Class 09 - Mathematics
Sample Paper - 01 (2022-23)

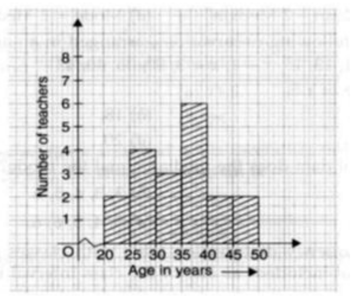
Maximum Marks: 80
Time Allowed: : 3 hours

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. The abscissa of a point is the distance of the point from
    a) None of these
    b) origin
    c) x-axis
    d) y-axis
2. The measure of each side of an equilateral triangle whose area is $\sqrt{3}$ cm^2 is
    a) 8 cm
    b) 4 cm
    c) 2 cm
    d) 16 cm
3. If a chord of a circle is equal to its radius, then the angle subtended by this chord in major segment is
    a) 30^o
    b) 90^o
    c) 45^o
    d) 60^o
4. The graph given below shows the frequency distribution of the age of 22 teachers in a school. The number of teachers whose age is less than 40 years is

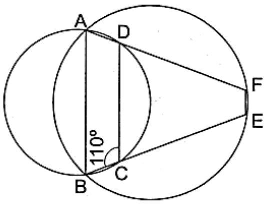


a) 17
b) 16
c) 15
d) 14

5. After rationalising the denominator of $\frac{7}{3\sqrt{3}-2\sqrt{2}}$, we get the denominator as
   a) 5
   b) 35
   c) 19
   d) 13
6. If two acute angles of a right triangle are equal, then each acute is equal to
   a) 45°
   b) 60°
   c) 30°
   d) 90°
7. Any solution of the linear equation 2x + 0y + 9 = 0 in two variables is of the form
   a) $\left(-\frac{9}{2}, m\right)$
   b) (-9 , 0)
   c) $\left(0, -\frac{9}{2}\right)$
   d) $\left(n, -\frac{9}{2}\right)$
8. If $x - \frac{1}{x} = \frac{15}{4}$, then $x + \frac{1}{x}$ =
   a) 4
   b) $\frac{1}{4}$
   c) $\frac{17}{4}$
   d) $\frac{13}{4}$
9. The value of $\left(\frac{256x^{16}}{81y^4}\right)^{-\frac{1}{4}}$ is
   a) $\frac{4y}{5x^4}$
   b) $\frac{3y}{4x^4}$
   c) $\frac{4x^4}{3y}$
   d) $\frac{3y}{8x^4}$
10. The opposite sides of a quadrilateral have
    a) two common points
    b) no common point
    c) one common point
    d) infinitely many common points
11. If $\sqrt{13 - a\sqrt{10}} = \sqrt{8} + \sqrt{5}$, then a =
    a) -5
    b) -2
    c) -4
    d) -6
12. Express y in terms of x in the equation 5y - 3x - 10 = 0.

a) $y=\frac{3-10x}{5}$
b) $y=\frac{3+10x}{5}$
c) $y=\frac{3x-10}{5}$
d) $y=\frac{3x+10}{5}$

13. Two angles measure $(70 + 2x)^o$ and $(3x - 15)^o$. If each angle is the supplement of the other, then the value of x is :
    a) 30
    b) 20
    c) 250^0
    d) 25
14. $\frac{125}{216}^{\frac{-1}{3}}$ =
    a) $\frac{6}{5}$
    b) 125
    c) $\frac{5}{6}$
    d) 216
15. In the given figure ABCD and ABEF are cyclic quadrilaterals. If $\angle BCD = 110^o$ then $\angle BEF$ = ?



    a) 90^o
    b) 70^o
    c) 55^o
    d) 110^o
16. Point (- 10,0) lies
    a) on the negative direction of the y-axis
    b) on the negative direction of the X-axis
    c) in the third quadrant
    d) in the fourth quadrant
17. Every linear equation in two variables has
    a) two solutions
    b) no solution
    c) an infinite number of solutions
    d) one solution
18. (x + 1) is a factor of the polynomial
    a) $x^3 + x^2 - x + 1$
    b) $x^3 + x^2 + x + 1$
    c) $x^4 + 3x^3 + 3x^2 + x + 1$
    d) $x^4 + x^3 + x^2 + 1$
19. **Assertion (A):** If the diagonals of a parallelogram ABCD are equal, then $\angle ABC = 90^o$
    Reason (R): If the diagonals of a parallelogram are equal, it becomes a rectangle.
    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):** The rationalised form of $\frac{1}{\sqrt{7}-2}$ is $\sqrt{7}$ + 2.

Reason (R): The conjugate of $\sqrt{7}$ - 2 is $\sqrt{7}$ + 2.

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

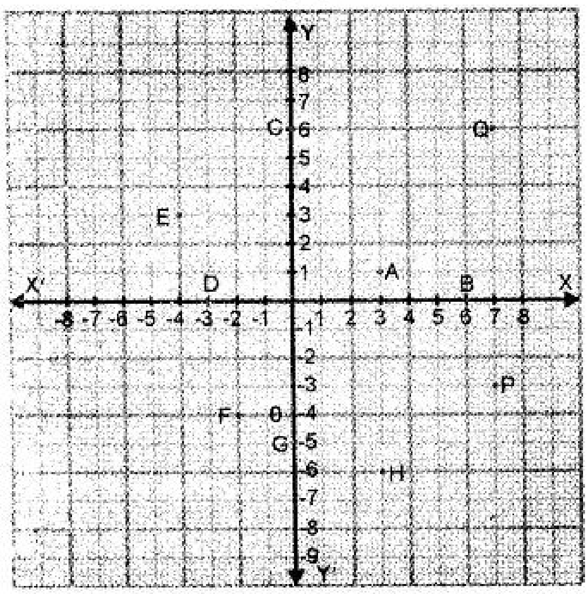
b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

Section B

21. Solve the equation a - 15 = 25 and state which axiom do you use here.
22. It is known that x + y = 10 and that x = z. Show that z + y = 10?
23. Write the co-ordinates of each of the following points marked in the graph paper.

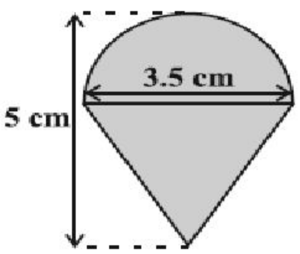


24. Simplify : $2^{2/3} . 2^{1/5}$

OR

If $a = \frac{3+\sqrt{5}}{2}$, then find the value of $a^2 + \frac{1}{a^2}$.

25. Harish was a student of 9th class. Once his birthday party was arranged in a restaurant. He got a playing top (lattu) as his birthday present, which surprisingly had no color on
it. He wanted to color it with his crayons. The top is shaped like a cone surmounted by a hemisphere as shown in the figure. The entire top of each lattu is 5 cm in height and the diameter of the top is 3.5 cm. Rashid wants to color the hemispherical part by red color and the conical part by green color.



Answer the following questions:

i. What is the area to be colored by red color?

ii. Also, find the area to be colored by green color.

OR

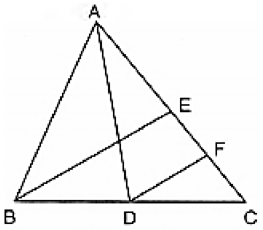
Find the ratio of the curved surface areas of two cones if their diameters of the bases are equal and slant heights are in the ratio 4 : 3.

Section C

26. If a = xy^{p-1}, b = xy^{q-1} and c = xy^{r-1}, prove that $a^{q-r}\, b^{r-p}\, c^{p-q} = 1$
27. Construct a histogram for the following data:

Monthly School fee (in ₹):	30-60	60-90	90-120	120-150	150-180	180-210	210-240
No of Schools	5	12	14	18	10	9	4

28. In Figure AD and BE are medians of ΔABC and BE || DF. Prove that CF = $\frac{1}{4}$ AC.



29. Find at least 3 solutions for the following linear equation in two variables:
    2x + 5y = 13
30. Draw a histogram of the following distribution:

Height (in cm)	Number of students
150 - 153	7
153 - 156	8
156 - 159	14
159 - 162	10
162 - 165	6
165 - 168	5

OR

The production of oil (in lakh tonnes) in some of the refineries in India during 1982 was given below:

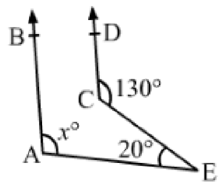
Refinery:	Barauni	Koyali	Mathura	Mumbai	Florida
Production of oil (in lakh tonnes)	30	70	40	45	25

Construct a bar graph to represent the above data so that the bars are drawn horizontally.

31. Factorize: $2\sqrt{2}x^3 + 3\sqrt{3}y^3 + \sqrt{5}(5 - 3\sqrt{6}xy)$

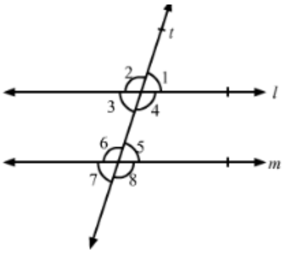
Section D

32. In the given figure, AB || CD. Find the value of x°



OR

In the given figure, l || m and a transversal t cuts them. If $\angle 1 : \angle 2 = 2 : 3$, find the measure of each of the marked angles.



33. A right angled triangle with sides 3 cm and 4 cm is revolved around its hypotenuse. Find the volume of the double cone thus generated.
34. Find the area of the triangle whose sides are 42 cm, 34 cm and 20 cm in length. Hence, find the height corresponding to the longest side.

OR

The perimeter of a triangle is 50 cm. One side of a triangle is 4 cm longer than the smaller side and the third side is 6 cm less than twice the smaller side. Find the area of the triangle.

35. Let R_1 and R_2 are the remainders when the polynomials $x^3 + 2x^2 - 5ax - 7$ and $x^3 + ax^2 - 12x + 6$ are divided by x + 1 and x - 2 respectively. If $2R_1 + R_2 = 6$, find the value of a.

Section E

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

Peter, Kevin James, Reeta and Veena were students of Class 9th B at Govt Sr Sec School, Sector 5, Gurgaon.

Once the teacher told **Peter to think a number x and to Kevin to think another number y** so that the difference of the numbers is 10 (x > y).

Now the teacher asked James to add double of Peter's number and that three times of Kevin's number, the total was found 120.

Reeta just entered in the class, she did not know any number.

The teacher said Reeta to form the 1st equation with two variables x and y.

Now Veena just entered the class so the teacher told her to form 2nd equation with two variables x and y.

Now teacher Told Reeta to find the values of x and y. Peter and kelvin were told to verify the numbers x and y.

i. What are the equation formed by Reeta and Veena?
ii. What was the equation formed by Veena?
iii. Which number did Peter think?

OR

Which number did Kelvin think?

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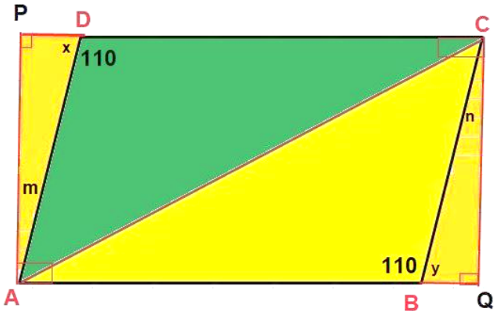
37. **Read the text carefully and answer the questions:**

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.



i. Show that ΔAPD and ΔBQC are congruent.
ii. PD is equal to which side?

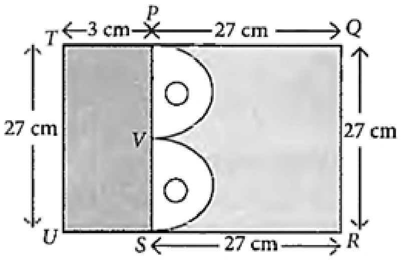
OR

What is the value of ∠m?

iii. Show that ΔABC and ΔCDA are congruent.

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

Mr. Vivekananda purchased a plot QRUT to build his house. He leaves space of two congruent semicircles for gardening and a rectangular area of breadth 3 cm for car parking.



i. Find the total area of Garden.
ii. Find the area of rectangle left for car parking.

OR

Find the area of a semi-circle.

iii. Find the radius of semi-circle.

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Solution

Section A

1. (d) y-axis
   Explanation: y-axis
2. (c) 2 cm
   Explanation: Area of equilateral triangle = $\frac{\sqrt{3}a^2}{4}$ where a = side of the triangle
   $\sqrt{3}$ = $\frac{\sqrt{3}a^2}{4}$
   Solving
   $a^2 = 4$
   a = 2 cm
3. (a) 30^o
   Explanation: Since the chord is equal to the radius therefore, it will form an equilateral triangle inside the circle with the third vertex being the centre of the circle.
   So the chord will make an angle of 60^o at the centre. As the angle made by the chord at any other point of the circumference would be half.
   So, we have that angle made at the major segment would be 30^o.

4. (c) 15
   Explanation: Add the values corresponding to the height of the bar before 40.
   6 + 3 + 4 + 2 = 15
5. (c) 19
   Explanation: After rationalizing:
   $\frac{7}{3\sqrt{3}-2\sqrt{2}} = \frac{7}{3\sqrt{3}-2\sqrt{2}} \times \frac{3\sqrt{3}+2\sqrt{2}}{3\sqrt{3}+2\sqrt{2}}$
   = $\frac{7(3\sqrt{3}+2\sqrt{2})}{(3\sqrt{3})^2-(2\sqrt{2})^2}$
   = $\frac{7(3\sqrt{3}+2\sqrt{2})}{27-8}$
   = $\frac{7(3\sqrt{3}+2\sqrt{2})}{19}$
6. (a) 45°
   Explanation: Let the measure of each acute angle of a triangle be x°.
   Then, we have
   x° + x° + 90° = 180°
   i.e. 2x° = 90°
   i.e. x° = 45°
7. (a) $\left(-\frac{9}{2}, m\right)$
   Explanation: 2x + 9 = 0
   $\Rightarrow x = \frac{-9}{2}$ and y = m, where m is any real number
   Hence, $\left(-\frac{9}{2}, m\right)$ is the solution of the given equation.

8. (c) $\frac{17}{4}$

Explanation: $\Rightarrow x - \frac{1}{x} = \frac{15}{4}$

Now , $\left(x - \frac{1}{x}\right)^2 = \left(\frac{15}{4}\right)^2$

$\Rightarrow (x^2) + \left(\frac{1}{x^2}\right) - 2 \times x \times \frac{1}{x} = \frac{225}{16}$

$\Rightarrow (x^2) + \left(\frac{1}{x^2}\right) = \frac{225}{16} + 2$

$\Rightarrow (x^2) + \left(\frac{1}{x^2}\right) = \frac{257}{16}$

$\Rightarrow (x^2) + \left(\frac{1}{x^2}\right) + 2 \times x \times \frac{1}{x} = \frac{257}{16} + 2 \times x \times \frac{1}{x}$

$\Rightarrow \left(x + \frac{1}{x}\right)^2 = \frac{257+32}{16} = \frac{289}{16}$

$\Rightarrow \left(x + \frac{1}{x}\right) = \sqrt{\frac{289}{16}} = \frac{17}{4}$

9. (b) $\frac{3y}{4x^4}$

Explanation: $\left(\frac{256x^{16}}{81y^4}\right)^{-\frac{1}{4}}$

= $\left(\frac{81y^4}{256x^{16}}\right)^{\frac{1}{4}}$

=$\left(\frac{3^4y^4}{4^4x^{16}}\right)^{\frac{1}{4}}$

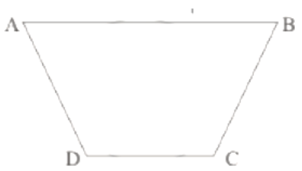
= $[\left(\frac{3y}{4x^4}\right)^4]^{\frac{1}{4}}$

= $\left(\frac{3y}{4x^4}\right)^{\frac{1}{4}\times 4}$

= $\frac{3y}{4x^4}$

10. (b) no common point

Explanation: We can look at a quadrilateral as:



The opposite sides of the above quadrilateral AB and CD have no point in common.

11. (c) -4

Explanation: $\sqrt{13 - a\sqrt{10}} = \sqrt{8} + \sqrt{5}$

Squaring both sides we get,

$(\sqrt{13 - a\sqrt{10}})^2 = (\sqrt{8} + \sqrt{5})^2$

$\Rightarrow 13 - a\sqrt{10} = 8 + 5 + 2(\sqrt{8})(\sqrt{5})$

$\Rightarrow$ 13 - a$\sqrt{10}$ = 13 + 2$\sqrt{40}$

$\Rightarrow$ -a$\sqrt{10}$ = 2(2$\sqrt{10}$)

$\Rightarrow$ -a$\sqrt{10}$ = 4 $\sqrt{10}$

$\Rightarrow$ a = -4

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

Explanation: 5y - 3x - 10 = 0

5y - 3x = 10

5y = 10 + 3x

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

13. (d) 25

Explanation: 70 + 2x + 3x - 15 = 180 (Supplimentary angles)

5x = 180 - 55

x = 25

14. (a) $\frac{6}{5}$

Explanation: $\frac{125}{216}^{\frac{-1}{3}}$

$= \frac{5}{6}^{3\times\frac{-1}{3}}$

$= \frac{5}{6}^{-1} = \frac{6}{5}$

15. (d) 110^o

Explanation: Given: ABCD, ABEF are two cyclic quadrilaterals and $\angle$BCD = 110^o

In Quadrilateral ABCD

We know that,

In a cyclic quadrilateral opposite angles are supplementary

$\therefore \angle BCD + \angle BAD = 180^\circ$

$110^\circ + \angle BAD = 180^\circ$

$\angle BAD = 180^\circ - 110^\circ = 70^\circ$

Similarly in Quadrilateral ABEF

$\therefore \angle \mathrm{BAD} + \angle \mathrm{BEF} = 180^\circ$

$70^\circ + \angle BEF = 180^\circ$

$\angle$BEF = 180^o - 70^o = 110^o

$\therefore \angle BEF = 110^\circ$

16. (b) on the negative direction of the X-axis

Explanation: In point (-10, 0) y-coordinate is zero, so it lies on X-axis and its x-coordinate is negative, so the point (-10, 0) lies on the X-axis in the negative direction.

17. (c) an infinite number of solutions

Explanation: A linear equation in two variables is of the form, ax + by + c = 0, where geometrically it does represent a straight line and every point on this graph is a solution for a given linear equation.

As a line consists of an infinite number of points. A linear equation has an infinite number of solutions.

18. (b) $x^3 + x^2 + x + 1$

Explanation: P(x) = $x^3 + x^2 + x + 1$

P(-1) = $(-1)^3 + (-1)^2 + (-1) + 1$

= -1 + 1 - 1 + 1 = 0

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

Explanation: Both A and R are true and R is the correct explanation of A.

20. (d) A is false but R is true.

Explanation: The rationalised form of $\frac{1}{\sqrt{7}-2}$ is $\frac{\sqrt{7}+2}{3}$..

Section B

21. We have,

a - 15 = 25.

On adding 15 to both sides, we have

a - 15 + 15 = 25 + 15 = 40 (using Euclid’s second axiom).or a = 40

22. We are given that,

x + y = 10 ...(i)

and x = z ...(ii)

According to Euclid's axioms, if equals are added to equals, the wholes are equal.

Therefore, From Eq.(ii),

x + y = z + y ...(iii)

From Equations (i) and (iii)

z + y = 10.

23. A(3, 1), B(6, 0), C(0, 6), D(–3, 0), E(–4, 3), F(–2, –4), G(0, –5), H(3, –6), P(7, –3), Q(7, 6).

24. $2^{2/3}$. $2^{1/5}$ = $2^{2/3 + 1/5}$ = $2^{\frac{10+3}{15}}$ = $2^{\frac{13}{15}}$

OR

Given, $a = \frac{3+\sqrt{5}}{2}$

$\Rightarrow a^2 = \frac{(3+\sqrt{5})^2}{4}$ $[\because (a+b)^2 = a^2 + b^2 + 2ab]$

$= \frac{9+5+6\sqrt{5}}{4}$

$= \frac{14+6\sqrt{5}}{4}$

$= \frac{7+3\sqrt{5}}{2}$

Now, $\frac{1}{a^2} = \frac{2}{7+3\sqrt{5}} = \frac{2}{7+3\sqrt{5}} \times \frac{7-3\sqrt{5}}{7-3\sqrt{5}}$

$= \frac{2(7-3\sqrt{5})}{(7)^2-(3\sqrt{5})^2}$ $[\because \left(a^2-b^2\right) = (a+b)(a-b)]$

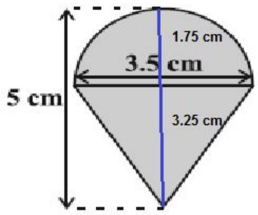
$= \frac{2(7-3\sqrt{5})}{49-45}$

$= \frac{2(7-3\sqrt{5})}{4}$

$= \frac{7-3\sqrt{5}}{2}$

$\therefore a^2 + \frac{1}{a^2} = \frac{7+3\sqrt{5}}{2} + \frac{7-3\sqrt{5}}{2}$

$= \frac{7+3\sqrt{5}+7-3\sqrt{5}}{2} = \frac{14}{2} = 7$

25. 

i. Diameter of hemispherical part = 3.5 cm

r = 3.5/2 = 1.75 cm

TSA = $2\pi r^2 = 2 \times \frac{22}{7} \times 1.75 \times 1.75$ = 19.25 cm^2

Hence area to be colored by red color = 19.25 cm^2

ii. From the figure,

height of cone h = total height - 1.75 = 5 - 1.75 = 3.25 cm

r = 1.75 cm

Slant height l = $\sqrt{r^2 + h^2}$

= $\sqrt{(1.75)^2 + (3.25)^2}$

= 3.7 cm (approx)

Hence area to be colored by green color = $\pi r l$ = 3.14×1.75×3.7 = 20.35 cm^2

OR

Since diameter of two cones are equal

∴ Their radius are equal

$\therefore r_1 = r_2 = r$ (say)

Let ratio be x,

$\therefore$ Slant height 'l_1' of 1st cone = 4x

Similarly, slant height 'l_2' of 2nd cone = 3x

$\therefore \frac{C.S.A_1}{C.S.A_2} = \frac{\pi r_1 l_1}{\pi r_2 l_2} = \frac{\pi \times r \times 4x}{\pi \times r \times 3x} = \frac{4}{3}$

Section C

26. $a = xy^{p-x}$, $b = xy^{q-1}$ and $c = xy^{r-1}$

$\therefore a^{q-r} \times b^{r-p} \times c^{p-q}$

$= (xy^{p-x})^{q-r} \times (xy^{q-1})^{r-p} \times (xy^{r-1})^{p-q}$

$= x^{q-r} \times y^{(p-1)(q-r)} \times x^{r-p} \times y^{(q-1)(r-p)} \times x^{p-q} \times y^{(r-1)(p-q)}$

$= x^{q-r} \times x^{r-p} \times x^{p-q} \times y^{pq-pr-q+r} \times y^{qr-pq-r+p} \times y^{pr-qr-p+q}$

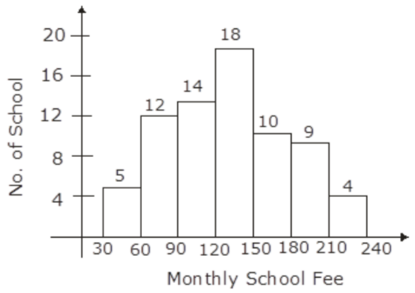
$= x^{q-r+r-p+p-q} \times y^{p q-p r-q+r+q r-p q-r+p+p r-q r-p+q}$

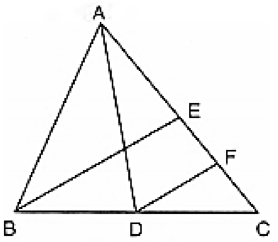
$= x^0 \times y^0$

$= 1 \times 1$

$= 1$

27. REQUIRED GRAPH



28. 

Consider the triangle ABC.

AD and BE are the medians of the triangle.

Thus, D is the midpoint of the side BC and E is the midpoint of the side AC.

Therefore, CD = $\frac{BC}{2}$ and CE = $\frac{AC}{2}$ ....(i)

Consider ΔBEC,

Given that DF || BE, therefore, F is the midpoint of CE.

i.e. CF = $\frac{CE}{2}$

$= \frac{1}{2}\left[\frac{AC}{2}\right]$ [From eq. (i)]

$= \frac{AC}{4}$

i.e. CF = $\frac{AC}{4}$

Hence proved.

29. $2x + 5y = 13$

$\Rightarrow 5y = 13 - 2x$

$\Rightarrow y = \frac{13-2x}{5}$

Put x = 0, then $y = \frac{13-2(0)}{5} = \frac{13}{5}$

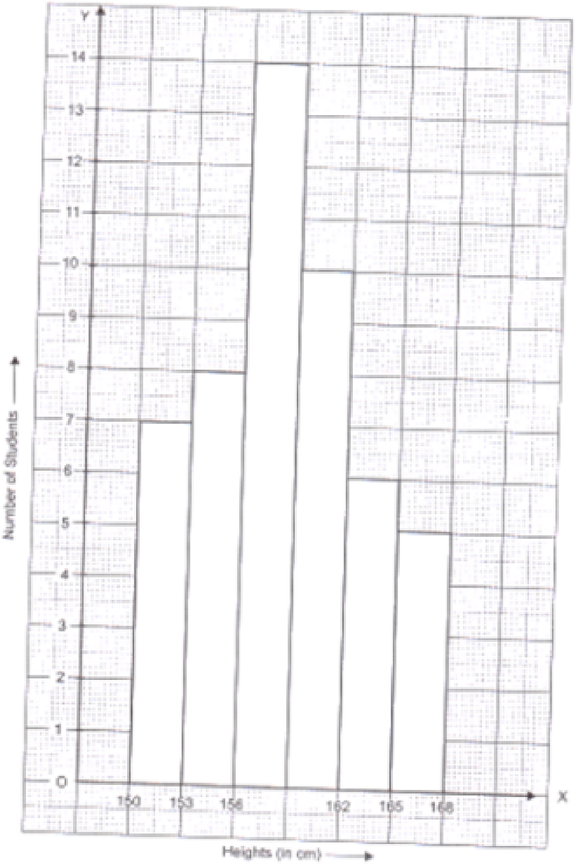
Put x = 1, then $y = \frac{13-2(1)}{5} = \frac{11}{5}$

Put x = 2, then$y = \frac{13-2(2)}{5} = \frac{9}{5}$

Put x = 3, then$y = \frac{13-2(3)}{5} = \frac{7}{5}$

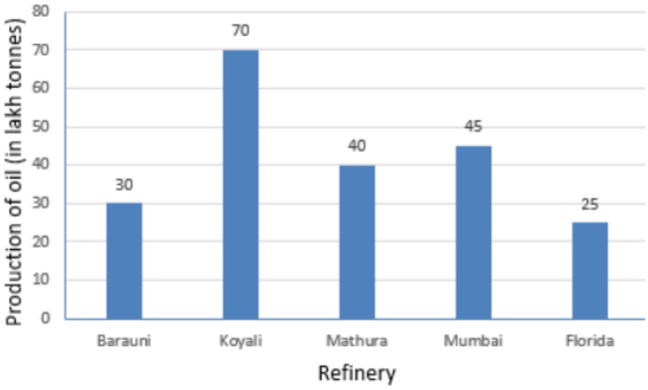
$\therefore (0, \frac{13}{5}), (1, \frac{11}{5}), (2, \frac{9}{5})\ and\ (3, \frac{7}{5})$ are the solutions of the equation 2x + 5y = 13.

30. Histogram which represent the given frequency distribution is shown below:



OR

The production of oil (in lakh tonnes) in some of the refineries in India during 1982



31. We have,

$2\sqrt{2}x^3 + 3\sqrt{3}y^3 + \sqrt{5}(5 - 3\sqrt{6}xy)$

$= 2\sqrt{2}x^3 + 3\sqrt{3}y^3 + 5\sqrt{5} - 3\sqrt{5} \times \sqrt{6}xy$

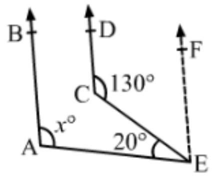
$= (\sqrt{2}x)^3 + (\sqrt{3}y)^3 + (\sqrt{5})^3 - 3 \times (\sqrt{2}x)(\sqrt{3}y)(\sqrt{5})$

Using $a^3 + b^3 + c^3 - 3abc = (a+b+c)(a^2 + b^2 + c^2 - ab - bc - ca)$

$= (\sqrt{2}x + \sqrt{3}y + \sqrt{5})\left(2x^2 + 3y^2 + 5 - \sqrt{2}x \times \sqrt{3}y - \sqrt{3}y \times \sqrt{5} - \sqrt{5} \times \sqrt{2}x\right)$

$= (\sqrt{2}x + \sqrt{3}y + \sqrt{5})\left(2x^2 + 3y^2 + 5 - \sqrt{6}xy - \sqrt{15}\,y - \sqrt{10}\,x\right)$

Section D

32. 

Draw EF || AB || CD

EF || CD and CE is the transversal

Then,

$\angle ECD + \angle CEF = 180^\circ$

[Angles on the same side of a transversal line are supplementary]

$\Rightarrow 130^\circ + \angle CEF = 180^\circ$

$\Rightarrow \angle CEF = 50^\circ$

Again EF || AB and AE is the transversal

Then,

$\angle BAE + \angle AEF = 180^\circ$ [Angles on the same side of a transversal line are supplementary]

$\Rightarrow \angle BAE + \angle$AEC + $\angle$CEF = 180° $[\angle AEF = \angle AEC + \angle CEF]$

$\Rightarrow$ x° + 20° + 50° = 180°

$\Rightarrow$ x° + 170° = 180°

$\Rightarrow$ x° = 110°

OR

Given that $\angle 1 : \angle 2 = 2 : 3$

Let $\angle 1 = 2k$ and $\angle 2 = 3k$, where k is some constant

Now, $\angle 1$ and $\angle 2$ form a linear pair

$\therefore \angle 1 + \angle 2 = 180^\circ$

$\Rightarrow 2k + 3k = 180^\circ$

$\Rightarrow 5k = 180^\circ$

$\Rightarrow k = 36^\circ$

$\therefore \angle 1 = 2k = 2 \times 36^\circ = 72^\circ$

$\angle 2 = 3k = 3 \times 36^\circ = 108^\circ$

Now,

$\angle 3 = \angle 1 = 72^\circ$ (Vertically opposite angles)

$\angle 4 = \angle 2 = 108^\circ$ (Vertically opposite angles)

It is given that, l || m and t is a transversal

$\therefore \angle 5 = \angle 1 = 72^\circ$ (Pair of corresponding angles)

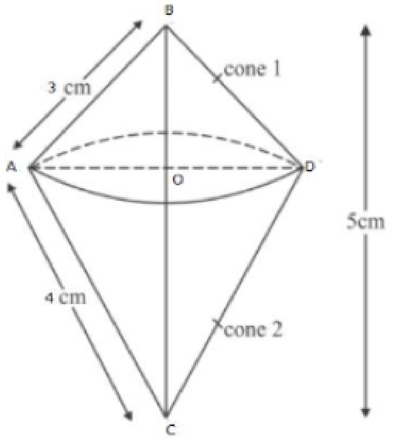
$\angle 6 = \angle 2 = 108^\circ$ (Pair of corresponding angles)

$\angle 7 = \angle 1 = 72^\circ$ (Pair of alternate exterior angles)

$\angle 8 = \angle 2 = 108^\circ$ (Pair of alternate exterior angles)

$\angle 1 = \angle 3 = \angle 5 = \angle 7 = 72^\circ$

and $\angle 2 = \angle 4 = \angle 6 = \angle 8 = 108^\circ$

33. 

AB = 3 cm, AC = 4 cm

In $\triangle$BAC, by pythagoras theorem

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

$\Rightarrow BC^2 = 3^2 + 4^2$

$\Rightarrow BC^2 = 25$

$\Rightarrow BC = \sqrt{25} = 5$ cm

In $\triangle$AOB and $\triangle$CAB

$\angle ABO = \angle ABC$ [common]

$\angle AOB = \angle BAC$ [each 90^o]

Then, $\triangle$AOB - $\triangle$CAB [by AA similarity]

$\therefore \frac{AO}{CA} = \frac{OB}{AB} = \frac{AB}{CB}$ [c.p.s.t]

$\Rightarrow \frac{AO}{4} = \frac{OB}{3} = \frac{3}{5}$

Then, AO = $\frac{4\times3}{5}$ and OB = $\frac{3\times3}{5}$

$\Rightarrow$ AO = $\frac{12}{5}$ cm and OB = $\frac{9}{5}$ cm

$\therefore$OC = 5 - $\frac{9}{5}$ = $\frac{16}{5}$cm

$\therefore$ Volume of double cone thus generated = volume of first cone + volume of second cone

$= \frac{1}{3}\pi(AO)^2 \times BO + \frac{1}{3}\pi(AO)^2 \times OC$

$= \frac{1}{3} \times \frac{22}{7} \times \left(\frac{12}{5}\right)^2 \times \frac{9}{5} + \frac{1}{3} \times \frac{22}{7} \times \left(\frac{12}{5}\right)^2 \times \frac{16}{5}$

$= \frac{1}{3} \times \frac{22}{7} \times \frac{12}{5} \times \frac{12}{5}\left[\frac{9}{5} + \frac{16}{5}\right]$

$= \frac{1}{3} \times \frac{22}{7} \times \frac{12}{5} \times \frac{12}{5} \times 5$

$= \frac{1056}{35} = 30\frac{6}{35}\text{cm}^3$.

34. Let: a = 42 cm, b = 34 cm and c = 20 cm

$\therefore s = \frac{a+b+c}{2} = \frac{42+34+20}{2} = 48\text{cm}$

By Heron's formula, we have:

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

$= \sqrt{48(48-42)(48-34)(48-20)}$

$= \sqrt{48 \times 6 \times 14 \times 28}$

$= \sqrt{4 \times 2 \times 6 \times 6 \times 7 \times 2 \times 7 \times 4}$

$= 4 \times 2 \times 6 \times 7$

Area of triangle = 336 cm^2

We know that the longest side is 42 cm.

Thus, we can find out the height of the triangle corresponding to 42 cm.

We have: Area of triangle = 336 cm^2

$\Rightarrow \frac{1}{2} \times$ Base $\times$ Height = 336

$\Rightarrow \frac{1}{2}$ (42)(height) = 336

$\Rightarrow$ Height $= \frac{336 \times 2}{42}$ = 16 cm

OR

Let the smaller side of the triangle be x cm. therefore, the second side will be (x + 4) cm, and third side is (2x - 6) cm.

Now, perimeter of triangle = x (x + 4) + (2x - 6)

= (4x - 2) cm

Also, perimeter of triangle = 50 cm.

4x = 52; x = 52 ÷ 4 = 13

Therefore, the three sides are 13 cm, 17 cm, 20 cm

$s = \frac{13+17+20}{2} = \frac{50}{2} = 25cm$

$\therefore$ Area of $\Delta = \sqrt{25(25-13)(25-17)(25-20)}$

$= \sqrt{25 \times 12 \times 8 \times 5} = \sqrt{5 \times 5 \times 4 \times 3 \times 4 \times 2 \times 5}$

$= 5 \times 4 \times \sqrt{3 \times 2 \times 5} = 20\sqrt{30}cm^2$

35. Let $p(x) = x^3 + 2x^2 - 5ax - 7$ and $q(x) = x^3 + ax^2 - 12x + 6$ be the given polynomials.

Now, R_1 = Remainder when p(x) is divided by x + 1

$\Rightarrow R_1 = p(-1)$

$\Rightarrow R_1 = (-1)^3 + 2(-1)^2 - 5a \times (-1) - 7$

$\Rightarrow R_1 = -1 + 2 + 5a - 7$

$\Rightarrow R_1 = 5a - 6$

And, R_2 = Remainder when q(x) is divided by x - 2

$\Rightarrow R_2 = q(2)$

$\Rightarrow R_2 = 2^3 + a \times 2^2 - 12 \times 2 + 6$

$\Rightarrow R_2 = 8 + 4a - 24 + 6$

$\Rightarrow R_2 = 4a - 10$

Substituting the values of R_1 and R_2 in $2R_1 + R_2 = 6$, we get

2(5a - 6) + (4a -10) = 6

$\Rightarrow$ 10a - 12 + 4a - 10 = 6

$\Rightarrow$ 14a - 22 = 6 $\Rightarrow$ 14a = 28 $\Rightarrow$ a = 2

Section E

36.
 i. x - y = 10
    2x + 3y = 120
 ii. 2x + 3y = 120
 iii. x - y = 10 ...(1)
    2x + 3y = 120 ...(2)
    Multiply equation (1) by 3 and to equation (2)
    3x - 3y + 2x + 3y = 30 + 120
    $\Rightarrow$ 5x = 150
    $\Rightarrow$ x = 30
    Hence the number thought by Prateek is 30.

OR

We know that x - y = 10 ...(i) and 2x + 3y = 120 ...(ii)

Put x = 30 in equation (i)

30 - y = 10

$\Rightarrow$ y = 40

Hence number thought by Kevin = 40

37. i. In $\triangle$APD and $\triangle$BQC

AD = BC (given)

AP = CQ (opposite sides of rectangle)

$\angle$APD = $\angle$BQC = 90^o

By RHS criteria $\triangle APD \cong \triangle CQB$

ii. $\triangle APD \cong \triangle CQB$

Corresponding part of congruent triangle

side PD = side BQ

OR

In $\triangle$APD

$\angle APD + \angle PAD + \angle ADP = 180^o$

$\Rightarrow 90^o + (180^o - 110^o) + \angle ADP = 180^o$ (angle sum property of $\triangle$)

$\Rightarrow \angle ADP = m = 180^o - 90^o - 70^o = 20^o$

$\angle ADP = m = 20^o$

iii. In $\triangle$ABC and $\triangle$CDA

AB = CD (given)

BC = AD (given)

AC = AC (common)

By SSS criteria $\triangle ABC \cong \triangle CDA$

38. i. Area of Garden is = 2 $\times$ semicircles

Area of a semi-circle = $2 \times \frac{1}{2}\pi r^2$

= $\frac{22}{7} \times 6.75 \times 6.75$ = 144.43 cm^2

ii. Area of rectangle left for car parking is area of region PSUT = 27 $\times$ 3 = 81 cm^2

OR

Diameter of semi-circle = PV = $\frac{PS}{2} = \frac{27}{2}$ = 13.5 cm

$\therefore$ Radius of semi-circle = $\frac{13.5}{2}$ = 6.75 cm

Area of a semi-circle = $\frac{1}{2}\pi r^2$

= $\frac{1}{2} \times \frac{22}{7} \times 6.75 \times 6.75$ = 71.59 cm^2

iii. Diameter of semi-circle = PV = $\frac{PS}{2} = \frac{27}{2}$ = 13.5 cm

$\therefore$ Radius of semi-circle = $\frac{13.5}{2}$ = 6.75 cm