Sample Paper 15

Class IX 2022-23

Mathematics

Time: 3 Hours **Max. Marks: 80**

General Instructions:

1. This Question Paper has 5 Sections A-E.
2. Section A has 20 MCQs carrying 1 mark each
3. Section B has 5 questions carrying 02 marks each.
4. Section C has 6 questions carrying 03 marks each.
5. Section D has 4 questions carrying 05 marks each.
6. Section E has 3 case based integrated units of assessment (04 marks each) with sub-parts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 3 Qs of 5 marks, 3 Qs of 3 marks and 2 Questions of 2 marks has been provided.
8. Draw neat figures wherever required. Take $\pi = \frac{22}{7}$ wherever required if not stated.

SECTION - A

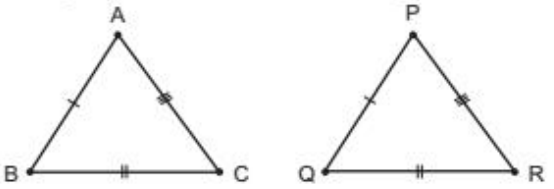
(Section A consists of 20 questions of 1 mark each.)

1. If one of the solutions of equation $3x + 2y = 7$ is (1, 2), then what will be the new solution if we add 1.49 on both sides of the equation?

(a) (3, 2.5) (b) (2.49, 3.49)

(c) (1, 2) (d) Cannot be determined 1

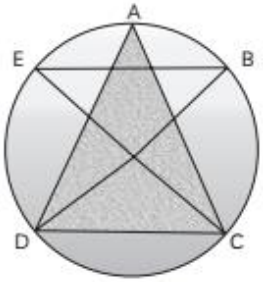
2. If $\Delta ABC \cong \Delta PQR$ and ΔABC is not congruent to ΔRPQ, then which of the following is not true?



(a) BC= PQ (b) AC = PR

(c) QR= BC (d) AB = PQ 1

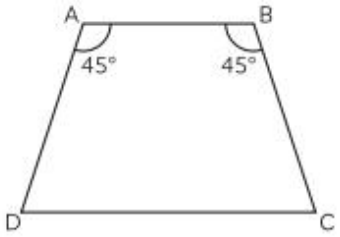
3. In the figure shown below, the region DEABC is a:



(a) minor arc (b) major arc

(c) major segment (d) minor segment 1

4. ABCD is a trapezium, in which AB || DC and $\angle A = \angle B = 45°$. Then, $\angle C$ and $\angle D$ of a trapezium are, respectively:



(a) 135°, 135° (b) 130°, 120°

(c) 120°, 130° (d) 145°, 75° 1

5. If $x^2 + kx + 6 = (x + 2)(x + 3)$ for all x, then the value of k is:

(a) 1 (b) –1

(c) 5 (d) 3 1

6. The milk of apex society has a conical vessel having radius 14 cm and slant height 50 cm, the capacity of the vessel is:

(a) 9858 cm^2 (b) 9856 cm^3

(c) 9586 cm^3 (d) 9685 cm^2 1

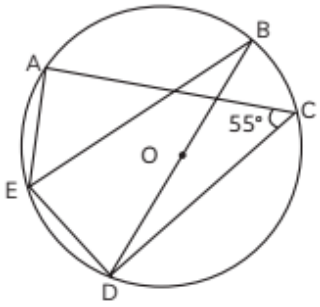
7. Rahul was crossing the railway track, he noticed that the railway tracks are parallel to each other.

With the help of Euclid's geometry, two parallel lines cannot have ..... in common.

(a) no point (b) one point

(c) two-point (d) none of these 1

8. In the figure, ∠ACD = 55° and BD is the diameter of the circle. ∠BED is:



(a) 35° (b) 55° 1

(c) 25° (d) Cannot be determine

9. In the class intervals 30-40 and 40-50, the number 40 is included in:

(a) 30-40

(b) 40-50

(c) both 30-40 and 40-50

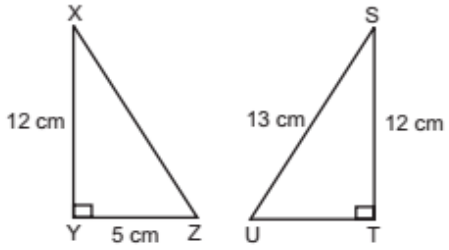
(d) None of these 1

10. Jitu was given a riddle by Pragya who stated that an angle is 24° less than its complementary angle, the angle's measure is:

(a) 36° (b) 33°

(c) 66° (d) 57° 1

11. Consider the triangles shown in the figure. Which of the following option is not true about the given triangles?



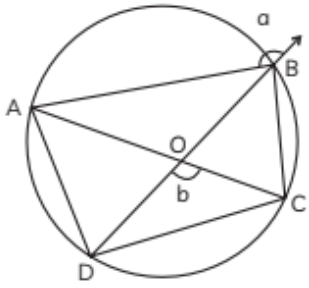
(a) ΔXYZ ≅ ΔSTU (by SSS congruence rule)

(b) ΔXYZ ≅ ΔSTU (by RHS congruence rule)

(c) ΔXYZ ≅ ΔSTU (by ASA congruence rule)

(d) ΔXYZ ≅ ΔSTU (by SAS congruence rule) 1

12. Given below is a circle with centre O. Which of the following represents the measure of ∠BCD.



(a) $180° + (a - \frac{b}{2})$ (b) $180° - (a + \frac{b}{2})$

(c) $90° - (a - \frac{b}{2})$ (d) $180° - (a - \frac{b}{2})$ 1

13. Priyanka's sister will be twice her age in 3 years later. The present age of Priyanka's brother who is 3 years younger than Priyanka is:

(a) 15

(b) 12

(c) 10

(d) cannot be determined 1

14. Ramanika is of the same age as Shinu, sona is also of the same age as Shinu.

(a) Ramanika and Sona are of same age.

(b) Ramanika is older than Sona.

(c) Sona is older than Ramanika.

(d) Ramanika and Shinu are younger than Sona. 1

15. How many balls each of radius 1 cm can be made by melting a big ball whose diameter is 8 cm?

(a) 54 (b) 64

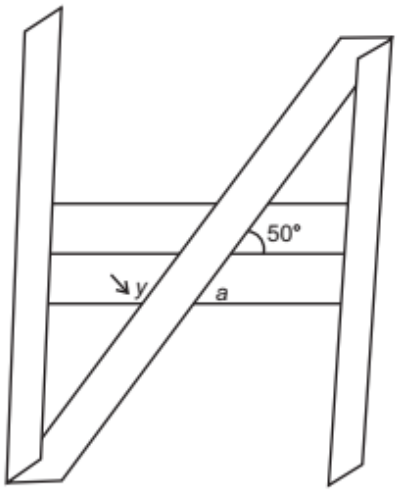
(c) 36 (d) 76 1

16. Let L be the lower class boundary of a class in a frequency distribution and M be the mid-point of the class. If U is the upper class boundary of that class, then which of the following is correct?

(a) U = 2M – L (b) U = M – L

(c) $U = \frac{1}{2}M - L$ (d) $U = \frac{1}{2}(M - L)$ 1

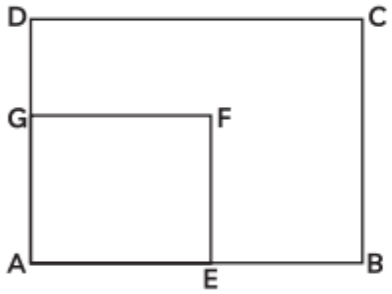
17. A diagonal brace on the roof strengthens to prevent it from sagging. The braces make an angle 50° with wire as shown in the figure below. The value of *y* in degrees is:



(a) 110° (b) 130°

(c) 30° (d) 50° 1

18. In given figure, ABCD and AEFG are two parallelograms. If $\angle C = 60°$ determine $\angle F$.



(a) 50° (b) 60°
(c) 70° (d) 80° 1

Direction: In the question number 19 and 20, a statement of assertion (A) is followed by a statement of reason (R).

Choose the correct option.

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

19. Statement A (Assertion): $f(x) = 2 - x^2 + x^3$ is a cubic polynomial.

Statement R (Reason): Every polynomial is a binomial. 1

20. Statement A (Assertion): Point P(1, -2) lies in IV quadrant.

Statement R (Reason): In the cartesian system, x and y coordinates of IV quadrant are positive and negative respectively. 1

SECTION - B

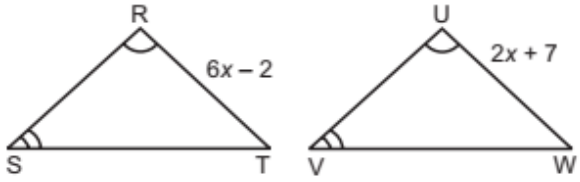
(Section B consists of 5 questions of 2 marks each.)

21. Find any three rational numbers between 8 and 14.

OR

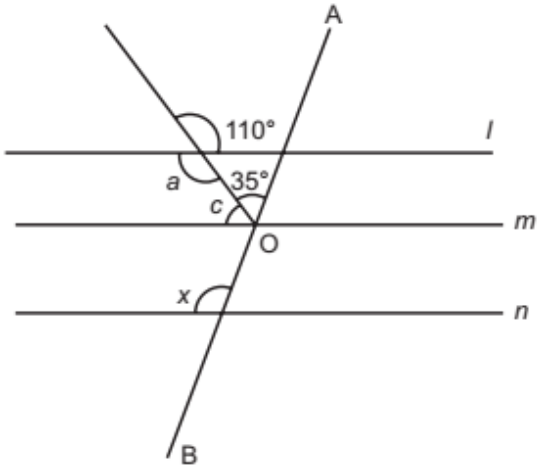
$x = \sqrt{2} - 1$, then find the value of $\left(x - \frac{1}{x}\right)^5$. 2

22. In ΔRST, $RT = 6x - 2$. In ΔUVW, $UW = 2x + 7$, $\angle R = \angle U$, and $\angle S = \angle V$. What must be the value of x in order to prove that $\Delta RST \cong \Delta UVW$? 2



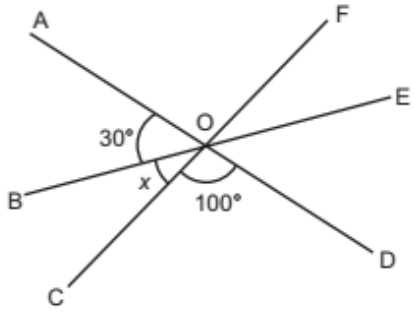
23. Find any two solutions of the equation $3x + 2y = 6$. 2

24. Calculate the value of angle x.



OR

Find vertically opposite angle of x. 2



25. If each side of an equilateral triangle becomes four times then how many times does the new area become? 2

SECTION - C

(Section C consists of 6 questions of 3 marks each.)

26. If polynomials $4x^3 + 2ax + 6x - 10$ and $3x^3 + 3x^2 - 12x + 3a$ leave the same remainder when divided by $(2x - 4)$, find the value of a. 3

27. Renu and Shyamu went to the vegetable market to buy potatoes and onions respectively. They mixed both of them in a bag and went home. The total number of potatoes and onions is 45 but twice the number of potatoes is equal to thrice the number of onions. Find the number of potatoes and onions and also, find the equation, if the number of potatoes in a bag is thrice the onions. 3

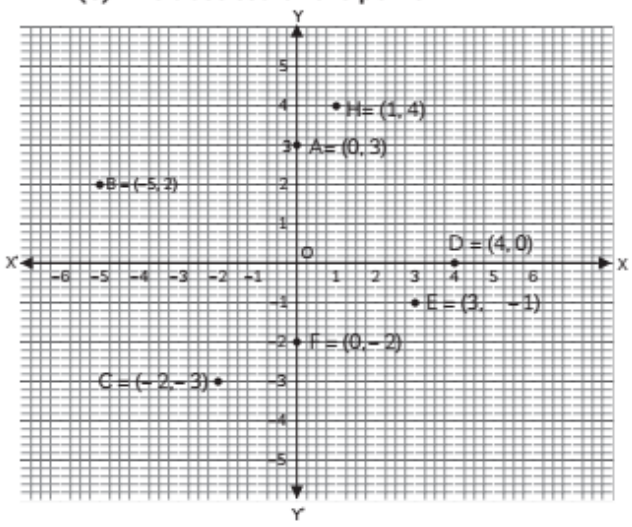
28. Express $0.\overline{123}$ in the form $\frac{p}{q}$ where p and q are integers where $q \neq 0$. 3

29. From the Figure, write the following:

(A) Coordinates of B, C and E

(B) The point identified by the coordinates (0, –2)

(C) The abscissa of the point H



OR

A city has two main roads which cross each other at the centre of the city. These two roads are along the North-South direction and East-West direction. All the other streets of the city run parallel to these roads and are 200 m apart. There are 5 streets in each direction. Using 1 cm = 100 m, draw a model of the city on your notebook to represent the roads/streets by single lines.

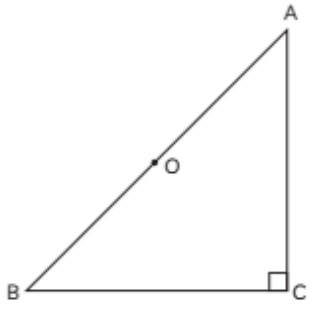
There are many cross-streets in your model. A particular cross-street is made by two streets, one running in the North-South direction and another in the East-West direction. Each cross-street is referred to in the following manner: If the $2^{(nd)}$ street running in the North-South direction and $5^{(th)}$ in the East-West direction meet at some crossing, then we will call this cross-street (2, 5). Using this convention, find:

(A) how many cross-streets can be referred to as (4, 3)?

(B) how many cross-streets can be referred to as (3, 4)? 3

30. Find the length and breadth of a rectangle, if its area is represented by the polynomial, $6x^2 - 29x + 30$ and also find the perimeter. 3

31. Let ABC be the right angle triangle, with right angle at C. If the longest side of a triangle is 70 cm, find the circumference of a semicircle circumscribing the triangle.



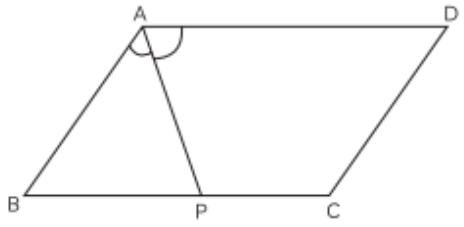
OR

PQ is the diameter of the circle and PR and QS are the chords. Extended QS and PR meet at T outside the circle. Join QR. If $\angle SOR = 70^{o}$, find complementary $\angle STR$. 3

SECTION - D

(Section D consists of 4 questions of 5 marks each.)

32. In figure given below, P is the mid-point of side BC of the parallelogram ABCD such that ∠BAP = ∠DAP. Prove that AD = 2CD.



OR

D and E are the mid-points of the sides AB and AC of ΔABC and O is any point on the side BC, an AO is joined. If P and Q are the mid-points of OB and OC respectively, then prove DEQP is a parallelogram. 5

33. If $a = \frac{3+2\sqrt{2}}{3-2\sqrt{2}}$ and $b = \frac{3-2\sqrt{2}}{3+2\sqrt{2}}$ then what is the value of $a^2 + b^2 - ab$? 5

34. What length of tarpaulin 3 m wide will be required to make a conical tent of height 8 m and base radius 6 m? Assume that the extra length of material that will be required for stitching margins and wastage in cutting is approximately 20 cm. (use π = 3.14).

OR

Metal spheres, each of radius 2 cm, are packed into a rectangular box of internal dimensions 16 cm × 8 cm × 8 cm. When 16 spheres are packed and the box is filled with preservative liquid. Find the volume of this liquid. Give your answer to the nearest integer. (use π=3.14) 5

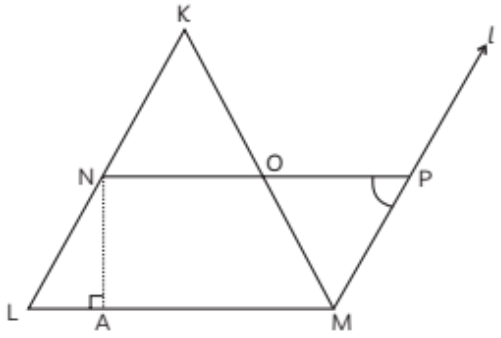
35. The cost of 1 pen is ₹1 more than that of 5 pencils. If the cost of each pen is represented by ₹y and that of 1 pencil by ₹x, then write the linear equation in two variables for the situation. Plot its graph. 5

SECTION - E

(Case study based questions are compulsory.)

36. *Ananya wants to frame a question based on quadrilaterals. So, she draws a triangle KLM (as shown in figure below) where N and O are mid-points of side KL and KM of ΔKLM.*

Now, she wants to prove NO || LM. She constructs a ray l such that KL || MP



(A) Using Congruence Rule, prove ΔKON ≅ ΔMOP. 1

(B) If LM = 12 cm. Find half of NO.

OR

Find the area of NOML, if NA ⊥ LM and NA = 7 cm, NO = 6 cm and LM = 12 cm. 2

(C) Write the figure name of NLMP. 1

37. *Red fort, also called as Lal Qila mughal fort in old delhi, India. It was built by shah Jahan in the mid-17th century and remains a major tourist attraction. The fort was designated a UNESCO world heritage site in 2007. It is surrounded by a 2km perimeter wall which is aced as an effective defensive measure.*

(A) A ladder was installed to clean the minaret's top. How long should the ladder be if the minaret is 8 meters tall and the base is 15 meters?

OR

If the radius of hemispherical dome is 4 cm, then find its curved surface area. 2

(B) If the smaller hemispherical dome's surface area (without the base) is found to be 7700 sq m. Determine the diameter. **1**

(C) If the radius of the hemispherical dome is 7 cm, then find its volume. **1**

38. *A teacher of Xavier School wanted to analyse the performance of two sections of students in a Mathematics test of 100 marks. She looked at the performance of the students, she found that a few students got under 20 marks and a few got 70 marks or above. So, she decided to group them into intervals of varying sizes as follows: 0–20, 20–30,..., 60–70 and 70–above. Then she formed the following table:*

Marks Scored	Numbers of Students
0 – 20	8
20 – 30	20
30 – 40	13
40 – 50	18
50 – 60	11
60 – 70	17
70 above	13
Total	**100**

(A) Find the number of students who scored less than 40 marks but more than 20 marks. **1**

(B) If two students scored distinction are also added, then find the number of students scoring more than 70 marks.

OR

Find the total number of students scoring marks between 50 – 60 and 60 – 70. **2**

(C) Find the number of students scoring less than 60 marks. **1**

SOLUTION

SAMPLE PAPER - 5

SECTION - A

1. *(d) Cannot be determined*

Explanation: The solution of a linear equation is not affected, on adding or subtracting any number from both sides of the equation.

2. *(a) BC = PQ*

Explanation: Given, $\Delta ABC \cong \Delta PQR$

Thus, the corresponding sides are equal.

Hence,

$$AB = PQ$$
$$BC = QR$$
$$AC = PR$$

Therefore, BC = PQ is not true for the triangles.

3. *(c) major segment*

Explanation: The region of the circle between chord and arc is called a segment. Hence, DEABC is a major segment.

4. *(a) 135°, 135°*

Explanation:

Given, ABCD is a trapezium.

$$\angle A = \angle B = 45° \quad \text{(given)}$$

AB || DC

Since, adjacent angles (angle A and angle B) are equal. We can conclude that the trapezium ABCD is isosceles trapezium. Hence, angle C would also be equal to angle D.

So, let $\angle C = \angle D = x$

$$\angle A + \angle B + \angle C + \angle D = 360°$$
$$45° + 45° + x + x = 360°$$
$$2x + 90° = 360°$$
$$2x = 360° - 90°$$

$$x = \frac{270°}{2}$$

$$x = 135°$$

Hence, $\angle C = \angle D = 135°$

5. *(c) 5*

Explanation:

Given equation is $x^2 + kx + 6 = (x + 2)(x + 3)$

On simplifying,

$$x^2 + kx + 6 = (x + 2)(x + 3)$$

$$\Rightarrow \quad x^2 + kx + 6 = x^2 + 3x + 2x + 6$$

$$\Rightarrow \quad x^2 + kx + 6 = x^2 + 5x + 6$$

$$\Rightarrow \quad kx = 5x$$

$$k = 5$$

Therefore, the value of k is 5.

6. *(b) 9856 cm^3*

Explanation: Given $r = 14$ cm

$$l = 50 \text{ cm}$$

We know,

$$l^2 = r^2 + h^2$$

$$h^2 = 50^2 - 14^2$$

$$h^2 = 2500 - 196$$

$$h^2 = 2304$$

$$h = \sqrt{2304}$$

$$h = 48 \text{ cm}$$

Now, Capacity of vessel = $\frac{1}{3} \times \pi r^2 h$

$$= \frac{1}{3} \times \frac{22}{7} \times 14 \times 14 \times 48$$

Capacity of vessel = 9856 cm^3

7. *(a) no point*

Explanation: Two parallel lines cannot have no point in common.

8. *(d) Cannot be determine*

Explanation: Here, the angle made by arc ACD is 55° and we have to find ∠BED made by the arc BED. But there is no relation between arcs ACD and BED.

Caution

Stud3ents will be confused by ∠ACD = ∠EBD, but it's not ∠ACD ≠ ∠EBD because ∠EBD and is ∠ACD made on different segments.

9. *(b) 40-50*

Explanation: In a continuous frequency distribution, the lower limit of a class is included within that interval while upper limit not. So, 40 is included in 40-50.

10. *(b) 33°*

Explanation: Let the angle be x

Its complementary angle = $x + 24°$

$$x + x + 24° = 90°$$

$$\Rightarrow \quad 2x = 66°$$

$$\Rightarrow \quad x = 33°$$

11. *(c) $\Delta XYZ \cong \Delta STU$ (By ASA congruence rule)*

Explanation: In ΔXYZ,

$$XZ^2 = XY^2 + YZ^2$$

$$XZ^2 = (12)^2 + (5)^2$$

$$XZ^2 = 144 + 25$$

$$XZ^2 = 169$$

$$XZ = 13 \text{ cm}$$

Now, In ΔXYZ and ΔSTU,

$\angle Y = \angle T$ [Right angles]

Hypotenuse XZ = Hypotenuse SU

Hypotenuse XZ = Hypotenuse XU = 13 cm

XY = ST = 12 cm

Therefore, ΔXYZ ≅ ΔSTU

[By RHS congruence rule]

Then, YZ = UT = 5 cm [By CPCT]

∴ XY = ST

YZ = UT

XZ = SU

And $\angle Y = \angle T$

Here, ΔXYZ ≅ ΔSTU

By SSS, RHS and SAS congruence rules, but as only one angle is known, ASA congruence rule is not applicable here.

12. *(d) $180° - (a - \frac{b}{2})$*

Explanation: From figure

$\angle AOB = \angle DOC$

[Vertically opposite angles]

Here, $\angle AOB = \angle DOC = b$

Now, $\angle ACB = \frac{1}{2} \angle AOB$

[Angle made by the same segment on the circumference is half of that made on the centre]

So, $\angle ACB = \frac{b}{2}$

Now, DB is a straight line

$\angle ABO + a = 180°$ [Linear pair]

$\angle ABO = 180° - a$

$\angle ACD = \angle ABO = 180° - a$

[Chord AD is common]

Now, $\angle BCD = \angle ACB + \angle ACD$

$$= \frac{b}{2} + 180° - a$$

$$\angle BCD = 180° - a + \frac{b}{2} = 180° - (a - \frac{b}{2})$$

13. *(d) cannot be determined*

Explanation: Let, the present age of Priyanka be x years and the present age of her sister be y years.

3 years later

Priyanka's age = $(x + 3)$ years

Priyanka's sister's age

$= (y + 3)$ years

According to question,

$$(y + 3) = 2(x + 3)$$
$$y + 3 = 2x + 6$$
$$2x - y = -3$$

Here, the age of neither Priyanka nor her sister is given. So, we cannot determine the age of Priyanka's brother due to insufficient information.

14. *(a) Ramanika and Sona are of same age.*

Explanation: According to Euclid's Axiom, things which are equal to the same thing are equal to one another.

15. *(b) 64*

Explanation:

Diameter = 8 cm

Radius of big ball = 4 cm

Radius of small ball = 1 cm

$$\text{No. of small balls} = \frac{\text{volume of big ball}}{\text{volume of 1 small ball}}$$

$$= \frac{\frac{4}{3}\pi(4)^3}{\frac{4}{3}\pi(1)^3}$$

$$= 4^3$$

$$= 64 \text{ balls}$$

16. *(a) $U = 2M - L$*

Explanation:

$$\text{Mid Value} = \frac{\text{Upper Limit} + \text{Lower Limit}}{2}$$

$$\Rightarrow \quad M = \frac{U+L}{2}$$

$$\Rightarrow \quad 2M = U + L$$

$$\Rightarrow \quad U = 2M - L$$

17. *(b) 130°*

Explanation: $a = 50°$[Corresponding angles]

$$y + a = 180°$$
$$y = 180° - a$$
$$y = 180° - 50°$$
$$y = 130°$$

18. *(b) 60°*

Explanation: Given, ABCD is a parallelogram and $\angle C = 60°$

[in a parallelogram, opposite sides are equal]

Also, AEFG is a parallelogram.

$$\angle A = \angle F = 60°.$$

19. *(c) Assertion (A) is true but reason (R) is false.*

Explanation: $f(x) = 2 - x^2 + x^3$

A polynomial of degree 3 is a cubic polynomial, and here $f(x)$ has degree 3.

A polynomial can be of any degree.

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

Explanation: The coordinates of point which lies in quadrant IV has x coordinate positive and y-coordinate negative.

SECTION - B

21. We know that a rational number between a and b is $\frac{a+b}{2}$

Hence, the first rational number between 8 and 14 is $\frac{8+14}{2} = \frac{22}{2} = 11$

The second rational number between 8 and 11 is $\frac{8+11}{2} = \frac{19}{2}$

The third rational number between 14 and 11 is $\frac{14+11}{2} = \frac{25}{2}$

Hence, the required rational number are $\frac{19}{2}$, 11 and $\frac{25}{2}$.

OR

Given:

$$x = \sqrt{2} - 1$$

$$\frac{1}{x} = \frac{1}{\sqrt{2}-1} \times \frac{\sqrt{2}+1}{\sqrt{2}+1}$$

[Rationalizing the denominator]

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

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

$$= \frac{\sqrt{2}+1}{2-1}$$

$$\therefore \quad \frac{1}{x} = \sqrt{2}+1$$

And, $x - \frac{1}{x} = \sqrt{2} - 1 - \sqrt{2} - 1$

$$x - \frac{1}{x} = -2$$

$$\left(x - \frac{1}{x}\right)^5 = (-2)^5$$

$$= -32$$

22. Given that $\angle S = \angle V$

and $\angle R = \angle U$

$\angle T = \angle W$

For $\Delta RST \cong \Delta UVW$

$\Rightarrow \quad 6x - 2 = 2x + 7$

$\Rightarrow \quad 6x - 2x = 9$

$\Rightarrow \quad 4x = 9$

$\Rightarrow \quad x = \frac{9}{4}$

$x = 2.25$

23. Given equation is

$$3x + 2y = 6$$

$\Rightarrow \quad 2y = 6 - 3x$

$\Rightarrow \quad y = \frac{6-3x}{2}$ ...(i)

On putting $x = 0$ in equation (i), we get

$$y = \frac{6-3(0)}{2}$$

$\Rightarrow \quad y = \frac{6}{2}$

$\Rightarrow \quad y = 3$

So, (0, 3) is a solution of the given equation.

On putting $y = 0$ in equation (i), we get

$$0 = \frac{6-3x}{2}$$

$\Rightarrow \quad 6 - 3x = 0$

$\Rightarrow \quad 3x = 6$

$\Rightarrow \quad x = 2$

So, (2, 0) is one more solution of the given equation.

Hence, the required solutions of the given equation are (0, 3) and (2, 0).

24. From the given figure,

$a = 110°$

[$\therefore$ Vertical opposite angle]

$a + c = 180°$

[$\therefore$ co-interior sum is 180°]

$\Rightarrow \quad 110° + c = 180°$

$\Rightarrow \quad c = 70°$

Now, $c + 35° = x$

[corresponding angle]

$\Rightarrow \quad 70° + 35° = x$

$\Rightarrow \quad x = 105°$

OR

From the given figure,

On the straight line AD

$30° + x + 100° = 180°$

$x = 180° - 30° - 100°$

$x = 180° - 130°$

$x = 50°$

Vertically opposite angle of x is $\angle FOE$.

$x = 50° = \angle FOE$ as vertically opposite angles are equal

25. Let the side of the equilateral triangle be x cm.

the area of equilateral triangle $= \frac{\sqrt{3}}{4} x^2$

When each side of the equilateral triangle is four times *i.e.*, $4x$

So, new Area $= \frac{\sqrt{3}}{4}(4x)^2 = 16 \times \left(\frac{\sqrt{3}}{4}x^2\right)$

Hence, the new area of the equilateral triangle becomes sixteen times the original area.

Caution

➥ *Area of triangle* $= \frac{1}{2} \times$ *base* $\times$ *height*

Here, $\frac{1}{2}$ *is constant and base and height are the parts of triangle or side and altitude.*

If we multiply side and side, it will be $(side)^2$.

SECTION - C

26. Let, $p(x) = 4x^3 + 2ax + 6x - 10$ and $q(x) = 3x^3 + 3x^2 - 12x + 3a$ be the given polynomials. The remainder when divided by $2x - 4$ are $p(2)$ and $q(2)$, respectively.

By the given condition, we have

$$p(2) = q(2)$$

$4(2)^3 + 2(a)(2) + 6 \times 2 - 10 = 3(2)^3 + 3(2)^2 - 12 \times 2 + 3a$

$\Rightarrow 32 + 4a + 12 - 10 = 24 + 12 - 24 + 3a$

$\Rightarrow 34 + 4a = 12 + 3a$

$\Rightarrow 34 - 12 = 3a - 4a$

$a = -22$

27. Let the number of potatoes be x,

and the number of onions be y.

According to question,

$$x + y = 45 \quad \text{... (i)}$$

Also,

$$2x = 3y$$

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

Put the value of x in equation (i), we get

$$x + y = 45$$

$$\Rightarrow \frac{3y}{2} + y = 45$$

$$\Rightarrow \frac{3y + 2y}{2} = 45$$

$$\Rightarrow \frac{5y}{2} = 45$$

$$\Rightarrow y = \frac{45 \times 2}{5}$$

$$y = 18$$

So, $x = \frac{3y}{2} = \frac{3 \times 18}{2} = 3 \times 9 = 27$

Hence, the number of potatoes = 27

Number of onions = 45 – 27 = 18

Now, the number of potatos = 3 × number of onions

$$x = 3y$$

$$\Rightarrow x - 3y = 0$$

Hence, the required equation is

$$x - 3y = 0.$$

28. Let $x = 0.12\overline{3} = 0.1233...$ ... (i)

Multiplying both sides by 10, we get

$10x = 0.12\overline{3} \times 10 = 1.233...$ ... (ii)

Multiplying both sides by 100, we get

$100x = 0.12\overline{3} \times 100 = 12.333...$ ... (iii)

Multiplying both sides by 1000, we get

$1000x = 0.12\overline{3} \times 1000 = 123.333.....$ (iv)

Subtract (iii) from (iv), we get

$1000x - 100x = 123.333... - 12.333...$

$900x = 111$

$$x = \frac{111}{900}$$

$$x = \frac{37}{300}$$

29. (A) When we look perpendicularly from the point B, C and E towards the x-axis and y-axis, we get the abscissa and the ordinates of the given points and hence we get the coordinates as (–5, 2), C = (–2, –3) and E = (3, –1)

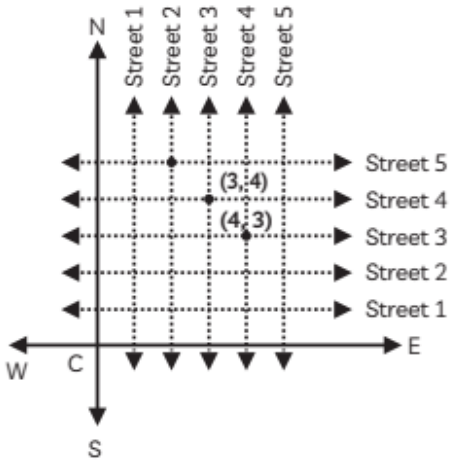
(B) Looking at the graph we will search for such a point whose abscissa is given as 0 and ordinate as –2 and the point we get is 'F'.

(C) The coordinates of point H are (1, 4), so we get its abscissa = 1

OR

Model of street plan of the city:

Taking: 1 cm = 100 m



From the above diagram,

(A) only one cross-street (Street 3 running North-South direction and street 4 running East-West direction) is referred to (3, 4).

(B) only one cross-street (Street 4 running North-South direction and street 3 running East-West direction) is referred to (3, 4).

30. We know, the area of rectangle = $l \times b$

As $6x^2 - 29x + 30$ = Area = $l \times b$

Use middle term splitting method

$6x^2 - 29x + 30 = l \times b$

$6x^2 - 20x - 9x + 30 = l \times b$

$2x(3x - 10x) - 3(3x - 10)$

$= l \times b$

$(2x - 3)(3x - 10) = l \times b$

So, we have

$l = 2x - 3$ and $b = 3x - 10$

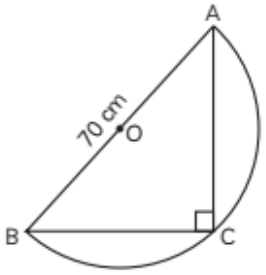
Now, perimeter $= 2(l + b]$

$= 2[2x - 3 + 3x - 10]$

$= 2[5x - 13]$

Perimeter $= 10x - 26$

31. For triangle ABC with right angle at C, AB is the longest side (hypotenus).



So, diameter AB = 70 cm and radius

OA = OB = 35 cm, where O be the mid-point of AB.

Circumference of semicircle with diameter AB

$= \pi r + d$

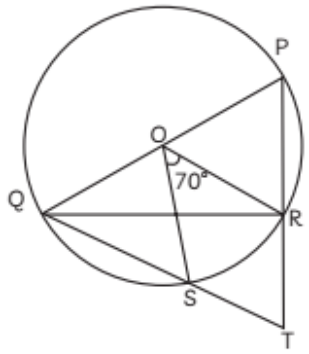
$= \frac{22}{7} \times 35 + 70$

$= (110 + 70)$ cm

Circumference = 180 cm

OR

Draw the figure, according to question.



Here, $\angle SOR = 70°$

Now, $\angle RQS = \frac{1}{2} \angle SOR$

[Arc SR is Common]

$\angle RQS = \frac{1}{2} \times 70°$

$\angle RQS = 35°$

Also, $\angle QRP = 90°$[Angle in a semicircle]

Now, In ΔTQR,

$\angle QRT + \angle RQT + \angle QTR = 180°$

[Angle sum property]

$90° + 35° + \angle QTR = 180°$

$\angle QTR = 180° - 125°$

$\angle QTR = 55°$

Hence, $\angle STR = \angle QTR = 55°$

So, complimentary angle of $\angle STR$

$= 90° - 55° = 35°$

SECTION - D

32. **Given:** ABCD is a parallelogram, P is a mid-point of BC such that $\angle BAP = \angle DAP$

To prove: ABCD is a parallelogram.

Here, AD || BC and AB is transversal

$\angle A + \angle B = 180°$ (Sum of co-interior angles)

$\angle B = 180° - \angle A$ ... (i)

In ΔABP,

$\angle PAB + \angle BPA + \angle B = 180°$

(Angle sum property of triangle)

Or, $\frac{1}{2}\angle A + \angle BPA + (180° - \angle A) = 180°$

$\angle BPA = \frac{\angle A}{2}$

$\angle BPA = \frac{\angle A}{2}$ ..... (ii)

$\angle BPA = \angle BAP$

$AB = BP$

(Opposite sides of equilateral triangle)

$2AB = 2BP$

(Multiply both sides by 2)

$2AB = BC$

(P is mid-point of BC)

$2CD = AD$

(ABCD is parallelogram, AB = CD and BC = AD)

So, $AD = 2CD$

Hence, proved.

OR

In ΔABC

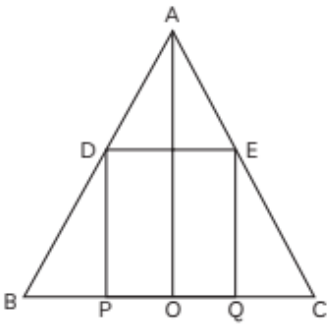
D and E are the mid-points of sides AB and AC of ΔABC respectively.

By mid-point theorem,

DE || BC ....(i)

$$DE = \frac{1}{2} BC$$

Also, $DE = \frac{1}{2}(BP + PO + OQ + QC)$



$$DE = \frac{1}{2}(2PO + 2OQ)$$

[$\because$ P and Q are mid-points of OB and OC]

$$DE = PO + OQ$$

$$DE = PQ \quad \text{....(ii)}$$

Now, In ΔAOC, Q and E are the mid-points of OC and AC, respectively.

Therefore, EQ || AO and $EQ = \frac{1}{2} AO$ ....(iii)

[By using mid-point theorem]

Similarly, In ΔABO,

PD || AOand $PD = \frac{1}{2} AO$ ....(iv)

From equation (iii) and (iv)

EQ || PDand EQ = PD

From equation (i) and (iii)

DE || PQand DE = PQ

Hence, DEQP is a parallelogram.

Hence, proved.

33. $$a = \frac{3+2\sqrt{2}}{3-2\sqrt{2}}$$

Now rationalize the denominator,

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

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

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

$$= \frac{\left(3+2\sqrt{2}\right)^2}{9-8}$$

$$= \frac{17+12\sqrt{2}}{1}$$

$$= 17 + 12\sqrt{2}$$

Now, $a^2 = (17 + 12\sqrt{2})^2$

$$\Rightarrow a^2 = 289 + 288 + 408\sqrt{2}$$

$$\Rightarrow a^2 = 577 + 408\sqrt{2}$$

Similarly,

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

Now, rationalize the denominator, we get

$$b = \frac{3-2\sqrt{2}}{3+2\sqrt{2}} \times \frac{3-2\sqrt{2}}{3-2\sqrt{2}}$$

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

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

$$\Rightarrow b = \frac{(3-2\sqrt{2})^2}{9-8}$$

$$\Rightarrow b = \frac{17-12\sqrt{2}}{1}$$

$$\Rightarrow b = 17 - 12\sqrt{2}$$

Now, $b^2 = (17 - 12\sqrt{2})2$

$$\Rightarrow b^2 = 289 + 288 - 408\sqrt{2}$$

$$b^2 = 577 - 408\sqrt{2}$$

Now,

$$ab = \frac{3+2\sqrt{2}}{3-2\sqrt{2}} \times \frac{3-2\sqrt{2}}{3+2\sqrt{2}}$$

$$\Rightarrow ab = 1$$

$$a^2 + b^2 - ab = 577 + 408\sqrt{2} + 577 - 408\sqrt{2} - 1$$

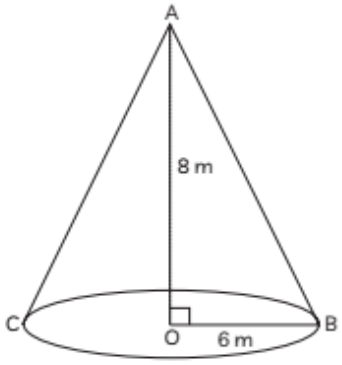
$$= 577 + 577 + 1$$

$$= 1155.$$

34. Tarpaulin will be on the curved area of tent.

Curved surface area of cone = πrl

Where r = 6 m, h = 8m, slant height = l



In ΔAOB,

$$AB^2 = AO^2 + OB^2$$

$$AB^2 = 64 + 36$$

$$AB^2 = 100$$

$$AB = \sqrt{100}$$

$l = 10$ m

$\therefore$ The curved surface area of tent

$= \pi rl$

$= \frac{22}{7} \times 6 \times 10$

$= 188.4\ m^2$

Now,

Area of tarpaulin material = Area of the tent

length × breadth = Area of tent

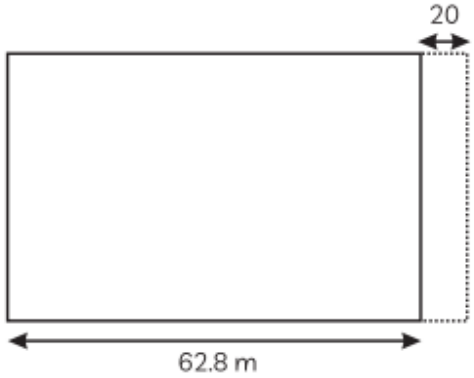
(length) × 3 = Area of tent

$\text{length} = \frac{1}{3}(\text{Area of tent})$

$= \frac{188.4}{3}$

length = 62.8 m

Now, given that margin is 20 cm.



Total length= Length calculated + Margin

$= 62.8\ m + 20\ cm$

$= 62.8\ m + 20 \times \frac{1}{100}\ m$

$= 62.8\ m + 0.2\ m$

Total length = 63 m

OR

Given,

Metal sphere of each radius = 2 cm

And the internal dimension of a packed rectangular box is l = 16 cm, b = 8 cm and h = 8 cm

Calculate the volume of a metal sphere

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

$= \frac{4}{3} \times 3.14 \times (2)^3$

$= \frac{4}{3} \times 3.14 \times 8$

Now, calculate the volume for 16 metal spheres

The volume of 16 metal spheres

$= 16 \times \frac{4 \times 3.14 \times 8}{3}$

$= \frac{100.48 \times 68}{3}$

$= \frac{1607.68}{3}$

$= 535.89\ cm^3$

Calculated the internal volume of a rectangular box

$V = l \times b \times h$

$V = 16 \times 8 \times 8$

$V = 1024\ cm^3$

When 16 spheres are packed in the rectangular box filled with preservative liquid, calculate the volume of preservation liquid.

$V_1 = 1024 - 535.89$

$V_1 = 488.11$

$V_1 \approx 488\ cm^3$

35. Since, the cost of 1 pen = ₹y and that of 1 pencil = ₹x

According to question, we have

Cost of 1 pen is ₹1 more than that of 5 pencils.

$y = 5x + 1$

is the required equation.

Now, putting $x = 0$

$y = 5(0) + 1$

$y = 1$

So, (0, 1) is a solution.

Putting $y = 6$

$6 = 5x + 1$

$5x = 5$

$x = 1$

So, (1, 6) is a solution.

Putting $x = 2$

$y = 5(2) + 1$

$y = 10 + 1$

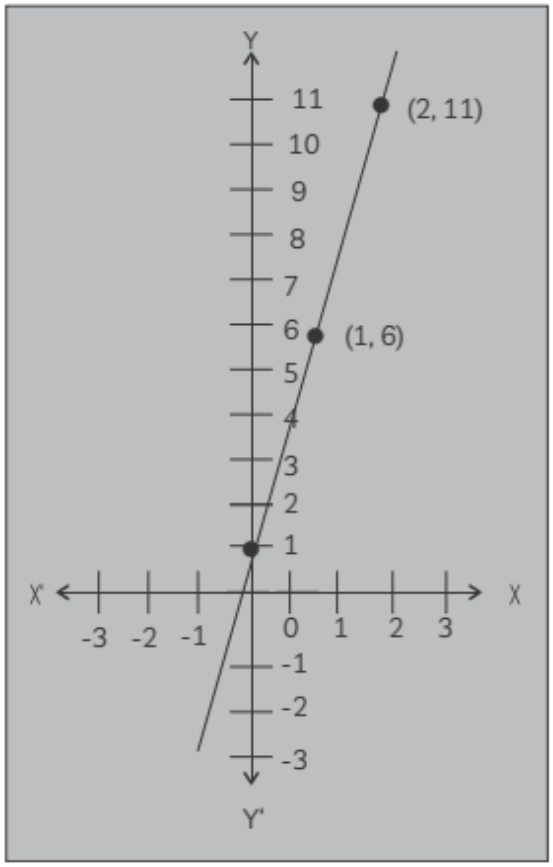
$y = 11$

So, (2, 11) is a solution.

So, the solutions of the equation are:

x	0	1	2
y	1	6	11

Now, plotting the above points, we get the required graph as



SECTION - E

36. (A) In ΔKON and ΔMOP,

KO = OM [O is mid-point]

∠KON = ∠MOP [Vertically opposite angles]

∠NKO = ∠PMO [Alternate angles]

Therefore, ΔKON ≅ ΔMOP

[By ASA Congruence Rule]

(B) According to the question,

N and O are the mid-points

So, By mid-point theorem

$$NO = \frac{1}{2} LM$$

$$\Rightarrow \quad NO = \frac{1}{2} \times 12 \text{ cm} = 6 \text{ cm}$$

So, $$\frac{1}{2} NO = \frac{1}{2} \times 6 \text{ cm} = 3 \text{ cm}$$

OR

NOML is a trapezium, because NO ∥ LM but Nl is not parallel to OM:

Area of Trapezium

$$= \frac{1}{2} \times \text{height} \times [\text{sum of parallel sides}]$$

$$= \frac{1}{2} \times 7 \times [12 + 6]$$

$$= \frac{1}{2} \times 7 \times 18 \text{ cm}^2$$

$$= 63 \text{ cm}^2$$

(C) As according converse of mid-point theorem, NO = OP and NL = PM

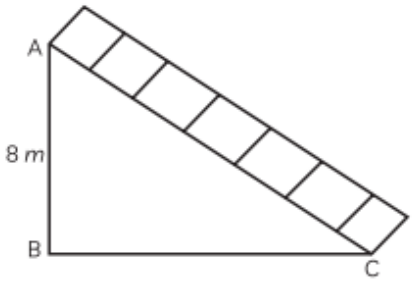
Therefore, NLMP is a parallelogram.

37. (A) As the height of minaret = 8 m

(AB)

Distance at which ladder is fixed = 15 m

(BC)



Apply Pythagoras theorem, in ΔABC

$$AB^2 + BC^2 = AC^2$$

$$(8)^2 + (15)^2 = AC^2$$

$$64 + 225 = AC^2$$

$$AC^2 = 289 \text{ m}^2$$

$$AC = \sqrt{289}$$

$$AC = 17 \text{ m}$$

So, height of ladder = 17 m

OR

Radius, r = 4 cm

Curved surface area of hemisphere = $2\pi r^2$ sq. units

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

$$= 3.14 \times 32$$

$$CSA = 100.48 \text{ cm}^2$$

(B) The surface area of hemisphere (Excluding base) = $2\pi r^2$

$$2\pi r^2 = 7700$$

$$r^2 = \frac{7700 \times 7}{2 \times 22}$$

$$r^2 = 1225$$

$$r = 35 \text{ m}$$

Diameter = $2r$ = 2 × 35 m = 70 m

(C) Radius of hemisphere dome = 7 cm

Volume of hemisphere dome = $\frac{2}{3}\pi r^3$

$$= \frac{2}{3} \times \frac{22}{7} \times 7 \times 7 \times 7$$

$$= 718.6 \text{ cm}^3$$

38. (A) From the given table,

Number of students scoring less than 40 marks = 20 + 13 = 33

Thus, 33 students scored less than 40 marks but more than 20 marks.

(B) Since, distinction are the mark secured above 75.

So, if two students scored distinction are also added, then the number of students scoring more than 70 marks are 13 + 2 = 15

Thus, 15 students scored more than 70 marks.

OR

From the table,

Number of students scoring marks between 50 – 60 = 11

Number of students scoring marks between 60 – 70 = 11

Total number of students = 11 + 17 = 28

(C) From the table,

Number of students scoring less than 60 marks = 8 + 20 + 13 + 18 + 11 = 70