Class IX Session 2023-24
Subject - Mathematics
Sample Question Paper - 2

Time Allowed: 3 hours **Maximum 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 subparts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2marks questions of Section E.
8. Draw neat figures wherever required. Take π =22/7 wherever required if not stated.

Section A

1. Rationalisation of the denominator of $\frac{1}{\sqrt{5}+\sqrt{2}}$ gives **[1]**

a) $\sqrt{5}+\sqrt{2}$ b) $\sqrt{5}-\sqrt{2}$

c) $\frac{1}{\sqrt{10}}$ d) $\frac{\sqrt{5}-\sqrt{2}}{3}$

2. If (4, 19) is a solution of the equation y = ax + 3, then a = **[1]**

a) 4 b) 6

c) 3 d) 5

3. P(5, -7) be a point on the graph. Draw the PM $\perp$ y-axis. The coordinates of M are **[1]**

a) (0, -7) b) (0, 0)

c) (-7, 0) d) (-7, 5)

4. To draw a histogram to represent the following frequency distribution : **[1]**

Class interval	5-10	10-15	15-25	25-45	45-75
Frequency	6	12	10	8	15

The adjusted frequency for the class 25-45 is

a) 6 b) 5

c) 2 d) 3

5. If the line represented by the equation 3x + ky = 9 passes through the points (2, 3), then the value of k is **[1]**

a) 2 b) 1

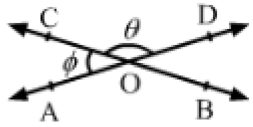
c) 3 d) 4

6. In ancient India, the shapes of altars used for household rituals were **[1]**

a) triangles and rectangles b) trpeziums and pyramids

c) squares and circles d) rectangles and squares

7. In the given figure, straight lines AB and CD intersect at O. If $\angle AOC = \phi, \angle BOC = \theta$ and $\theta = 3\phi$, then $\phi = ?$ **[1]**



a) 40° b) 30°

c) 45° d) 60°

8. In which of the following figures are the diagonals equal? **[1]**

a) Rhombus b) Rectangle

c) Parallelogram d) Trapezium

9. If x + 1 is a factor of the polynomial $2x^2$ + kx, then k = **[1]**

a) -3 b) 4

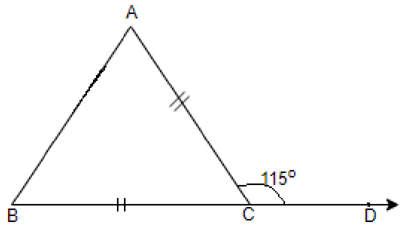
c) -2 d) 2

10. x = 2, y = 5 is a solution of the linear equation **[1]**

a) 5 x + y = 7 b) x + y = 7

c) 5x +2y = 7 d) x + 2y = 7

11. In the adjoining figure, BC = AC. If ∠ACD = 115°, the ∠A is **[1]**



a) 50° b) 65°

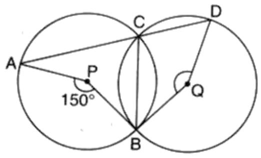
c) 57.5° d) 70°

12. Diagonals of a quadrilateral ABCD bisect each other. If ∠A = 45^o, then ∠B = **[1]**

a) 125^o b) 115^o

c) 120^o d) 135^o

13. In the given figure, P and Q are centers of two circles intersecting at B and C. ACD is a straight line. Then, the measure of $\angle BQD$ is **[1]**



a) 130^o

b) 150^o

c) 105^o

d) 115^o

14. An irrational number between 2 and 2.5 is **[1]**

a) $\sqrt{5}$

b) $\sqrt{11}$

c) $\sqrt{22.5}$

d) $\sqrt{12.5}$

15. Express y in terms of x in the equation 5y - 3x - 10 = 0. **[1]**

a) $y = \frac{3-10x}{5}$

b) $y = \frac{3+10x}{5}$

c) $y = \frac{3x-10}{5}$

d) $y = \frac{3x+10}{5}$

16. If the sides of a triangle are produced in order, then the sum of the three exterior angles so formed is **[1]**

a) 90°

b) 270°

c) 180°

d) 360°

17. $x + 1$ is a factor of the polynomial **[1]**

a) $x^3 + 2x^2 - x - 2$

b) $x^3 + 2x^2 - x + 2$

c) $x^3 - 2x^2 + x + 2$

d) $x^3 + 2x^2 + x - 2$

18. If a solid sphere of radius r is melted and cast into the shape of a solid cone of height r, then the radius of the base of the cone is **[1]**

a) 3r

b) r

c) 2r

d) 4r

19. **Assertion (A):** The side of an equilateral triangle is 6 cm then the area of the triangle is 9 cm^2. **[1]**
Reason (R): All the sides of an equilateral triangle are equal.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

20. **Assertion (A):** For all values of k, $(\frac{-3}{2}, k)$ is a solution of the linear equation 2x + 3 = 0. **[1]**
Reason (R): The linear equation ax + b = 0 can be expressed as a linear equation in two variables as ax + y + b = 0.

a) Both A and R are true and R is the correct explanation of A.

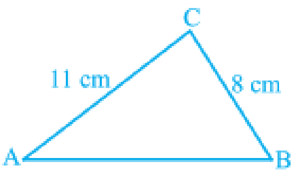
b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

Section B

21. Find the area of a triangle, two sides of which are 8 cm and 11 cm and the perimeter is 32 cm. **[2]**

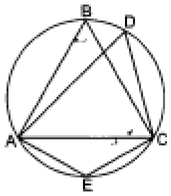


22. Prove the exterior angle formed by producing a side of a cyclic quadrilateral is equal to the interior opposite angle. **[2]**

23. A right triangle ABC with sides 5 cm, 12 cm and 13 cm is revolved about the side 12 cm. Find the volume of the solid so obtained. **[2]**

24. In the given figure, $\triangle ABC$ is an equilateral. Find **[2]**

i. $\angle ADC$
ii. $\angle AEC$



OR

Prove that a diameter of a circle which bisects a chord of the circle also bisects the angle subtended by the chord at the centre of the circle.

25. Find whether the given equation have x = 2, y = 1 as a solution: **[2]**

2x + 5y = 9

OR

The following values of x and y are thought to satisfy a linear equation :

x	1	2
y	1	3

Section C

26. Find the values of a and b in each of $\frac{\sqrt{2}+\sqrt{3}}{3\sqrt{2}-2\sqrt{3}} = a - b\sqrt{6}$ **[3]**

27. Factorise : $x^3 - 23x^2 + 142x - 120$ **[3]**

28. The perimeter of an isosceles triangle is 32 cm. The ratio of the equal side to its base is 3: 2. Find the area of the triangle. **[3]**

OR

The perimeter of a triangle is 480 meters and its sides are in the ratio of 1:2:3. Find the area of the triangle?

29. Find solutions of the form x = a, y = 0 and x = 0, y = b for the following pairs of equations. Do they have any common such solution? **[3]**

5x + 3y = 15 and 5x + 2y = 10

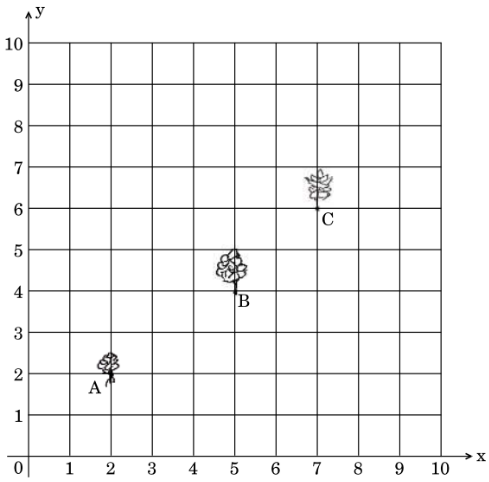
30. If two isosceles triangles have a common base, prove that the line joining their vertices bisects them at right angles. **[3]**

OR

S is any point on side QR of a $\triangle PQR$. Show that: PQ + QR + RP > 2PS.

31. Seema has a 10 m $\times$ 10 m kitchen garden attached to her kitchen. She divides it into a 10 $\times$ 10 grid and wants to grow some vegetables and herbs used in the kitchen. She puts some soil and manure in that and sows a green chilly plant at A, a coriander plant at B and a tomato plant at C. **[3]**

Her friend Kusum visited the garden and praised the plants grown there. She pointed out that they seem to be in a straight line. See the below diagram carefully and answer the following questions :



i. Write the coordinates of the points A, B, and C taking the 10×10 grid as coordinate axes.

ii. By distance formula or some other formula, check whether the points are collinear.

Section D

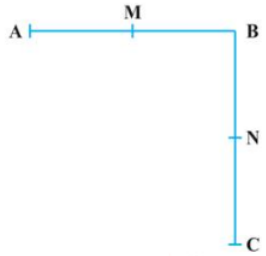
32. It being given that $\sqrt{3} = 1.732$, $\sqrt{5}$ = 2.236, $\sqrt{6} = 2.449$ and $\sqrt{10} = 3.162$, find upto three places of decimal, $\frac{3+\sqrt{5}}{3-\sqrt{5}}$. **[5]**

OR

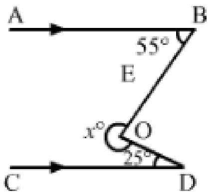
Simplify: $\frac{7\sqrt{3}}{\sqrt{10}+\sqrt{3}} - \frac{2\sqrt{5}}{\sqrt{6}+\sqrt{5}} - \frac{3\sqrt{2}}{\sqrt{15}+3\sqrt{2}}$.

33. i. AB = BC, M is the mid-point of AB and N is the mid-point of BC. Show that AM = NC. **[5]**

ii. BM = BN, M is the mid-point of AB and N is the mid-point of BC. Show that AB = BC.

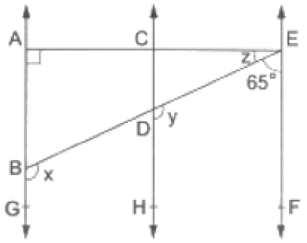


34. In each of the figures given below, AB || CD. Find the value of x° **[5]**



OR

In the given figure, AB || CD || EF, $\angle DBG = x, \angle EDH = y, \angle AEB = z, \angle EAB = 90^\circ$ and $\angle BEF = 65^\circ$. Find the values of x, y and z.



35. The following data gives the amount of manure (in thousand tonnes) manufactured by a company during some years: **[5]**

Year	1992	1993	1994	1995	1996	1997
Manure (in thousand tonnes)	15	35	45	30	40	20

i. Represent the above data with the help of a bar graph.

ii. Indicate with the help of the bar graph the year in which the amount of manufactured by the company was maximum.

iii. Choose the correct alternative :

The consecutive years during which there was maximum decrease in manure production are:

a. 1994 and 1995

b. 1992 and 1993

c. 1996 and 1997

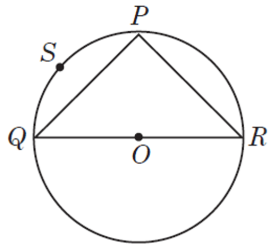
d. 1995 and 1996

Section E

36. **Read the text carefully and answer the questions:** **[4]**

Sanjay and his mother visited in a mall. He observes that three shops are situated at P, Q, R as shown in the figure from where they have to purchase things according to their need. Distance between shop P and Q is 8 m and between shop P and R is 6 m.

Considering O as the center of the circles.



(i) Find the Measure of $\angle$QPR.

(ii) Find the radius of the circle.

(iii) Find the Measure of $\angle$QSR.

OR

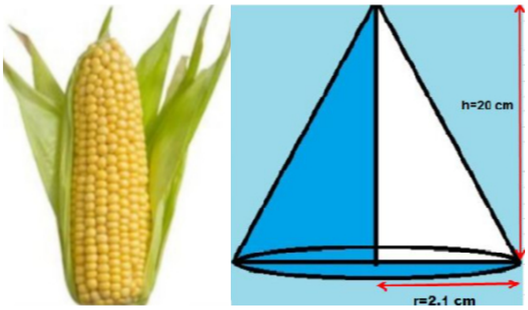
Find the area of ΔPQR.

37. **Read the text carefully and answer the questions:** **[4]**

Once upon a time in Ghaziabad was a corn cob seller. During the lockdown period in the year 2020, his business was almost lost.

So, he started selling corn grains online through Amazon and Flipcart. Just to understand how many grains he will have from one corn cob, he started counting them.

Being a student of mathematics let's calculate it mathematically. Let's assume that one corn cob (see Fig.), shaped somewhat like a cone, has the radius of its broadest end as 2.1 cm and length as 20 cm.



(i) Find the curved surface area of the corn cub.

(ii) What is the volume of the corn cub?

(iii) If each 1 cm^2 of the surface of the cob carries an average of four grains, find how many grains you would find on the entire cob?

OR

How many such cubs can be stored in a cartoon of size 20 cm $\times$ 25 cm $\times$ 20 cm.

38. **Read the text carefully and answer the questions:** **[4]**

Harish makes a poster in the shape of a parallelogram on the topic SAVE ELECTRICITY for an inter-school competition as shown in the follow figure.

(i) If $\angle A = (4x + 3)^o$ and $\angle D = (5x - 3)^o$, then find the measure of $\angle B$.

(ii) If $\angle B = (2y)^o$ and $\angle D = (3y - 6)^o$, then find the value of y.

(iii) If $\angle A = (2x - 3)^o$ and $\angle C = (4y + 2)^o$, then find how x and y relate.

OR

If AB = (2y - 3) and CD = 5 cm then what is the value of y?

Solutions

Section A

1.

   (d) $\frac{\sqrt{5}-\sqrt{2}}{3}$

   Explanation: $\frac{1}{\sqrt{5}+\sqrt{2}}$

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

   $=\frac{\sqrt{5}-\sqrt{2}}{3}$

2. **(a)** 4

   Explanation: Given, (4, 19) is a solution of the equation *y*=*ax*+3

   =19 = 4a + 3

   = a = 4

3. **(a)** (0, -7)

   Explanation: Here, PM Perpendicular to y-axis.

   So point M lies on the y-axis, and for any point on y-axis always the value of x = 0.

   So Co-ordinate of M = (0, -7).

4.

   (c) 2

   Explanation: Adjusted frequency = $\left(\frac{\text{frequency of the class}}{\text{width of the class}}\right) \times 5$

   Therefore, Adjusted frequency of 25 - 45 = $\frac{8}{20} \times 5 = 2$

5.

   (b) 1

   Explanation: If the line represented by the equation 3x + ky = 9 passes through the points (2, 3) then (2, 3) will satisy the equation 3x + ky = 9

   3 (2) + 3k = 9

   ⇒ 6 + 3k = 9

   ⇒ 3k = 9 - 6

   ⇒ 3k = 3

   ⇒ k = 1

6.

   (c) squares and circles

   Explanation: In ancient India, squares and circular altars were used for household rituals. The geometry of the Vedic period originated with the construction of altars (or vedis) and fireplaces for performing Vedic rites. Square and circular altars were used for household rituals, while altars, whose shapes were combinations of rectangles, triangles and trapeziums, were required for public worship.

7.

   (c) 45°

   Explanation: We have:

   $\theta+\phi=180^{\circ}$ [$\because$ AOD is a straight line]

   $\Rightarrow 3\phi+\phi=180^{\circ}$ [$\because \theta=3\phi$]

   $\Rightarrow 4\phi=180^{\circ}$

   $\Rightarrow \phi=45^{\circ}$

8.

   (b) Rectangle

   Explanation: Rectangle is the correct answer. As we know that from all the quadrilaterals given in other options, diagonals of a rectangle are equal.

9.

(d) 2

Explanation: If p(x) = x + 1 is a factor of $2x^2 + kx$, then

p(-1) = 0

$\Rightarrow 2(-1)^2 + k(-1) = 0$

$\Rightarrow$ 2 - k = 0

$\Rightarrow$ k = 2

10.

(b) x + y = 7

Explanation: x = 2 and y = 5 satisfy the given equation.

11.

(c) 57.5°

Explanation: As BC = AC, therefore triangle ABC is an isoscelestriangle.

Given $\angle ACD = 115^o$, $\angle ACB = 180 - 115 = 65^o$ (Linear Pair)

As AC = BC, therefore $\angle A = \angle B$

As sum of all the three angles of atriangle is 180°

Therefore,$\angle A + \angle B + \angle ACB = 180^o$

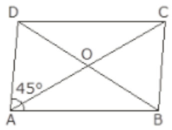
$\angle A = \angle B = 57.5$

12.

(d) 135^o

Explanation:

Given,



ABCD is a quadrilateral

$\angle A = 45^o$,

$\because$ diagonals of quadrilateral bisects each other hence ABCD is a parallelogram,

$\Rightarrow \angle A + \angle B = 180^o$

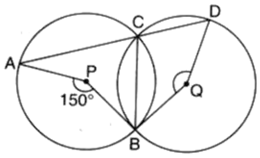
$\Rightarrow 45^o + \angle B = 180^o$

$\Rightarrow \angle B = 180^o - 45^o = 135^o$

13.

(b) 150^o

Explanation:



$\angle APB$ = 150°, so, $\angle ACB$ = 75° {Angle subtended by an arc at centre is twice the angle subtended at any point on circumference}

Now, ACD is straight line, so, $\angle ACB + \angle DCB = 180^{\circ}$

$\angle DCB$ = 180 - 75 = 105°

Now, angle subtended by arc BD on centre is twice of $\angle DCB = 2 \times 105 = 210°$

Now, $\angle BQD$ = 360°- 210° = 150°

14. **(a)** $\sqrt{5}$

Explanation: $\sqrt{5}$ = 2.23606797749978969, Which is a non-terminating and non- repeating decimal therefore it is an irrational and also lies between 2 and 2,5

15.

(d) $y = \frac{3x+10}{5}$

Explanation: 5y - 3x - 10 = 0

5y - 3x = 10

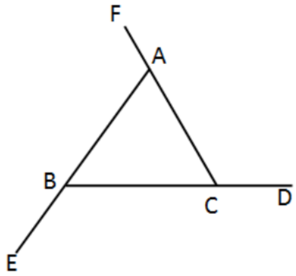
5y = 10 + 3x

y = $\frac{10+3x}{5}$

16.

(d) 360°

Explanation:



In △ABC

∠A + ∠B + ∠C = 180°

Now, ∠FAB = 180°- ∠A ...(i)

∠DCA = 180° - ∠C ...(ii)

∠EBC = 180° - ∠B ...(iii)

Adding equations (i), (ii) and (iii)

∠FAB + ∠DCA + ∠EBC = 180° - ∠A + 180° - ∠C + 180° - ∠B

= 540° - (∠A + ∠B + ∠C)

= 540° - 180°

⇒ Sum of All exterior angles = 360°

17. **(a)** $x^3 + 2x^2 - x - 2$

Explanation: $x^3 + 2x^2 - x - 2$

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

= $\left(x^2 - 1\right)(x+2)$

= $(x+1)(x-1)(x+2)$

18.

(c) 2r

Explanation: Volume of a sphere = (4/3)πr^3

Volume of a solid cone = (1/3)πr^{2}h

Given, solid sphere of radius *r* is melted and cast into the shape of a solid cone of height *r*

Let the base radius be A.

⇒ (4/3)πr^3 = (1/3)π × A^2 × r

⇒ A = 2r

19.

(d) A is false but R is true.

Explanation: s = $\frac{6+6+6}{2} = \frac{18}{2}$ = 9 cm

Area = $\sqrt{9(9-6)(9-6)(9-6)}$

= $\sqrt{9 \times 3 \times 3 \times 3}$ = $9\sqrt{3}$ cm^2

20.

(c) A is true but R is false.

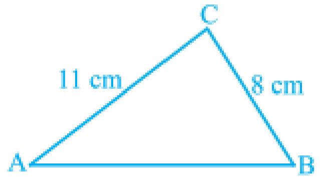
Explanation: ($\frac{-3}{2}$, k) is a solution of 2x + 3 = 0

$2 \times \left(-\frac{3}{2}\right) + 3$ = -3 + 3 = 0

($\frac{-3}{2}$, k) is the solution of 2x + 3 = 0 for all values of k.

Also ax + b = 0 can be expressed as a linear equation in two variables as ax + 0·y + b = 0.

Section B

21. 

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

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

Now,

a + b + c = 2s

$\Rightarrow$ 8 + 11 + c = 32

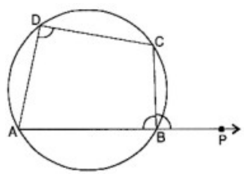
$\Rightarrow$ c = 13

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

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

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

22. Given: ABCD is a cyclic quadrilateral whose side AB is produced to P to formed exterior $\angle$CBP.



To prove: $\angle$ CBP. = Interior opposite $\angle$ ADC

Proof : $\because$ ABCD is a cyclic quadrilateral

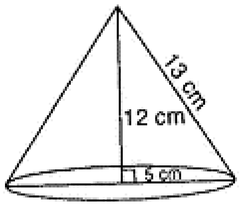
$\therefore$ $\angle$ADC+ $\angle$ABC = 180° 180°

$\because$ Opposite angles of a cyclic quadrilateral are supplementary

Also, $\angle$ABC + $\angle$CBP = 180° ...(2) |Linear Pair Axiom

From (1) and (2), we have

$\angle$ABC + $\angle$CBP = $\angle$ABC + $\angle$ABC

23. 

The solid obtained will be a right circular cone whose radius of the base is 5 cm. and height is 12 cm

$\therefore$ r = 5 cm, h = 12 cm

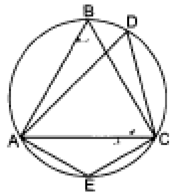
$\therefore$ Volume = $\frac{1}{3}\pi r^2 h$

$\frac{1}{3} \times \pi \times (5)^2 \times 12\ cm^3$

= 100π cm^3

The volume of the solid so obtained is 100π cm^3

24. Here it is given that $\triangle \mathrm{ABC}$ is an equilateral triangle,



i. As ABC is equilateral, we have

$\angle$ABC = 60^o

$\angle$ADC = $\angle$ABC ....(Angles in the same segment)

$\therefore\angle$ADC = 60^o

ii. ∠ABC + ∠AEC = 180° ....(Opposite angles of cyclic quadrilateral)

60° + ∠AEC = 180°

⇒ ∠AEC = 180°- 60° = 120°

OR

Given that, PQ is a diameter of circle which bisects chord AB to C

To prove: PQ bisects ∠AOB

Proof: In △AOC and △BOC,

OA = OB (Radius of circle)

OC = OC (Common)

AC = BC (Given)

Then, △ADC ≅ △BOC (By SSS congruence rule)

∠AOC = ∠BOC (By c.p.c.t)

Hence, PQ bisects ∠AOB.

25. For x = 2, y = 1,

L.H.S. = 2x + 5y

= 2(2) + 5(1)

= 4 + 5 = 9

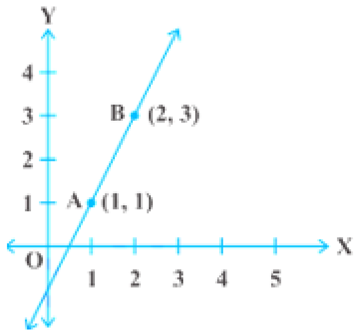
= R.H.S.

∴ x = 2, y = 1 is a solution of 2x + 5y = 9

OR

From the table, we get two points A (1,1) and B (2,3) which lie on the graph of the linear equation Obviously, the graph will be a straight line so we first plot the points A and B and join them as shown in the fig

from the fig we see that the graph cuts the x axis at the point $\left(\frac{1}{2}, 0\right)$ an and y - axis at the point (0, -1)



Section C

26. LHS $= \frac{\sqrt{2}+\sqrt{3}}{3\sqrt{2}-2\sqrt{3}} = \frac{\sqrt{2}+\sqrt{3}}{3\sqrt{2}-2\sqrt{3}} \times \frac{3\sqrt{2}+2\sqrt{3}}{3\sqrt{2}+2\sqrt{3}}$

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

$= \frac{6+2\sqrt{6}+3\sqrt{6}+6}{18-12}$

$= \frac{12+5\sqrt{6}}{6} = 2 + \frac{5\sqrt{6}}{6}$

Now, $a - b\sqrt{6} = 2 + \frac{5}{6}\sqrt{6}$

a = 2

b = $-\frac{5}{6}$

27. Let p(x) = $x^3 - 23x^2 + 142x - 120$

We shall now look for all the factors of –120. Some of these are ±1, ±2, ±3, ±4, ±5, ±6, ±8, ±10, ±12, ±15, ±20, ±24, ±30, ±60.

By hit and trial, we find that p(1) = 0. Therefore, x – 1 is a factor of p(x).

Now we see that $x^3 - 23x^2 + 142x - 120 = x^3 - x^2 - 22x^2 + 22x + 120x - 120$

$= x^2 (x - 1) - 22x(x - 1) + 120(x - 1)$

$= (x - 1)(x^2 - 22x + 120)$ [Taking (x – 1) common]

Now $x^2 - 22x + 120$ can be factorised either by splitting the middle term or by using the Factor theorem. By splitting the middle term, we have: $x^2 - 22x + 120 = x^2 - 12x - 10x + 120$

= x(x – 12) – 10(x – 12)

= (x – 12) (x – 10)

Therefore, $x^3 - 23x^2 - 142x - 120 = (x - 1)(x - 10)(x - 12)$

28. As the sides of the equal to the base of an isosceles triangle is 3 : 2, so let the sides of an isosceles triangle be 3x, 3x and 2x.

Now, perimeter of triangle = 3x + 3x + 2x = 8x

Given Perimeter of triangle = 32 m

$\therefore 8x = 32; x = 32 \div 8 = 4$

So, the sides of the isosceles triangle are $(3 \times 4)cm, (3 \times 4)cm, (2 \times 4)cm$ i.e., 12 cm, 12 cm and 8cm

$\therefore\ s = \frac{12+12+8}{2} = \frac{32}{2} = 16cm$

$= \sqrt{16(16-12)(16-12)(16-8)}$

$= \sqrt{16 \times 4 \times 4 \times 8} = \sqrt{4 \times 4 \times 4 \times 4 \times 4 \times 2}$

$= 4 \times 4 \times 2\sqrt{2} = 32\sqrt{2}cm^2$

OR

Let the sides of the triangle be x,2x,3x

Perimeter of the triangle = 480 m

$\therefore x + 2x + 3x = 480m$

$6x = 480m$

$x = 80m$

$\therefore$ The sides are 80m, 160m, 240m

so,

$S = \frac{80+160+240}{2} = \frac{480}{2}$

= 240 m

And,

$\therefore \quad \text{Area of triangle } = \sqrt{s(s-a)(s-b)(s-c)}\ sqm$

$= \sqrt{240(240-80)(240-160)(240-240)}$sqm

= 0 sq m

$\therefore$ Triangle doesn't exit with the ratio 1:2:3 whose perimeter is 480 m.

29. 5x + 3y = 15

Put x = 0, we get

5(0) + 3y = 15

⇒ 3y = 15

⇒ $y = \frac{15}{3} = 5$

∴ (0, 5) is a solution.

5x + 3y = 15

Put y = 0, we get

5x + 3(0) = 15

⇒ 5x = 15

⇒ $x = \frac{15}{5} = 3$

∴ (3, 0) is a solution.

5x + 2y = 10

Put x = 0, we get

5(0) + 2y = 10

⇒ 2y = 10

⇒ $y = \frac{10}{2} = 5$

∴ (0, 5) is a solution.

5x + 2y = 10

Put y = 0, we get

5x + 2(0) = 10

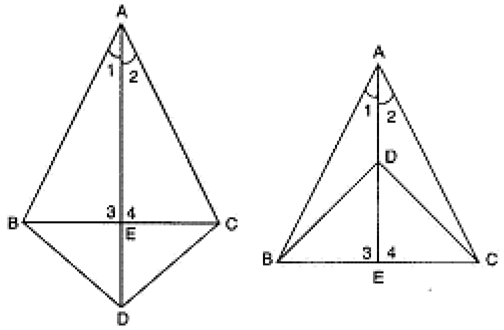
⇒ 5x = 10

⇒ $x = \frac{10}{5} = 2$

∴ (2, 0) is a solution.

The given equations have a common solution (0, 5).

30. In $\triangle$ABD and $\triangle$ACD



AB = AC, BD = CD . . . [Given]

AD = AD . . . [Common]

$\therefore$ $\triangle$ABD $\cong$ $\triangle$ACD . . . [SSS axiom]

$\therefore$ $\angle$1 = $\triangle$2 . . .[c.p.c.t.]

In $\triangle$ABE and $\triangle$ACE,

AB = AC . . .[Given]

AE = AE . . .[Common]

$\angle$1 = $\angle$2 . . .[As proved above]

$\therefore$ $\triangle$ABE $\cong$ $\triangle$ACE . . . [SAS axiom]

$\therefore$ BE = CE . . . [c.p.c.t.]

and $\angle$3 = $\angle$4 . . .[c.p.c.t.]

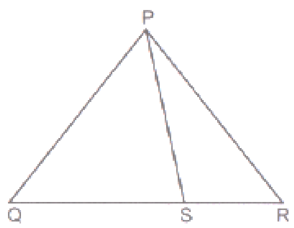
But $\angle 3 + \angle 4 = 180^o$ . . .[Linear pair axiom]

$\therefore \angle 3 = \angle 4 = 90^o$

Hence, AD bisects BC at right angles.

OR

Given: A Point S on side QR of $\triangle$PQR.



To prove: PQ + QR + RP > 2PS

Proof: In ΔPQS, we have

PQ + QS > PS…(1)

[$\because$ Sum of the length of any two sides of a triangle must be greater than the third side]

Now, in $\triangle$PSR, we have

RS + RP > PS…(2)

[$\because$ Sum of the length of any two sides of triangle must be greater than the third side]

Adding (1) and (2), we get

PQ + QS + RS + RP > 2PS

$\Rightarrow$ PQ + QR + RP > 2PS

Hence, proved.

31. i. A(2, 2)
B(5, 4)
C(7, 6)

ii. AB = $\sqrt{(5-2)^2+(2-2)^2}$

= $\sqrt{9+4}$

= $\sqrt{13}$

BC = $\sqrt{(7-5)^2+(6-4)^2}$

= $\sqrt{4+4}$

= $2\sqrt{2}$

AC = $\sqrt{(7-2)^2+(6-2)^2}$
= $\sqrt{25+16}$
= $\sqrt{41}$
$\because$ AB + BC = $\sqrt{13}+2\sqrt{2}$
AC = $\sqrt{41}$
$\therefore$ AB + BC $\neq$ AC
$\therefore$ A, B, C are not collinear

Section D

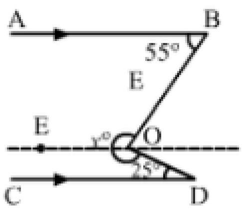
32. $\frac{3+\sqrt{5}}{3-\sqrt{5}}$
$= \frac{3+\sqrt{5}}{3-\sqrt{5}} \times \frac{3+\sqrt{5}}{3+\sqrt{5}}$
$= \frac{(3+\sqrt{5})^2}{3^3-\sqrt{5}^2}$ [$a^2 - b^2 = (a + b)(a - b)$]
$= \frac{3^2+2\times3\sqrt{5}+\sqrt{5}^2}{9-5}$
$= \frac{9+6\sqrt{5}+5}{4}$
$= \frac{14+6\sqrt{5}}{4}$
$= \frac{7+3\sqrt{5}}{2}$
Substituting the value $\sqrt{5}$ we get,
$\frac{7+3\times2.236}{2}$
$= \frac{7+6.708}{2}$
$= \frac{13.708}{2}$
= 6.854

OR

Given, $\frac{7\sqrt{3}}{\sqrt{10}+\sqrt{3}} - \frac{2\sqrt{5}}{\sqrt{6}+\sqrt{5}} - \frac{3\sqrt{2}}{\sqrt{15}+3\sqrt{2}}$
$= \frac{7\sqrt{3}}{\sqrt{10}+\sqrt{3}} \times \frac{\sqrt{10}-\sqrt{3}}{\sqrt{10}-\sqrt{3}} - \frac{2\sqrt{5}}{\sqrt{6}+\sqrt{5}} \times \frac{\sqrt{6}-\sqrt{5}}{\sqrt{6}-\sqrt{5}} - \frac{3\sqrt{2}}{\sqrt{15}+3\sqrt{2}} \times \frac{\sqrt{15}-3\sqrt{2}}{\sqrt{15}-3\sqrt{2}}$
$= \frac{7\sqrt{3}(\sqrt{10}-\sqrt{3})}{(\sqrt{10})^2-(\sqrt{3})^2} - \frac{2\sqrt{30}-2\times5}{(\sqrt{6})^2-(\sqrt{5})^2} - \frac{3\sqrt{30}-18}{(\sqrt{15})^2-(3\sqrt{2})^2}$
$= \frac{7(\sqrt{30}-3)}{10-3} - \frac{(2\sqrt{30}-10)}{6-5} - \frac{3\sqrt{30}-18}{15-18}$
$= \sqrt{30}-3-(2\sqrt{30}-10)-(6-\sqrt{30})$
$= \sqrt{30}-3-2\sqrt{30}+10-6+\sqrt{30}$
$= 10-9+2\sqrt{30}-2\sqrt{30} = 1$

33. i. From the above figure, We have AB = BC…(1) [Given]
Now, A, M, B are the three points on a line, and M lies between A and B such that M is the mid point of AB [Given], then AM + MB = AB …(2) Also B, N, C are three points on a line such that N is the mid point of BC [Given]
Similarly, BN + NC = BC....(3)
So, we get AM + MB = BN + NC
From (1), (2), (3) and Euclid's first axiom
Since M is the mid-point of AB and N is the mid-point of BC, therefore
2AM = 2NC i.e. AM = NC
Hence, AM = NC. Proved
Using axiom 6, things which are double of the same thing are equal to one another.

ii. From the above figure, We have BM = BN …(1) [Given]
As M is the mid-point of AB [Given] , so that
BM = AM…(2)
And N is the mid-point of BC [Given]
BN = NC…(3)
From (1), (2) and (3) and Euclid's first axiom, we get
AM = NC…(4)
Adding (4) and (1), we get
AM + BM = NC + BN
Hence, AB = BC Proved
[By axiom 2 if equals are added to equals, the wholes are equal]

34. 

Draw EO || AB || CD

Then, $\angle EOB + \angle EOD = x°$

Now, EO || AB and BO is the transversal.

$\therefore \angle EOB + \angle ABO = 180°$ [Consecutive Interior Angles]

$\Rightarrow \angle EOB + 55° = 180°$

$\Rightarrow \angle EOB = 125°$

Again, EO || CD and DO is the transversal.

$\therefore \angle EOD + \angle CDO = 180°$ [Consecutive Interior Angles]

$\Rightarrow \angle EOD + 25° = 180°$

$\Rightarrow \angle EOD = 155°$

Therefore,

$x° = \angle EOB + \angle EOD$

x° = (125 + 155)°

x° = 280°

OR

EF || CD and ED is the transversal.

$\therefore \quad \angle FED + \angle EDH = 180°$ [co-interior angles]

$\Rightarrow$ 65° + y = 180°

$\Rightarrow$ y = (180° - 65°) = 115°.

Now CH || AG and DB is the transversal

$\therefore$ x = y = 115° [corresponding angles]

Now, ABG is a straight line.

$\therefore \angle ABE + \angle EBG = 180°$ [sum of linear pair of angles is 180°]

$\Rightarrow \angle ABE + x = 180°$

$\Rightarrow \angle ABE + 115° = 180°$

$\Rightarrow \angle ABE = (180° - 115°) = 65°$

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

From $\triangle$EAB, we get

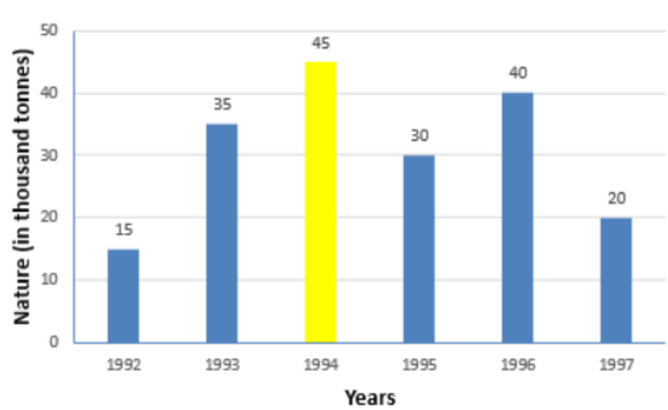
$\angle EAB + \angle ABE + \angle BEA = 180°$

$\Rightarrow$ 90° + 65° + z = 180°

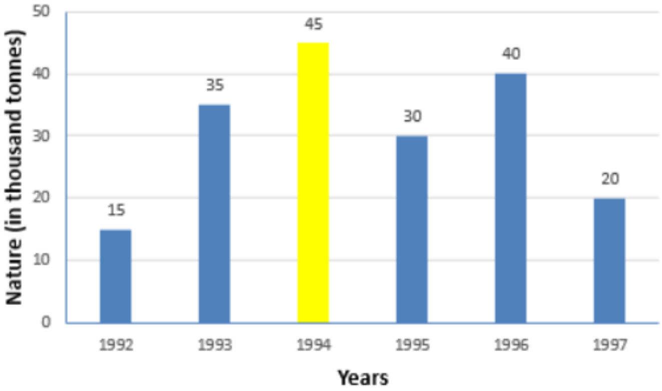
$\Rightarrow$ z = (180° - 155°) = 25°

$\therefore$ x = 115°, y = 115° and z = 25°

35. i. The bar graph is given below.



ii. Max. is shown by yellow colour.

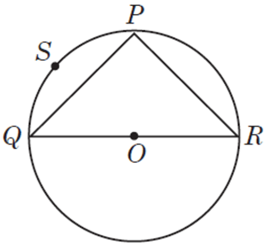


iii. (c) 1996 and 1997

Section E

36. **Read the text carefully and answer the questions:**

Sanjay and his mother visited in a mall. He observes that three shops are situated at P, Q, R as shown in the figure from where they have to purchase things according to their need. Distance between shop P and Q is 8 m and between shop P and R is 6 m. Considering O as the center of the circles.



(i) We know that angle in the semicircle = 90^o

Here QR is a diameter of circle and $\angle$QPR is angle in semicircle.

Hence $\angle QPR = 90^o$

(ii) $\angle QPR = 90^o$

$\Rightarrow QR^2 = PQ^2 + PR^2$

$\Rightarrow QR^2 = 8^2 + 6^2$

$\Rightarrow QR = \sqrt{64 + 36}$

$\Rightarrow$ QR = 10 m

(iii) Measure of $\angle QSR = 90^o$

Angles in the same segment are equal. $\angle$QSR and $\angle$QPR are in the same segment.

OR

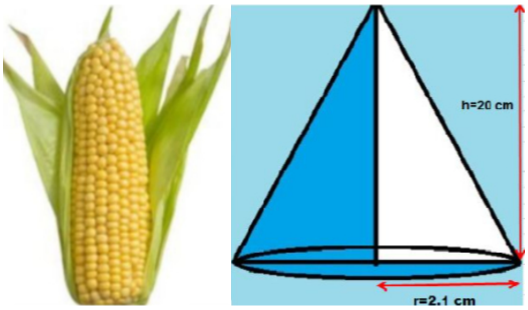
Area $\Delta PQR = \frac{1}{2} \times PQ \times PR$

$\Rightarrow$ Area $\Delta PQR = \frac{1}{2} \times 8 \times 6 = 24$ sqm

37. **Read the text carefully and answer the questions:**

Once upon a time in Ghaziabad was a corn cob seller. During the lockdown period in the year 2020, his business was almost lost. So, he started selling corn grains online through Amazon and Flipcart. Just to understand how many grains he will have from one corn cob, he started counting them.

Being a student of mathematics let's calculate it mathematically. Let's assume that one corn cob (see Fig.), shaped somewhat like a cone, has the radius of its broadest end as 2.1 cm and length as 20 cm.



(i) First we will find the curved surface area of the corn cob.

We have, r = 2.1 and h = 20

Let l be the slant height of the conical corn cob. Then,

l = $\sqrt{r^2+h^2} = \sqrt{(2.1)^2+(20)^2}$ = $\sqrt{4.41+400} = \sqrt{404.41}$ = 20.11 cm

$\therefore$ Curved surface area of the corn cub = $\pi r l$

= $\frac{22}{7} \times 2.1 \times 20.11$ cm^2

= 132.726 cm^2 = 132.73 cm^2

(ii) The volume of the corn cub

$= \frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times 2.1 \times 2.1 \times 20$

= 92.4 cm^3

(iii)Now

Total number of grains on the corn cob = Curved surface area of the corn cob $\times$ Number of grains of corn on 1 cm^2

Hence, Total number of grains on the corn cob = 132.73 $\times$ 4 = 530.92

So, there would be approximately 531 grains of corn on the cob.

OR

Volume of a corn cub = 92.4 cm^3

Volume of the cartoon = 20 $\times$ 25 $\times$ 20 = 10,000 cm^3

Thus no. of cubs which can be stored in the cartoon

$\frac{10000}{92.4} \approx 108$ cubs

38. **Read the text carefully and answer the questions:**

Harish makes a poster in the shape of a parallelogram on the topic SAVE ELECTRICITY for an inter-school competition as shown in the follow figure.

(i) Since, ABCD is a parallelogram.

$\angle$A + $\angle$D = 180^o (adjacent angles of a quadrilateral are equal)

(4x + 3)^o + (5x + 3)^o = 180^o

9x = 180^o

x = 20

$\angle$D = (5x - 3)^o = 97^o

$\angle$D = $\angle$B (opposite angles of a parallelogram are equal)

Thus, $\angle$B = 97^o

(ii) $\angle$B = $\angle$D (opposite angles of a parallelogram are equal)

$\Rightarrow$ 2y = 3y - 6

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

$\Rightarrow$ -y = -6

$\Rightarrow$ y = 6

(iii)$\angle$A = $\angle$C (opposite angles of a parallelogram are equal)

$\Rightarrow$ 2x - 3 = 4y + 2

$\Rightarrow$ 2x = 4y + 5

$\Rightarrow$ x = 2y + $\frac{5}{2}$

OR

AB = CD

$\Rightarrow$ 2y - 3 = 5

$\Rightarrow$ 2y = 8

$\Rightarrow$ y = 4