Class IX Session 2025-26
Subject - Mathematics
Sample Question Paper - 1

Time Allowed: 3 hours **Maximum Marks: 80**

General Instructions:

Read the following instructions carefully and follow them:

1. This question paper contains 38 questions.
2. This Question Paper is divided into 5 Sections A, B, C, D and E.
3. In Section A, Questions no. 1-18 are multiple choice questions (MCQs) and questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.
4. In Section B, Questions no. 21-25 are very short answer (VSA) type questions, carrying 02 marks each.
5. In Section C, Questions no. 26-31 are short answer (SA) type questions, carrying 03 marks each.
6. In Section D, Questions no. 32-35 are long answer (LA) type questions, carrying 05 marks each.
7. In Section E, Questions no. 36-38 are case study-based questions carrying 4 marks each with sub-parts of the values of 1,1 and 2 marks each respectively.
8. All Questions are compulsory. However, an internal choice in 2 Questions of Section B, 2 Questions of Section C and 2 Questions of Section D has been provided. An internal choice has been provided in all the 2 marks questions of Section E.
9. Draw neat and clean figures wherever required.
10. Take $\pi = 22/7$ wherever required if not stated.
11. Use of calculators is not allowed.

Section A

1. Point (0, –7) lies **[1]**

a) in the fourth quadrant b) on the y-axis

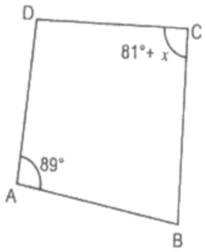
c) on the x –axis d) in the second quadrant

2. The sides of a triangle are 50 cm, 78 cm and 112 cm. The smallest altitude is **[1]**

a) 20 cm b) 40 cm

c) 30 cm d) 50 cm

3. For what value of x in the figure, points A, B, C and D are concyclic? **[1]**



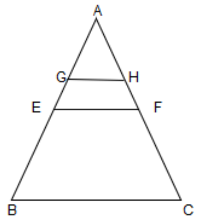
a) 10^o

b) 9^o

c) 12^o

d) 11^o

4. E and F are the mid-points of sides AB and AC res. Of the △ABC ; G and H are the mid-points of the sides AE and AF res. Of the △AEF. If GH = 1.8cm, Find BC **[1]**



a) 6 cm

b) 7.2 Cm

c) 7.5cm

d) 6.5 cm

5. If $\frac{5-\sqrt{3}}{2+\sqrt{3}} = x + y\sqrt{3}$, then **[1]**

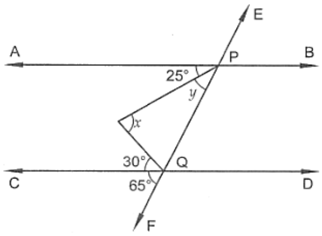
a) x = 13, y = 7

b) x = -13, y = - 7

c) x = -13, y = 7

d) x = 13, y = -7

6. In Figure, AB and CD are parallel lines and transversal EF intersects them at P and Q respectively. If ∠APR = 25°, ∠RQC = 30° and ∠CQF = 65°, then **[1]**



a) x = 50°, y = 45°

b) x = 60°, y = 35°

c) x = 35°,y = 60°

d) x = 55°, y = 40°

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

a) x + y = 7

b) 5 x + y = 7

c) 5x +2y = 7

d) x + 2y = 7

8. When $p(x) = x^4 + 2x^3 - 3x^2 + x - 1$ is divided by (x - 2), the remainder is **[1]**

a) 21

b) -1

c) -15

d) 0

9. The difference between two distinct irrational numbers is always **[1]**

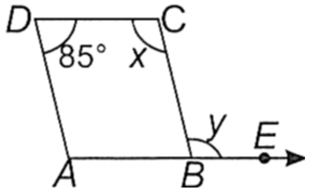
a) a rational number

b) both rational and irrational number

c) an irrational number

d) an integer

10. ABCD is a parallelogram in which ∠ADC = 85° and side AB is produced to point E as shown in the figure. Find the value of (x + y). **[1]**



a) 85°
b) 95°
c) 190°
d) 160°

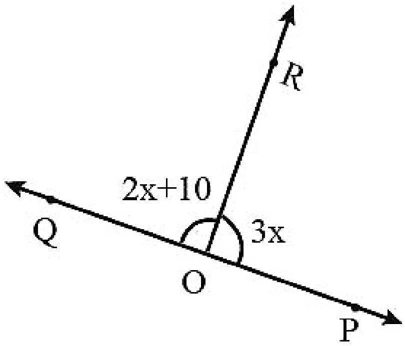
11. The simplest form of $0.12\overline{3}$ is **[1]**

a) none of these
b) $\frac{41}{333}$
c) $\frac{41}{330}$
d) $\frac{37}{330}$

12. The graph of the line y = -6 passes through **[1]**

a) (-1, 4)
b) (0, 4)
c) (4, -6)
d) (-6, 4)

13. Given $\angle POR = 3x$ and $\angle QOR = 2x + 10°$. If $\angle POQ$ is a straight line, then the value of x is **[1]**

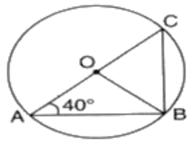


a) 36°
b) 34°
c) 30°
d) 42^o

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

a) $\sqrt{22.5}$
b) $\sqrt{12.5}$
c) $\sqrt{5}$
d) $\sqrt{11}$

15. If $\angle OAB = 40^o$, then the measure of $\angle ACB$ is **[1]**



a) 50^o
b) 80^o
c) 40^o
d) 20^o

16. The point whose abscissa is 4 and this point lies on the x-axis is: **[1]**

a) (0, 4)
b) (4, 0)
c) (4, 4)
d) (2, 4)

17. The positive solutions of the equation ax + by + c = 0 always lie in the **[1]**

a) 1st quadrant

b) 2nd quadrant

c) 3rd quadrant

d) 4th quadrant

18. If $x+y+z=9$ and $xy+yz+zx=23$, then the value of $x^3+y^3+z^3-3xyz$ is **[1]**

a) 108

b) 180

c) 209

d) 144

19. **Assertion (A):** If the diagonals of a parallelogram ABCD are equal, then ∠ABC = 90^o **[1]**

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):** Rational number lying between two rational numbers a and b is $\frac{a+b}{2}$. **[1]**

Reason (R): There is one rational number lying between any two rational numbers.

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

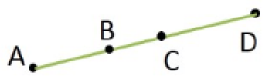
b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

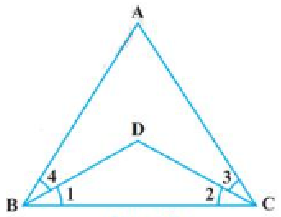
d) A is false but R is true.

Section B

21. In fig., if AC = BD, then prove that AB = CD **[2]**



22. In the given figure, we have ∠ABC = ∠ACB,$\angle 4=\angle 3$. Show that $\angle 1=\angle 2$. **[2]**



23. Which of the following points lie on the x-axis? **[2]**

i. A (0,8)
ii. 6(4,0)
iii. C(0,-3)
iv. D (-6,0)
v. E (2,1)
vi. F(-2, -1)
vii. G (-1, 0)
viii. H(0, -2)

24. Express 0.9999 ... as a fraction in simplest form. **[2]**

OR

Simplify: $\frac{2+\sqrt{3}}{2-\sqrt{3}}+\frac{2-\sqrt{3}}{2+\sqrt{3}}+\frac{\sqrt{3}-1}{\sqrt{3}+1}$.

25. A military tent is in the form of a right circular cone 21 dm in height, the diameter of the base being 4 m. If 6 men sleep in it, find the average number of cubic decimetres of air surface per man. **[2]**

OR

A cloth having an area of 165 m^2 is shaped into the form of a conical tent of radius 5 m. How many students can sit in the tent if a student, on an average, occupies $\frac{5}{7}m^2$ on the ground?

Section C

26. Locate $\sqrt{3}$ on the number line. **[3]**

27. The following data shows the average age of men in various countries in a certain year: **[3]**

Country	India	Nepal	China	Pakistan	U.K.	U.S.A.
Average age (in years)	55	52	60	50	70	75

Represent the above information by a bar graph.

28. P and Q are the mid-points of the opposite sides AB and CD of a parallelogram ABCD. AQ intersects DP at S and BQ intersects CP at R. Show that PRQS is a parallelogram. **[3]**

29. Draw the graph of the following linear equation in two variables : x – y = 2 **[3]**

30. The monthly profits (in Rs) of 100 shops are distributed as follows: **[3]**

Profits per shop:	0-50	50-100	100-50	150-200	200-250	250-300
No. of shops:	12	18	27	20	17	6

Draw a histogram for the data and show the frequency polygon for it.

OR

The following data gives the production of foodgrains (in thousand tonnes) for some years:

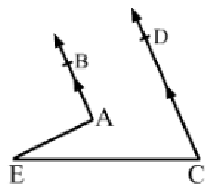
Year	1995	1996	1997	1998	1999	2000
Production (in thousand tonnes)	120	150	140	180	170	190

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

31. Find m and n if x - 1 and x - 2 exactly divide the polynomial $x^3 + mx^2 - nx + 10$ **[3]**

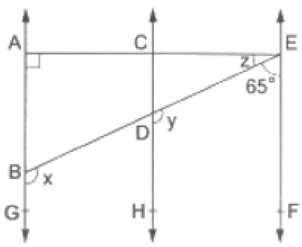
Section D

32. In the given figure, AB || CD. Prove that $\angle BAE - \angle DCE = \angle AEC$. **[5]**



OR

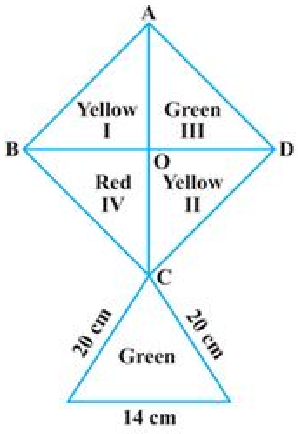
In the given figure, AB || CD || EF, $\angle DBG = x, \angle EDH = y$, $\angle AEB = z$, $\angle EAB = 90^\circ$ and $\angle BEF = 65^\circ$. Find the values of x, y and z.



33. Shanti sweets stall was placing an order for making cardboard boxes for packing their sweets two sizes of boxes **[5]**

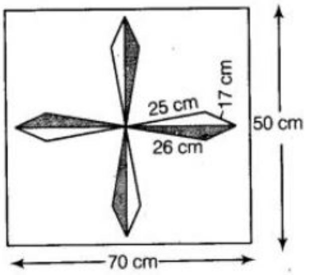
were required. The bigger of dimensions $25cm \times 20cm \times 5cm$ and the smaller of dimensions $15cm \times 12cm \times 5cm$ for all the overlaps, 5% of the total surface area is required extra. If the cost of cardboard is ₹ 4 for 1000 cm^2.Find the cost of cardboard required for supplying 250 boxes of each kind.

34. How much paper of each shade is needed to make a kite given in Figure, in which ABCD is a square with diagonal 44 cm? **[5]**



OR

A design is made on a rectangular tile of dimensions 50 cm $\times$ 70 cm as shown in Figure. The design shows 8 triangles, each of sides 26 cm, 17 cm and 25 cm. Find the total area of the design and the remaining area of the tile.



35. Find the integral roots of the polynomial $f(x) = x^3 + 6x^2 + 11x + 6$. **[5]**

Section E

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

Reeta was studying in the class 9th C of St. Surya Public school, Mehrauli, New Delhi-110030

Once Ranjeet and his daughter Reeta were returning after attending teachers' parent meeting at Reeta's school.

As the home of Ranjeet was close to the school so they were coming by walking.

Reeta asked her father, "Daddy how old are you?"

Ranjeet said, "Sum of ages of both of us is 55 years, After 10 years my age will be double of you.

i. What is the second equation formed? (1)

ii. What is the present age of Reeta in years? (1)

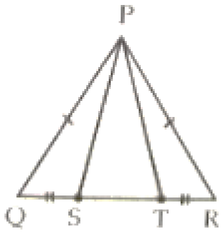
iii. What is the present age of Ranjeet in years? (2)

OR

If the ratio of age of Reeta and her mother is 3 : 7 then what is the age of Reeta's mother in years? (2)

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

A children's park is in the shape of isosceles triangle said PQR with PQ = PR, S and T are points on QR such that QT = RS.



i. Which rule is applied to prove that congruency of △PQS and △PRT. (1)

ii. Name the type of △PST. (1)

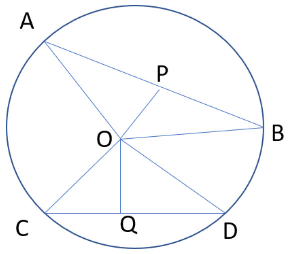
iii. If PQ = 6 cm and QR = 7 cm, then find perimeter of △PQR. (2)

OR

If ∠QPR = 80^o find ∠PQR? (2)

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

Rohan draws a circle of radius 10 cm with the help of a compass and scale. He also draws two chords, AB and CD in such a way that the perpendicular distance from the center to AB and CD are 6 cm and 8 cm respectively. Now, he has some doubts that are given below.



i. Show that the perpendicular drawn from the Centre of a circle to a chord bisects the chord. (1)

ii. What is the length of CD? (1)

iii. What is the length of AB? (2)

OR

How many circles can be drawn from given three noncollinear points? (2)

Solution

Section A

1.

(b) on the y-axis

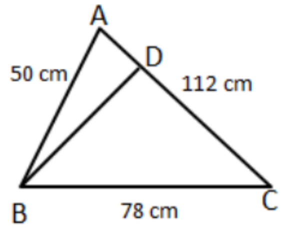
Explanation:

In point (0, -7) x - coordinate is zero, so it lies on Y-axis and y-coordinate is negative, so the point (0, – 7) lies on the Y-axis in the negative direction.

2.

(c) 30 cm

Explanation:



The smallest altitude is $\perp$ drawn to the largest side of a Δ from opposite point.

i.e. BD Area of $\Delta = \frac{1}{2} \times$ Ac $\times$ BD = $\frac{1}{2} \times$ 112 $\times$ BD = 56 $\times$BD

s = $\frac{50+78+112}{2}$ = 120cm

s - AB = 70 cm, s - BC = 42 cm, s - AC = 8 cm

Area = $\sqrt{s(s-AB)-(s-BC)(s-AC)}$

$= \sqrt{120 \times 70 \times 42 \times 8}$

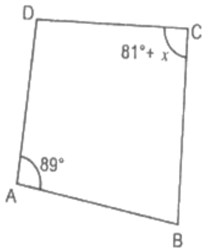
= 1680 cm^2

Now, 56$\times$BD = 1680 cm^2

$\Rightarrow$ BD= $\frac{1680}{56}$ = 30 cm

3. **(a)** 10^o

Explanation:



If the quadrilateral ABCD is concyclic, then,

$\angle$A + $\angle$C = 180^o

80^o + 81^o + x = 180^o

x = 10^o

4.

(b) 7.2 Cm

Explanation:

BC = 4 $\times$1.8 = 7.2 CM

5.

(d) x = 13, y = -7

Explanation:

$x + y\sqrt{3} = \frac{5-\sqrt{3}}{2+\sqrt{3}}$

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

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

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

$= \frac{10-5\sqrt{3}-2\sqrt{3}+3}{1}$

$= 13 - 7\sqrt{3}$

Hence, $x+y\sqrt{3} = 13-7\sqrt{3}$

$\Rightarrow x = 13, y = -7$

6.

(d) x = 55°, y = 40°

Explanation:

$\angle OQP = 180° - \angle OQF$

= 180° - (30° + 65°)

$\Rightarrow \angle OQP = 85°$ ...(i)

$\angle APQ = \angle CQF$ (Corresponding angles)

$\Rightarrow 25° + y° = 65°$

$\Rightarrow y° = 65° - 25°$

$\Rightarrow y° = 40°$

Now in $\triangle OPQ$

$\angle 0 + \angle OPQ + \angle PQO = 180°$

$\Rightarrow x° + 40° + 85° = 180°$

x° = 180° - 85° - 40° = 55°

$\Rightarrow$ x = 55°, y = 40°

7. **(a)** x + y = 7

Explanation:

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

8. **(a)** 21

Explanation:

$x^4 + 2x^3 - 3x^2 + x - 1$

Using remainder theorem,

$= (2)^4 + 2(2)^3 - 3(2)^2 + 2 - 1$

= 16 + 16 - 12 + 2 - 1

= 34 - 13

= 21

9.

(b) both rational and irrational number

Explanation:

The difference between two distinct irrational numbers can be either a rational number or an irrational number.

e.g difference between pi and (π - 3) is equal to 3 which is rational

$\sqrt{2}$ and $\sqrt{2} + 1$ both are irrational but their difference is 1 which is rational

Similarly, $\sqrt{2}$ and $\sqrt{3}$ are irrational and their difference ($\sqrt{3} - \sqrt{2}$) is also irrational

10.

(c) 190°

Explanation:

$\angle ADC + \angle DCB = 180°$ (Sum of adjacent angles of a parallelogram is 180°)

$\Rightarrow 85° + x = 180° \Rightarrow x = 95°$

Now, DC || AE and CB is a transversal.
∴ y - x - 95° (Alternate interior angles)
∴ x + y = 95° + 95° = 190°

11. **(a)** none of these
Explanation:
none of these
Since $0.12\overline{3} = \frac{111}{900} = \frac{37}{300}$

12.
(c) (4, -6)
Explanation:
because value of y -co-ordinate is - 6

13.
(b) 34°
Explanation:
Given,
POQ is a straight line
∠POR + ∠QOR = 180^{o} (Linear pair)
3x + 2x + 10^{o} = 180^{o}
5x = 170^{o}
x = 34^{o}

14.
(c) $\sqrt{5}$
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. **(a)** 50^{o}
Explanation:
In triangle ABC,
$\angle A + \angle B + \angle C = 180^{0}$
$40^{0} + 90^{0} + \angle C = 180^{0}$
$\angle C = 50^{0}$

16.
(b) (4, 0)
Explanation:
Since the abscissa or x-coordinate of a point is 4 and this point lies on the x-axis. And the ordinate or y-coordinate of a point lying on the x-axis is 0.
Therefore the coordinate of the point is (4, 0).

17. **(a)** 1st quadrant
Explanation:
The positive solutions of the equation ax + by + c = 0 always lie in the 1st quadrant
Because in 1st quadrant both x and y have positive value.

18. **(a)** 108
Explanation:
Given: $x + y + z = 9$ and $xy + yz + zx = 23$
$x^3 + y^3 + z^3 - 3xyz = (x + y + z)\left(x^2 + y^2 + z^2 - xy - yz - zx\right)$

$= (x+y+z)\left[(x+y+z)^2 - 2xy - 2yz - 2zx - xy - yz - zx\right]$

$= (x+y+z)\left[(x+y+z)^2 - 3xy - 3yz - 3zx\right]$

$= (x+y+z)\left[(x+y+z)^2 - 3(xy+yz+zx)\right]$

$= (9)\left[(9)^2 - 3(23)\right]$

$= 9 \times [81 - 69]$

= 9 x 12

= 108

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.

(c) A is true but R is false.

Explanation:

There are infinitely many rational numbers between any two given rational numbers.

Section B

21. AC = BD . . . . [Given] . . . (1)

AC = AB + BC . . . . [Point B lies between A and C] . . . . (2)

BD = BC + CD . . . . [Point C lies between B and D] . . . . (3)

Substituting (2) and (3) in (1), we get

AB + BC = BC + CD

$\Rightarrow$ AB = CD . . . . [Subtracting equals from equals]

22. We have

$\Rightarrow \angle ABC = \angle ACB$ ...(1) [(Given)]

And $\angle 4 = \angle 3$ ...(2) [(Given)]

Now, subtracting (2) from (1), we get

Now, by Euclid's axiom 3, if equals are subtracted from equals, the remainders are equal.

$\angle ABC - \angle 4 = \angle ACB - \angle 3$

Hence, $\angle 1 = \angle 2$.

23. The coordinates of every point on the X-axis are of the form (x, 0). that means y coordinate is always zero on x-axis.

Hence, the following points lie on the x-axis:

(ii) B(4, 0)

(iv) D(-6, 0)

(vii) G(-1, 0)

24. Let x = 0.9999 .... ---------(i)

multiply eq (i) by 10, we get

10x = 9.9999 .... -----------(ii)

Subtracting (i) from (ii), we get

9x = 9 $\implies$ x = 1

Hence, 0.9999... = 1

OR

$\frac{2+\sqrt{3}}{2-\sqrt{3}} + \frac{2-\sqrt{3}}{2+\sqrt{3}} + \frac{\sqrt{3}-1}{\sqrt{3}+1}$

$= \frac{2+\sqrt{3}}{2-\sqrt{3}} \times \frac{2-\sqrt{3}}{2-\sqrt{3}} + \frac{2-\sqrt{3}}{2+\sqrt{3}} \times \frac{2-\sqrt{3}}{2-\sqrt{3}} + \frac{\sqrt{3}-1}{\sqrt{3}+1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1}$

According to the formula $a^2 - b^2 = (a + b)(a - b)$

$= \frac{(2+\sqrt{3})^2}{2^2-\sqrt{3}^2} + \frac{(2-\sqrt{3})^2}{2^2-\sqrt{3}^2} + \frac{(\sqrt{3}-1)^2}{\sqrt{3}^2-1}$

$= \frac{2^2+2\times2\sqrt{3}+\sqrt{3}^2}{4-3} + \frac{2^2-2\times2\sqrt{3}+\sqrt{3}^2}{4-3} + \frac{\sqrt{3}^2-2\sqrt{3}+1}{3-1}$

$= \frac{4+4\sqrt{3}+3}{1} + \frac{4-4\sqrt{3}+3}{1} + \frac{3-2\sqrt{3}+1}{2}$

$= 7 + 4\sqrt{3} + 7 - 4\sqrt{3} + \frac{4-2\sqrt{3}}{2}$

$= 14 + 2 - \sqrt{3}$
$= 16 - \sqrt{3}$

25. For military tent

Diameter of the base = 4 m

$\therefore$Radius of the base (r) = $\frac{4}{2}$ m = 2m = 20 dm

Height (h) = 21 dm

$\therefore$ Volume of air in the tent =$\frac{1}{3}\pi r^2 h$

$= \frac{1}{3} \times \frac{22}{7} \times (20)^2 \times 21 = 8800\ dm^3$

$\because$ 16 men sleep in the tent

$\therefore$ Average space per man = $\frac{8800}{16}$ = 550 dm^3

$\therefore$ The average number of cubic decimetres of air surface per man is 550.

OR

Radius of the base of conical tent (r) = 5 cm

Area of the circular base of the cone = πr^2= $\frac{22}{7} \times 5^2 m^2$

Number of student = $\frac{Area\ of\ the\ base}{Area\ occupied\ by\ one\ student}$

$= \frac{\frac{22}{7}\times5\times5m^2}{\frac{5}{7}m^2}$ = $\frac{22}{7}\times 5 \times 5 \times \frac{7}{5} = 110$

Section C

26. Let point A represents 1 as shown in Figure.

Clearly, $OA = 1\ unit$.

Now, draw a right triangle OAB in which $AB = OA = 1\ unit$.

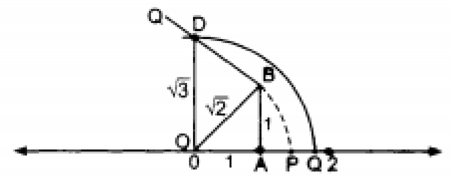
By Using Pythagoras theorem, we have

$OB^2 = OA^2 + AB^2$

$= 1^2 + 1^2$

$= 2$

$\Rightarrow OB = \sqrt{2}$



Taking O as centre and OB as a radius draw an arc intersecting the number line at point P.

Then p corresponds to $\sqrt{2}$ on the number line. Now draw DB of unit length perpendicular to OB.

By using Pythagoras theorem, we have

$OD^2 = OB^2 + DB^2$

$OD^2 = (\sqrt{2})^2 + 12$

$= 2 + 1 = 3$

OD = $\sqrt{3}$

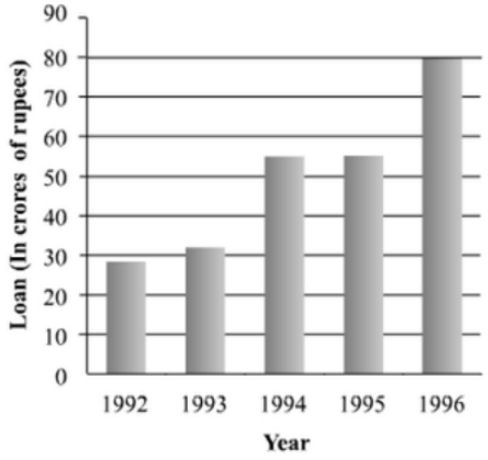
Taking O as centre and OD as a radius draw an arc which intersects the number line at the point Q.

Clearly, Q corresponds to $\sqrt{3}$.

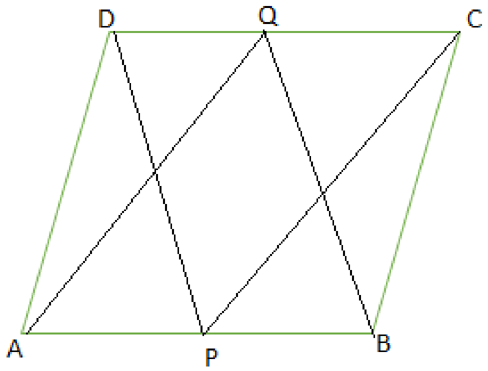
27. To represent the given data by a vertical bar graph, we first draw horizontal and vertical axes. Let us consider that the horizontal and vertical axes represent the years and the amount of loan in Crores of rupees respectively. We have to draw 5 bars of different lengths given in the table.

At first, we mark 5 points in the horizontal axis at equal distances and erect rectangles of the same width at these points. The heights of the rectangles are proportional to the amount of loan disbursed by the bank.

(1) The vertical bar graph of the average age of men in various countries in a certain year is



28.



Given, P and Q are mid-points of AB and CD.

Now, AB||CD,

∴AP || QC

Also, AB = DC

$\frac{1}{2}$AB = $\frac{1}{2}$DC

AP = QC

Now, AP || QC and AP = QC

∴APCQ is a parallelogram.

AQ || PC or SQ || PR

Again,

AB || DC ⇒ $\frac{1}{2}$ AB = $\frac{1}{2}$DC

∴BP = QD

Now, BP||QD and BP = QD

∴BPDQ is a parallelogram

So, PD||BQ or PS||QR

Thus, SQ||RP and PS||QR

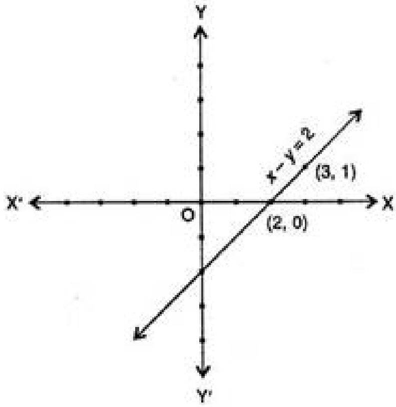
∴PQRS is a parallelogram.

29. $x - y = 2$

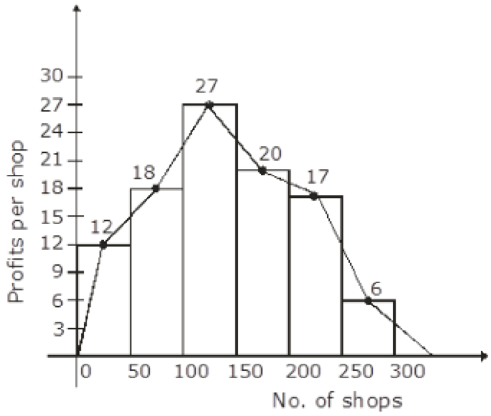
$y = x - 2$

x	2	3
y	0	1

We plot the points (2, 0) and (3, 1) on the graph paper and join the same by a ruler to get the line which is the graph of the equation $x - y = 2$

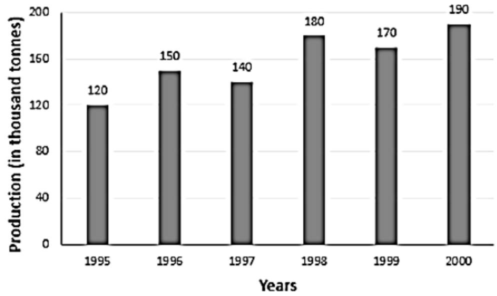


30. Monthly profits (in Rs) of 100 shops



OR

The production of foodgrains (in thousand tonnes) for some years:



31. Let $p(x) = x^3 + mx^2 - nx + 10$

x – 1 and x – 2 exactly divide p(x)

$\therefore p(1) = 0 \; and \; p(2) = 0$

$p(1) = 1^3 + m \times 1^2 - n \times 1 + 10 = 0$

1+m-n+10=0

m-n+11=0

m-n= -11 -----(1)

$p(2) = 2^3 + m \times 2^2 - n \times 2 + 10 = 0$

8+4m-2n+10=0

4m-2n=-18

2m-n=-9 ----{dividing by 2}

Subtracting eq. (2) form (1). We get

-m=-2

m=2

Putting m = 2 in eq. (1). We get

2-n=-11

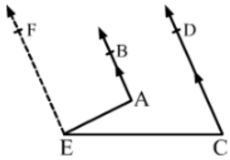
-n=-11-2

+n=+13

Therefore, n=13 and m=2

Section D

32. To Prove : ∠BAE - ∠DCE = ∠ACE



Draw EF || AB || CD through E.

Now, 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

Again, EF || CD and CE is the transversal

Then,

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

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

$\Rightarrow \angle DCE + (\angle AEC + \angle AEF) = 180^\circ$

$\Rightarrow \angle DCE + \angle AEC + 180^\circ - \angle BAE = 180^\circ$

$\Rightarrow \angle BAE - \angle DCE = \angle AEC$

OR

EF || CD and ED is the transversal.

$\therefore \quad \angle FED + \angle EDH = 180^\circ$ [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.

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

$\Rightarrow \angle ABE + x = 180^\circ$

$\Rightarrow \angle ABE + 115^\circ = 180^\circ$

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

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

From $\triangle$EAB, we get

$\angle EAB + \angle ABE + \angle BEA = 180^\circ$

$\Rightarrow$ 90° + 65° + z = 180°

$\Rightarrow$ z = (180° - 155°) = 25°

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

33. Given dimensions of bigger box

$= 25cm \times 20cm \times 5cm$

Total surface area of bigger box

$= 2\,[25 \times 20 + 20 \times 5 + 25 \times 5]\,cm^2$

$= 2\,[500 + 100 + 125]\,cm^2$

$= 2 \times 725 = 1450cm^2$

Extra cardboard for packing = 5 of $1450cm^2$

$= \frac{5}{100} \times 1450 = 72.5cm^2$

Cardboard used for making box $= 1450 + 72.5 = 1522.5cm^2$

Dimensions of smaller box $= 15cm \times 12cm \times 5cm$

Total surface area of smaller box $= 2\,[15 \times 12 + 12 \times 15 + 15 \times 5]\,cm^2$

$= 2\,[180 + 60 + 75]\,cm^2$

$= 2 \times 315cm^2 = 630cm^2$

Extra cardboard for packing $= 5$ % of 630

=0.05x630=31.5

Total area of cardboard = $630 + 31.5 = 661.5cm^2$

Total cardboard used for making both boxes

$= (1522.5 + 661.5)\,cm^2 = 2184cm^2$

Cardboard used for making 250 boxes $= 250 \times 2184 = 546000cm^2$

Cost of cardboard= $\frac{4}{1000} \times 546000$
= ₹ 2184

34. Each diagonal of square = 44 cm

So, AC = BD = 44 cm

And as diagonal of a square bisect each other at right angles

So,

BO = $\frac{1}{2}$ BD = $\frac{1}{2}\times$ 44 = 22 cm

$\therefore$ Area of square ABCD = 2(area of $\triangle ABC$)

$= 2\left(\frac{1}{2} \times 44 \times 22\right) = 2(44 \times 11)$

= 968 cm^2.

$\therefore$ Paper of Red shade needed to make the kite

$= \frac{1}{4}\left(968 cm^2\right) = 242 cm^2$

Paper of yellow shade needed to make the kite = (242 + 242) = 484 cm^2.

Let us find the area of a triangle with sides 20 cm, 20 cm and 14 cm which is at the bottom of the square ABCD.

a = 20 cm, b = 20 cm and c = 14 cm

Now, semi-perimeter

$s = \frac{a+b+c}{2} = \frac{20+20+14}{2} = \frac{54}{2} = 27 cm$

Area of $\Delta = \sqrt{s(s-a)(s-b)(s-c)}$ [Using Heron's Formula]

$= \sqrt{27(27-20)(27-20)(27-14)}$

$= \sqrt{27 \times 7 \times 7 \times 13} = 21\sqrt{39}$

$= 21 \times 6.245 = 131.15 cm^2$

Paper of Green shade needed to make the kite

= (242 + 131.15) cm^2 = 373.15 cm^2.

Hence, paper of Red, yellow and green shade needed to make the kite is 242 cm^2,484 cm^2 and 373.15 cm^2 respectively .

OR

Given, A design is made on a rectangular tile of dimensions 50 cm $\times$ 70 cm

$\therefore$ Area of rectangular tile = 50 $\times$ 70 = 3500 cm^2.

The sides of a design of one triangle be a = 25 cm, b = 17 cm and c = 26 cm.

Now, semi-perimeter, $s = \frac{a+b+c}{2}$

$= \frac{25+17+26}{2} = \frac{68}{2} = 34 cm$

$\therefore$ Area of $\Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$

[By Heron's formula]

$= \sqrt{34(34-25)(34-17)(34-26)} = \sqrt{34 \times 9 \times 17 \times 8}$

$= \sqrt{17 \times 2 \times 3 \times 3 \times 17 \times 2 \times 2 \times 2}$

= 17 $\times$ 3 $\times$ 2 $\times$ 2

= 204 cm^2.

$\therefore$ Total area of eight triangles = 204 $\times$ 8 = 1632 cm^2

The design shows 8 triangles

So, area of the design = Total area of eight triangles = 1632 cm^2

And, remaining area of the tile = Area of the rectangle – Area of the design

= 3500 cm^2 – 1632 cm^2

= 1868 cm^2

Hence, the total area of the design is 1632 cm^2 and the remaining area of the tile is 1868 cm^2.

35. Given, that f(x) = $x^3 + 6x^2 + 11x + 6$

Clearly we can say that, the polynomial f(x) with an integer coefficient and the highest degree term coefficient which is known as leading factor is 1.

So, the roots of f(x) are limited to integer factor of 6, they are $\pm$1, $\pm$ 2, $\pm$ 3, $\pm$ 6

Let x = -1

f(-1) = $(-1)^3 + 6(-1)^2 + 11(-1) + 6$

= -1 + 6 -11 + 6

= 0

Let x = – 2

f(-2) = $(-2)^3 + 6(-2)^2 + 11(-2) + 6$

= – 8 – (6 * 4) - 22 + 6

= – 8 + 24 - 22 + 6

= 0

Let x = – 3

f(-3) = $(-3)^3 + 6(-3)^2 + 11(-3) + 6$

= – 27 – (6 × 9) - 33 + 6

= – 27 + 54 - 33 + 6

= 0

But from all the given factors only -1, -2, -3 gives the result as zero.Furher,since f(x) is a polynomial of degree 3, therefore,it has almost 3 roots.

Therefore, the integral roots of $x^3 + 6x^2 + 11x + 6$ are -1, -2, -3.

Section E

36. i. x - 2y = 10

ii. x + y = 55 ...(i) and x - 2y = 10 ...(ii)

Subtracting (ii) from (i)

x + y - x + 2y = 55 - 10

⇒ 3y = 45

⇒ y = 15

So present age of Reeta is 15 years.

iii. x + y = 55 ...(i) and x - 2y = 10 ...(ii)

Subtracting (ii) from (i)

x + y - x + 2y = 55 - 10

⇒ 3y = 45

⇒ y = 15

Put y = 15 in equation (i)

x + y = 55

⇒ x + 15 = 55

⇒ x = 55 − 15 = 40

So Ranjeet's present age is 40 years.

OR

Let Reeta;s mother age be 'z'.

Given Reeta age : Her mother age = 7 : 5

We know that Reeta age = 15 years

$\frac{Mother\,age}{Reeta\,age} = \frac{7}{5}$

⇒ z = $\frac{7}{3} \times y$

⇒ z = $\frac{7}{3} \times 15$

⇒ Here Mother age = 35 years

Hence Reeta's mother's age is 35 years.

37. i. In △PQS and △PRT

PQ = PR (Given)

QS = TR (Given)

∠PQR =∠ PRQ (corresponding angles of an isosceles △)

By SAS commence

△PQS ≅ △PRT

ii. $\triangle PQS \cong \triangle PRT$

⇒ PS = PT (CPCT)

So in △PST

PS = PT

It is an isosceles triangle.

iii. Perimeter = sum of all 3 sides

PQ = PR = 6 cm

QR = 7 cm

So, P = (6 + 6 + 7) cm

= 19 cm

OR

Let $\angle Q = \angle R = x$ and $\angle P = 80^o$

In $\triangle PQR$, $\angle P + \angle Q + \angle R = 180^o$ (Angle sum property of $\triangle$)

$80^o + x + x = 180^o$

$2x = 180^o - 80$

$2x = 100^o$

$x = \frac{100^\circ}{2}$

$= 50^o$

38. i. In ΔAOP and ΔBOP

$\angle APO = \angle BPO$ (Given)

OP = OP (Common)

AO = OB (radius of circle)

$\Delta AOP \cong \Delta BOP$

AP = BP (CPCT)

ii. In right ΔCOQ

$CO^2 = OQ^2 + CQ^2$

$\Rightarrow 10^2 = 8^2 + CQ^2$

$\Rightarrow CQ^2 = 100 - 64 = 36$

$\Rightarrow CQ = 6$

CD = 2CQ

$\Rightarrow$ CD = 12 cm

iii. In right ΔAOB

$AO^2 = OP^2 + AP^2$

$\Rightarrow 10^2 = 6^2 + AP^2$

$\Rightarrow AP^2 = 100 - 36 = 64$

$\Rightarrow AP = 8$

AB = 2AP

$\Rightarrow$ AB = 16 cm

OR

There is one and only one circle passing through three given non-collinear points.