10}$

OR

$\frac{4}{\sqrt{11}-\sqrt{7}}$

$= \frac{4}{\sqrt{11}-\sqrt{7}} \times \frac{\sqrt{11}+\sqrt{7}}{\sqrt{11}+\sqrt{7}}$

$= \frac{4(\sqrt{11}+\sqrt{7})}{\sqrt{11^2}-\sqrt{7^2}}$

$= \frac{4(\sqrt{11}+\sqrt{7})}{11-7}$

$= \frac{4(\sqrt{11}+\sqrt{7})}{4}$

$= (\sqrt{11}+\sqrt{7})$

23. $(x+4)(x+10)$

We know that $(x+a)(x+b) = x^2 + (a+b)x + ab$

Here a = 4 and b = 10

We need to apply the above identity to find the product

$(x+4)(x+10) = x^2 + (4+10)x + (4 \times 10)$

$= x^2 + 14x + 40.$

Therefore, we conclude that the product $(x+4)(x+10)$ is $x^2 + 14x + 40$

24. Given: Diameter = 140 cm

$\Rightarrow$ Radius (r) = 70 cm = 0.7 m

Height of the cylinder (h) = 1 m

Total Surface Area of the cylinder = $2\pi rh$ (r + h) = $2 \times \frac{22}{7} \times 0.7$ (0.7 + 1)

= $2 \times 22 \times 0.1 \times 1.7 = 7.48$ m^2

Hence 7.48 m^2 metal sheet is required to make the close cylindrical tank.

25. Since, sides of coloured triangular wall are 15 m, 11 m and 6 m.

$\therefore$ Semi-perimeter of coloured triangular wall

S = $\frac{15+11+6}{2} = \frac{32}{2}$ =16 m

Now, Using Heron's formula,

Area of coloured triangular wall

$= \sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{16(16-15)(16-11)(16-6)}$

$= \sqrt{16 \times 1 \times 5 \times 10}$

$= 20\sqrt{2}m^2$

Hence area painted in blue colour = $20\sqrt{2}m^2$

OR

Side of the field are 52m, 56m and 60m

$\therefore S = \frac{52+56+60}{2} = 84\text{m}$

$\therefore$ Area of field $= \sqrt{84(84-52)(84-56)(84-60)}\text{sqm}$

$= \sqrt{(7 \times 12)(2 \times 16(4 \times 7)(12 \times 2)}\text{sqm}$

$= \sqrt{7 \times 7 \times 12 \times 12 \times 2 \times 2 \times 4 \times 16}\text{sqm}$

= 1344 sq m

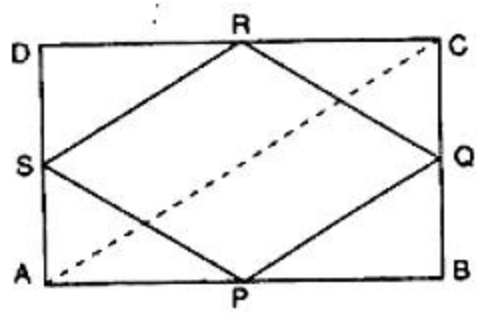
$\therefore$ Total cost of levelling the field $= \text{Rs}18 \times 1344$

= Rs. 24192

26. ABCD is a rectangle. P, Q, R and S are the mid-points of AB, BC, CD and DA respectively. PQ, QR, RS and SP are joined.

To Prove : Quadrilateral PQRS is a rhombus.

Construction: Join AC.



Proof: In $\triangle$ABC,

As P and Q are the mid-points of AB and BC respectively.

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

In $\triangle$ ADC,

As S and R are the midpoints of AD and DC respectively.

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

From (1) and (2)

PQ || SR and PQ = SR

$\therefore$ Quadrilateral PQRS is a parallelogram . . . (3)

In rectangle ABCD,

AD = BC . . .[Opposite sides]

$\therefore \frac{1}{2}$ AD = $\frac{1}{2}$ BC ...[Halves of equals are equal]

$\therefore$ AS = BQ

In $\triangle$APS and $\triangle$BPQ

As P is the mid-point of AB

AP = BP

AS = BQ . . . [As proved above]

$\angle$PAS = $\angle$PBQ . . .[Each 90°]

$\therefore$ $\triangle$APS $\cong$ $\triangle$BPQ . . . [By SAS axiom]

$\therefore$ PS = PQ . . .[c.p.c.t.] . . . (4)

According to (3), (4) PQRS is a rhombus.

27. As $PQ \| SR$ and QR is a transversal

$\therefore \quad \angle PQR = \angle QRT$ (Alternate interior angles)

$\Rightarrow \quad x + 28^\circ = 65^\circ$

$\Rightarrow \quad x = 65^\circ - 28^\circ$

$\therefore \quad x = 37^\circ = \angle PQS$ .....(1)

Now, in ΔPQS, we have $\angle QPS = 90^\circ$ .....(2)

$\angle QPS + \angle PQS + \angle PSQ = 180^\circ$ (sum of angles of $\triangle PQS$)

$\Rightarrow 90^\circ + 37^\circ + y = 180^\circ$ [from (1) & (2)]

$\Rightarrow \quad 127^\circ + y = 180^\circ$

$\Rightarrow \quad y = 180^\circ - 127^\circ$

$\therefore \quad y = 53^\circ$

28. Given, BC = 10 cm, $\angle$B = 45 ° and AB - AC = 5 cm

Steps of Construction

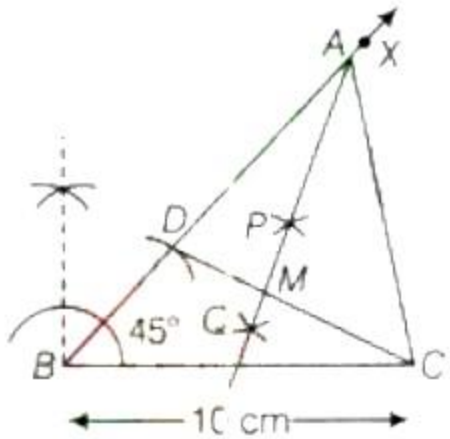
i. First, draw the base, BC =10 cm

At point B, draw a ray BX, which makes $\angle$CBX = 45°.

ii. Here, AB - AC = 5 cm

$\therefore$ AB > AC

Hence, cut line segment BD is equal to AB - AC = 5 cm from the ray BX.



iii. Now, join CD and draw its perpendicular bisector PQ, which bisects CD at M (say).

iv. Let A be the intersection point of perpendicular bisector PQ and ray BX. Join AC. Thus, $\triangle$ABC is the required triangle.

Justification:

Base BC and $\angle B$ are drawn as given. Since the point A lies on the perpendicular bisector of DC.

$\therefore$ AD = AC

BD = AB - AD

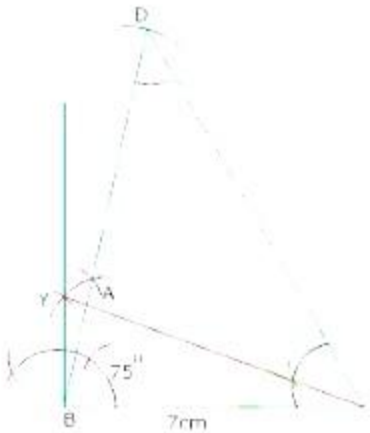
$\Rightarrow$ BD = AB - AC

Thus, the construction is justified.

OR

Steps of construction:

i. Draw BC = 7cm
ii. Draw $\angle DBC = 75°$
iii. Cut a line segment BD = 9cm
iv. Join DC and make $\angle DCY = \angle BDC$
v. Let CY intersect BX at A
vi. Triangle ABC is required triangle



29. Length of room = 12m

Let height of room be h m

Area of 4 walls = $2(l + b) \times h$

According to question

$\Rightarrow 2(l + b) \times h \times 1.35 = 340.20$

$\Rightarrow 2(12 + b) \times h \times 1.35 = 340.20$

$\Rightarrow (12 + b) \times h = \frac{170.10}{1.35} = 126$ .....(i)

Also area of floor = $l \times b$

$\therefore l \times b \times 0.85 = 91.80$

$\Rightarrow 12 \times b \times 0.85 = 91.80$

$\Rightarrow$ b = 9m .....(ii)

Substituting b = 9m in equation (i)

$\Rightarrow$ (12 + 9) $\times$ h = 126

$\Rightarrow$ h = 6 m

30. $8a^3 + b^3 + 12a^2b + 6ab^2$

The expression $8a^3 + b^3 + 12a^2b + 6ab^2$ can also be written as

$= (2a)^3 + (b)^3 + 3 \times 2a \times 2a \times b + 3 \times 2a \times b \times b$

$= (2a)^3 + (b)^3 + 3 \times 2a \times b\,(2a + b)\,.$

Using identity $(x + y)^3 = x^3 + y^3 + 3xy\,(x + y)$ with respect to the expression

$(2a)^3 + (b)^3 + 3 \times 2a \times b\,(2a + b)$ *we get* $(2a + b)^3$

Therefore, after factorizing the expression $8a^3 + b^3 + 12a^2b + 6ab^2$ we get $(2a + b)^3$

OR

$\left(\frac{5}{2}x + \frac{3}{4}\right)^3$

$(a + b)^3 = a^3 + b^3 + 3ab(a + b)$

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

$= \frac{125x^3}{8} + \frac{27}{64} + \frac{45}{8}x\left(\frac{5}{2}x + \frac{3}{4}\right)$

$= \frac{125x^3}{8} + \frac{27}{64} + \frac{225}{16}x^2 + \frac{135}{32}x$

$= \frac{125x^3}{8} + \frac{225}{16}x^2 + \frac{135}{32}x + \frac{27}{64}$

31. $S = \frac{a+a+a}{2}$ units $= \frac{3a}{2} units$

$\therefore$Area of triangle = $\sqrt{\frac{3a}{2} \times (\frac{3a}{2} - a)(\frac{3a}{2} - a)(\frac{3a}{2} - a)}$

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

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

Now, perimeter = 180 cm

$\therefore$ each side $= \frac{180}{3} = 60cm$

Using above derived formula

$\therefore$ Area of signal board = $\frac{\sqrt{3}}{4}\ (60)^2$ sq cm

$= 900\ \sqrt{3}$ sq cm

32. Let $3^x = 5^y = (75)^z = k$

Then, $3 = k^{\frac{1}{x}}$, $5 = k^{\frac{1}{y}}$ and $75 = k^{\frac{1}{z}}$

Now,

$75 = k^{\frac{1}{z}}$

$\Rightarrow 3 \times 5^2 = k^{\frac{1}{z}}$

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

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

$\Rightarrow k^{\frac{1}{x}+\frac{2}{y}} = k^{\frac{1}{z}}$

$\Rightarrow \frac{1}{x} + \frac{2}{y} = \frac{1}{z}$ (when bases are same powers are equal)

$\Rightarrow \frac{y+2x}{xy} = \frac{1}{z}$

$\Rightarrow z = \frac{xy}{2x+y}$

33. We have,

$\angle DCA = \angle ECB$

$\Rightarrow \angle DCA + \angle ECD = \angle ECB + \angle ECD$

$\Rightarrow \angle ECA = \angle DCB$ ...(i)

Now, in $\triangle$ DBC and $\triangle$ EAC, we have

$\angle DCB = \angle ECA$ [From (i)]

BC = AC [Given]

and, $\angle DBC = \angle EAC$ [Given]

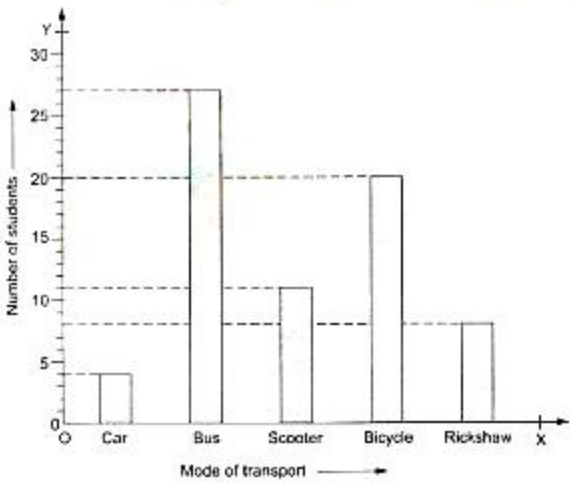
So, ASA (Angle-Side-Angle) criterion of congruence, we obtain

$\Delta DBC \cong \Delta EAC$

$\Rightarrow$ DC = EC and BD = AE

34. All the bars should be of the same width and same space should be left between the consecutive bars.

These bars may be drawn as shown below.



OR

Graph of the equation 2x + 3y = 12:

We have,

2x + 3y = 12

$\Rightarrow$ 2x = 12 - 3y

$\Rightarrow x = \frac{12-3y}{2}$ .....(i)

Putting y = 4, we get $x = \frac{12-3\times4}{2} = 0$

Putting y = 2, we get $x = \frac{12-3\times2}{2} = 3$

Thus, we have the following table for the points on the line 2x + 3y = 12:

x	0	3
y	4	2

Plotting points A(3, 2), B(0, 4) on the graph paper and drawing a line passing through them, we obtain graph of the equation 2x + 3y = 12.

Graph of the equation x - y = 1:

We have,

x - y = 1

$\Rightarrow$ x = 1 + y

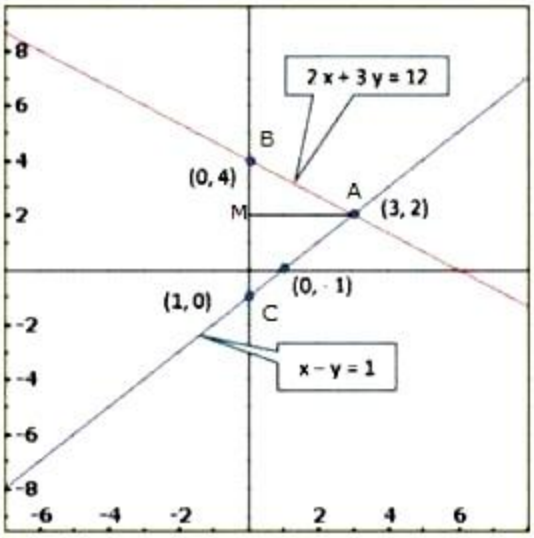
Putting y = 0, we get x = 1 + 0 = 1

Putting y = -1, we get x = 1 - 1 = 0

Thus, we have the following table for the points on the line x - y = 1:

x	1	0
y	0	-1

Ploting points C(1,0) and D(0,-1) on the same graph paper and drawing a line passing through them, we obtain the graph of the line represented by the equation x - y = 1.



Thus, the coordinates of the vertices of the triangle formed by the two straight lines and y-axis are A(3, 2), B(0, 4) and C(1,0).

35. It is given that, the total number of workers = 30

Probability of an event = $\frac{Favourable\ space\ no.\ space\ of\ space\ outcomes}{Total\ space\ no.\ space\ of\ space\ outcomes}$

Thus, using the above formula we will find the required probabilities in all the following parts, as follows.

i. No. of workers whose wages are less than Rs.150 = 3 + 4 = 7

Thus, Probability that a worker gets wage less than Rs.150 = $\frac{7}{30}$.

ii. No. of workers whose wages is at least Rs. 210 = 4 + 3 = 7

Thus, Probability that a worker gets a wage of at least Rs.210 = $\frac{7}{30}$.

iii. No. of workers whose wages is more than or equal to Rs.150 but less than Rs.210 = 5 + 6 + 5 = 16

Thus, Probability that a worker gets a wage of more than or equal to Rs.150 but less than Rs.210 = $\frac{16}{30} = \frac{8}{15}$.

iv. No. of workers whose wages lies in the interval Rs.190 - Rs.250 = 5 + 4 + 3 = 12

Thus, Probability that a worker gets a wage lies in the interval Rs.190 - Rs.250 = $\frac{12}{30} = \frac{2}{5}$.

36. ABCD is a rectangle. Therefore AB = DC ...(i)

And BC = AD

Also $\angle A = \angle B = \angle C = \angle D = 90°$

i. In $\triangle ABC$ and $\triangle ADC$

$\angle 1 = \angle 2$ and $\angle 3 = \angle 4$

[AC bisects $\angle A$ and $\angle C$ (given)]

AC = AC [Common]

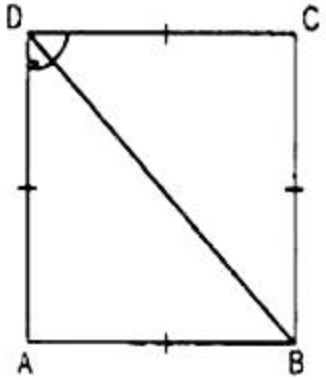
$\therefore \triangle ABC \cong \triangle ADC$ [By ASA congruency]

$\Rightarrow$ AB = AD ...(ii)

From eq. (i) and (ii), AB = BC = CD = AD

Hence ABCD is a square.

ii. In $\triangle ABC$ and $\triangle ADC$



AB = BA [Since ABCD is a square]

AD = DC [Since ABCD is a square]

BD = BD [Common]

$\therefore \triangle ABD \cong \triangle CBD$ [By SSS congruency

$\Rightarrow \angle ABD = \angle CBD$ [By C.P.C.T.] ...(iii)

And $\angle ADB = \angle CDB$ [By C.P.C.T.] ...(iv)

From eq. (iii) and (iv), it is clear that diagonal BD bisects both $\angle B$ and $\angle D$.