Solved Paper–1

Class 9th, Mathematics, SA–2

Time: 3hours **Max. Marks 90**

General Instructions

1. All questions are compulsory.
2. Draw neat labeled diagram wherever necessary to explain your answer.
3. Q.No. 1 to 8 are of objective type questions, carrying 1 mark each.
4. Q.No.9 to 14 are of short answer type questions, carrying 2 marks each.
5. Q. No. 15 to 24 carry 3 marks each. Q. No. 25 to 34 carry 4 marks each.

1. Point (–3, 5) lies in the
(A) first quadrant (B) second quadrant
(C) third quadrant (D) fourth quadrant

2. If Δ ABC ≅ Δ PQR and Δ ABC is not congruent to Δ RPQ, then which of the following is not true:
(A) BC = PQ (B) AC = PR
(C) QR = BC (D) AB = PQ

3. ABCD is a cyclic quadrilateral such that AB is a diameter of the circle circumscribing it and ∠ADC = 140º, then ∠BAC is equal to:
(A) 80º (B) 50º
(C) 40º (D) 30º

4. The linear equation 3x – y = x – 1 has :
(A) A unique solution (B) Two solutions
(C) Infinitely many solutions (D) No solution

5. The width of each of five continuous classes in a frequency distribution is 5 and the lower class-limit of the lowest class is 10. The upper class-limit of the highest class is:
(A) 15 (B) 25
(C) 35 (D) 40

6. In a cylinder, if radius is halved and height is doubled, the volume will be
(A) Same (B) doubled
(C) halved (D) four times

7. In a sample study of 642 people, it was found that 514 people have a high school certificate. If a person is selected at random, the probability that the person has a high school certificate is :

(A) 0.5 (B) 0.6

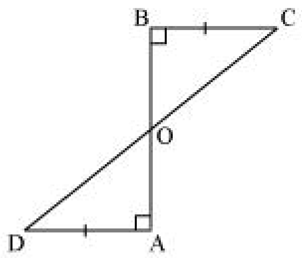
(C) 0.7 (D) 0.8

8. The total surface area of a cube is 96 cm^2. The volume of the cube is:

(A) 8 cm^3 (B) 512 cm^3

(C) 64 cm^3 (D) 27 cm^3

9. AD and BC are equal perpendiculars to a line segment AB (See the given figure). Show that CD bisects AB.



10. Find the capacity in litres of a conical vessel with

(i) radius 7 cm, slant height 25 cm

(ii) height 12 cm, slant height 12 cm $\left[\text{Assume } \pi = \frac{22}{7}\right]$

11. The relative humidity (in %) of a certain city for a month of 30 days was as follows:

98.1	98.6	99.2	90.3	86.5	95.3	92.9	96.3	94.2	95.1
89.2	92.3	97.1	93.5	92.7	95.1	97.2	93.3	95.2	97.3
96.2	92.1	84.9	90.2	95.7	98.3	97.3	96.1	92.1	89

(i) Construct a grouped frequency distribution table with classes 84 - 86, 86 - 88

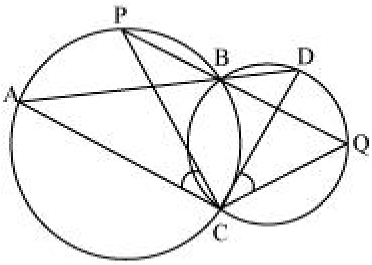
(ii) Which month or season do you think this data is about?

(iii) What is the range of this data?

12. Eleven bags of wheat flour, each marked 5 kg, actually contained the following weights of flour (in kg): 4.97 5.05 5.08 5.03 5.00 5.06 5.08 4.98 5.04 5.07 5.00

Find the probability that any of these bags chosen at random contains more than 5 kg of flour.

13. Two circles intersect at two points B and C. Through B, two line segments ABD and PBQ are drawn to intersect the circles at A, D and P, Q respectively (see the given figure). Prove that ∠ACP = ∠QCD.



14. The value of π up to50 decimal places is given below:
3.14159265358979323846264338327950288419716939937510
(i) Make a frequency distribution of the digits from 0 to 9 after the decimal point.
(ii) What are the most and the least frequently occurring digits?

15. Draw the graph of each of the following linear equations in two variables:
(i) $x + y = 4$ (ii) $x - y = 2$

16. Show that if the diagonals of a quadrilateral bisect each other at right angles, then it is a rhombus.

17. Construct a triangle XYZ in which ∠Y = 30°, ∠Z = 90° and XY + YZ + ZX = 11 cm.

18. The volume of a right circular cone is 9856 cm^3. If the diameter of the base is 28 cm, find
(i) height of the cone
(ii) slant height of the cone
(iii) curved surface area of the cone $\left[\text{Assume } \pi = \frac{22}{7}\right]$

19. The following data on the number of girls (to the nearest ten) per thousand boys in different sections of Indian society is given below.

Section	**Number of girls per thousand boys**
Scheduled Caste (SC)	940
Scheduled Tribe (ST)	970
Non SC/ST	920

Backward districts	950
Non-backward districts	920
Rural	930
Urban	910

(i) Represent the information above by a bar graph.

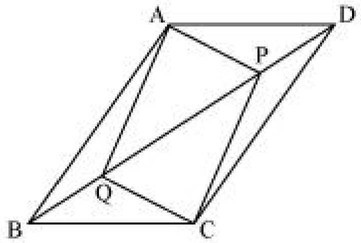
(ii) In the classroom discuss what conclusions can be arrived at from the graph.

20. The taxi fare in a city is as follows: For the first kilometre, the fares is Rs 8 and for the subsequent distance it is Rs 5 per km. Taking the distance covered as *x* km and total fare as Rs *y*, write a linear equation for this information, and draw its graph.

21. Find the volume of a sphere whose radius is

(i) 7 cm (ii) 0.63 m $\left[\text{Assume } \pi = \frac{22}{7}\right]$

22. In parallelogram ABCD, two points P and Q are taken on diagonal BD such that DP = BQ (see the given figure). Show that:



(i) ΔAPD ≅ ΔCQB

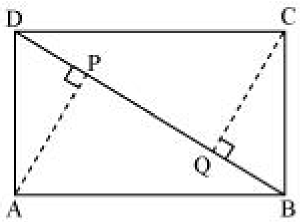
(ii) AP = CQ

(iii) ΔAQB ≅ ΔCPD

(iv) AQ = CP

(v) APCQ is a parallelogram

23. ABCD is a parallelogram and AP and CQ are perpendiculars from vertices A and C on diagonal BD (See the given figure). Show that



(i) ΔAPB ≅ ΔCQD

(ii) AP = CQ

24. The following table gives the distribution of students of two sections according to the mark obtained by them:

Section A		Section B	
Marks	**Frequency**	**Marks**	**Frequency**
0 − 10	3	0 − 10	5
10 − 20	9	10 − 20	19
20 − 30	17	20 − 30	15
30 − 40	12	30 − 40	10
40 − 50	9	40 − 50	1

Represent the marks of the students of both the sections on the same graph by two frequency polygons. From the two polygons compare the performance of the two sections.

25. ABCD is a rhombus and P, Q, R and S are the mid-points of the sides AB, BC, CD and DA respectively. Show that the quadrilateral PQRS is a rectangle.

26. Construct the following angles and verify by measuring them by a protractor:
(i) 75° (ii) 105° (iii) 135°

27. Give the geometric representation of $y = 3$ as an equation
(I) in one variable
(II) in two variables

28. How many litres of milk can a hemispherical bowl of diameter 10.5 cm hold? $\left[\text{Assume } \pi = \frac{22}{7}\right]$

29. Prove that the circle drawn with any side of a rhombus as diameter passes through the point of intersection of its diagonals.

30. Show that the line segments joining the mid-points of the opposite sides of a quadrilateral bisect each other.

31. The following number of goals was scored by a team in a series of 10 matches:
2, 3, 4, 5, 0, 1, 3, 3, 4, 3 Find the mean, median and mode of these scores.

32. Two congruent circles intersect each other at points A and B. Through A any line segment PAQ is drawn so that P, Q lie on the two circles. Prove that BP = BQ.

33. Twenty seven solid iron spheres, each of radius r and surface area S are melted to form a sphere with surface area S'. Find the
(i) radius r' of the new sphere, (ii) ratio of S and S'.

34. Find the mean salary of 60 workers of a factory from the following table:

Salary (in Rs)	**Number of workers**
3000	16
4000	12
5000	10
6000	8
7000	6
8000	4
9000	3
1000	1
Total	60

Solutions

1. B
2. A
3. C
4. C
5. C
6. B
7. D
8. C

9. In ΔBOC and ΔAOD,
∠BOC = ∠AOD (Vertically opposite angles)
∠CBO = ∠DAO (Each 90º)
BC = AD (Given)
∴ ΔBOC ≅ ΔAOD (AAS congruence rule)
∴ BO = AO (By CPCT)
⇒ CD bisects AB.

10. (i) Radius (r) of cone = 7 cm
Slant height (l) of cone = 25 cm
Height (h) of cone $= \sqrt{l^2 - r^2}$
$= \left(\sqrt{25^2 - 7^2}\right)$ cm
$= 24$ cm
Volume of cone $= \frac{1}{3}\pi r^2 h$
$= \left(\frac{1}{3} \times \frac{22}{7} \times (7)^2 \times 24\right)$ cm^3
$= (154 \times 8)$ cm^3
$= 1232$ cm^3
Therefore, capacity of the conical vessel
$= \left(\frac{1232}{1000}\right)$ litres $\left(1 \text{ litre} = 1000 \text{ cm}^3\right)$
= 1.232 litres

(ii) Height (h) of cone = 12 cm

Slant height (l) of cone = 13 cm

Radius (r) of cone $= \sqrt{l^2 - h^2}$

$= \left(\sqrt{13^2 - 12^2}\right)$ cm

$= 5$ cm

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

$= \left[\frac{1}{3} \times \frac{22}{7} \times (5)^2 \times 12\right]$ cm^3

$= \left(4 \times \frac{22}{7} \times 25\right)$ cm^3

$= \left(\frac{2200}{7}\right)$ cm^3

Therefore, capacity of the conical vessel

$= \left(\frac{2200}{7000}\right)$ litres $\left(1 \text{ litre} = 1000 \text{ cm}^3\right)$

$= \frac{11}{35}$ litres

11. (i) A grouped frequency distribution table of class size 2 has to be constructed. The class intervals will be 84 − 86, 86 − 88, and 88 − 90…

By observing the data given above, the required table can be constructed as follows.

Relative humidity (in %)	**Number of days (frequency)**
84 − 86	1
86 − 88	1
88 − 90	2
90 − 92	2
92 − 94	7
94 − 96	6
96 − 98	7

98 − 100	4
Total	30

(ii) It can be observed that the relative humidity is high. Therefore, the data is about a month of rainy season.

(iii) Range of data = Maximum value − Minimum value

= 99.2 − 84.9 = 14.3

12. Number of total bags = 11

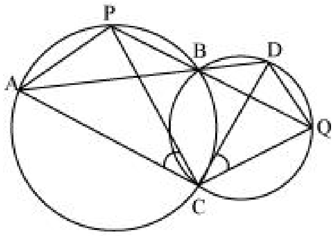
Number of bags containing more than 5 kg of flour = 7

Hence, required probability, $P = \frac{7}{11}$

13. Join chords AP and DQ.

For chord AP,

∠PBA = ∠ACP (Angles in the same segment) ... (1)



For chord DQ,

∠DBQ = ∠QCD (Angles in the same segment) ... (2)

ABD and PBQ are line segments intersecting at B.

∴ ∠PBA = ∠DBQ (Vertically opposite angles) ... (3)

From equations (1), (2), and (3), we obtain

∠ACP = ∠QCD

14. (i) By observation of the digits after decimal point, the required table can be constructed as follows.

Digit	0	1	2	3	4	5	6	7	8	9	Total
Frequency	2	5	5	8	4	5	4	4	5	8	50

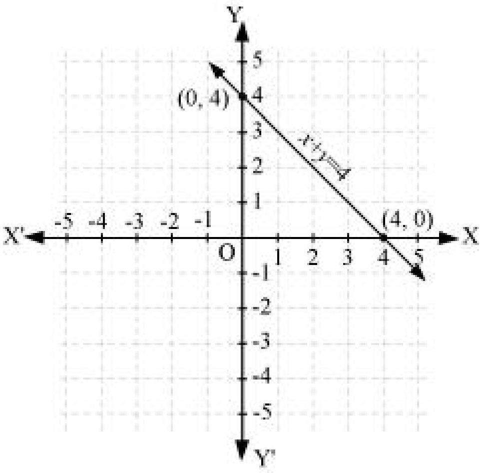
(ii) It can be observed from the above table that the least frequency is 2 of digit 0, and the maximum frequency is 8 of digit 3 and 9. Therefore, the most frequently occurring digits are 3 and 9 and the least frequently occurring digit is 0.

15. (i) $x + y = 4$

It can be observed that x = 0, y = 4 and x = 4, y = 0 are solutions of the above equation. Therefore, the solution table is as follows.

x	0	4
y	4	0

The graph of this equation is constructed as follows.

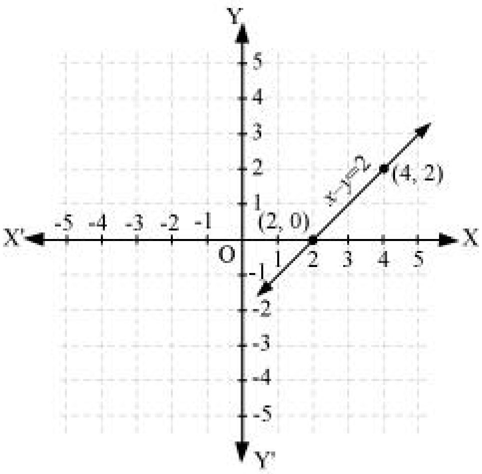


(ii) $x - y = 2$

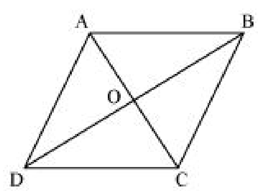
It can be observed that $x = 4$, $y = 2$ and $x = 2$, $y = 0$ are solutions of the above equation. Therefore, the solution table is as follows.

x	4	2
y	2	0

The graph of the above equation is constructed as follows.



16. Let ABCD be a quadrilateral, whose diagonals AC and BD bisect each other at right angle i.e., OA = OC, OB = OD, and ∠AOB = ∠BOC = ∠COD = ∠AOD = 90º. To prove ABCD a rhombus, we have to prove ABCD is a parallelogram and all the sides of ABCD



are equal.
In ΔAOD and ΔCOD,
OA = OC (Diagonals bisect each other)
∠AOD = ∠COD (Given)
OD = OD (Common)
∴ ΔAOD ≅ ΔCOD (By SAS congruence rule)
∴ AD = CD (1)
Similarly, it can be proved that
AD = AB and CD = BC (2)
From equations (1) and (2),
AB = BC = CD = AD
Since opposite sides of quadrilateral ABCD are equal, it can be said that ABCD is a parallelogram. Since all sides of a parallelogram ABCD are equal, it can be said that ABCD is a rhombus.

17. The below given steps will be followed to construct the required triangle.

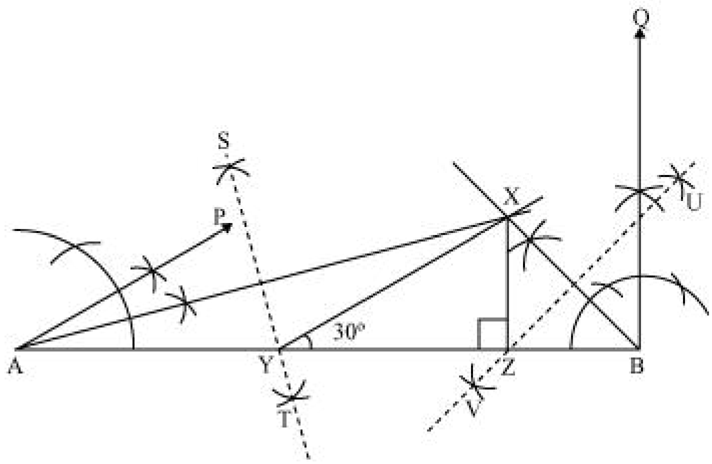
Step I: Draw a line segment AB of 11 cm.
(As XY + YZ + ZX = 11 cm)

Step II: Construct an angle, ∠PAB, of 30° at point A and an angle, ∠QBA, of 90° at point B.

Step III: Bisect ∠PAB and ∠QBA. Let these bisectors intersect each other at point X.

Step IV: Draw perpendicular bisector ST of AX and UV of BX.

Step V: Let ST intersect AB at Y and UV intersect AB at Z.
Join XY, XZ.
ΔXYZ is the required triangle.



18. (i) Radius of cone = $\left(\frac{28}{2}\right)$ cm = 14 cm

Let the height of the cone be h.

Volume of cone = 9856 cm^3

$$\Rightarrow \frac{1}{3}\pi r^2 h = 9856 \text{ cm}^3$$

$$\Rightarrow \left[\frac{1}{3}\times\frac{22}{7}\times(14)^2\times h\right] \text{cm}^2 = 9856 \text{ cm}^3$$

h = 48 cm

Therefore, the height of the cone is 48 cm.

(ii) Slant height (l) of cone $= \sqrt{r^2+h^2}$

$$= \left[\sqrt{(14)^2+(48)^2}\right] \text{cm}$$

$$= \left[\sqrt{196+2304}\right] \text{cm}$$

$$= 50 \text{ cm}$$

Therefore, the slant height of the cone is 50 cm.

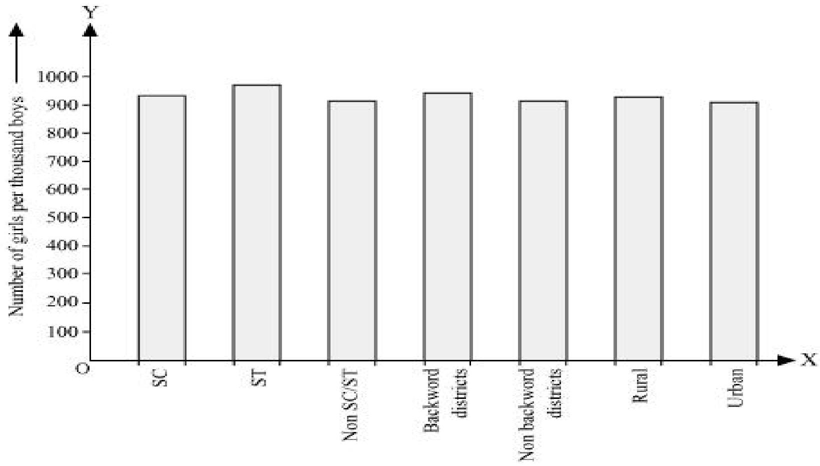
(iii) CSA of cone = πrl

$$= \left(\frac{22}{7}\times 14\times 50\right) \text{cm}^2$$

= 2200 cm^2

Therefore, the curved surface area of the cone is 2200 cm^2.

19. (i) By representing section (variable) on x-axis and number of girls per thousand boys on y-axis, the graph of the information given above can be constructed by choosing an appropriate scale (1 unit = 100 girls for y-axis)



Here, all the rectangle bars are of the same length and have equal spacing in between them.

(ii) It can be observed that maximum number of girls per thousand boys (i.e., 970) is for ST and minimum number of girls per thousand boys (i.e., 910) is for urban.

Also, the number of girls per thousand boys is greater in rural areas than that in urban areas, backward districts than that in non-backward districts, SC and ST than that in non-SC/ST.

20. Total distance covered = x km

Fare for 1st kilometre = Rs 8

Fare for the rest of the distance = Rs $(x - 1)\,5$

Total fare = Rs $[8 + (x - 1)\,5]$

$y = 8 + 5x - 5$

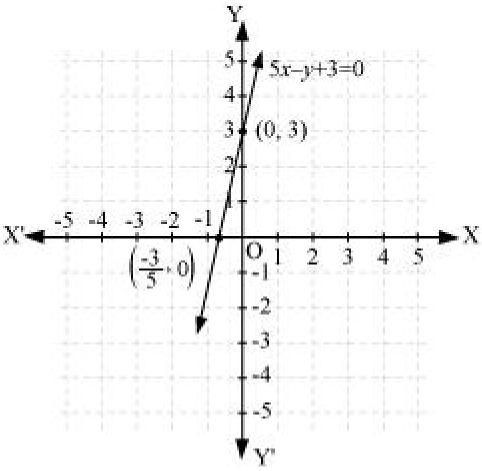
$y = 5x + 3$

$5x - y + 3 = 0$

It can be observed that point (0, 3) and $\left(-\frac{3}{5}, 0\right)$ satisfies the above equation. Therefore, these are the solutions of this equation.

x	0	$\frac{-3}{5}$
y	3	0

The graph of this equation is constructed as follows.



Here, it can be seen that variable x and y are representing the distance covered and the fare paid for that distance respectively and these quantities may not be negative. Hence, only those values of x and y which are lying in the 1st quadrant will be considered.

21. (i) Radius of sphere = 7 cm

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

$= \left[\frac{4}{3} \times \frac{22}{7} \times (7)^3\right] \text{ cm}^3$

$= \left(\frac{4312}{3}\right) \text{ cm}^3$

$= 1437\frac{1}{3} \text{ cm}^3$

Therefore, the volume of the sphere is $1437\frac{1}{3}$ cm^3.

(ii) Radius of sphere = 0.63 m

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

$= \left[\frac{4}{3} \times \frac{22}{7} \times (0.63)^3\right] \text{ m}^3$

$= 1.0478 \text{ m}^3$

Therefore, the volume of the sphere is 1.05 m^3 (approximately).

22. (i) In ΔAPD and ΔCQB,

∠ADP = ∠CBQ (Alternate interior angles for BC || AD)

AD = CB (Opposite sides of parallelogram ABCD)

DP = BQ (Given)

∴ ΔAPD ≅ ΔCQB (Using SAS congruence rule)

(ii) As we had observed that ΔAPD ≅ ΔCQB,

∴ AP = CQ (CPCT)

(iii) In ΔAQB and ΔCPD,

∠ABQ = ∠CDP (Alternate interior angles for AB || CD)

AB = CD (Opposite sides of parallelogram ABCD)

BQ = DP (Given)

∴ ΔAQB ≅ ΔCPD (Using SAS congruence rule)

(iv) As we had observed that ΔAQB ≅ ΔCPD,

∴ AQ = CP (CPCT)

(v) From the result obtained in (ii) and (iv),

AQ = CP and

AP = CQ

Since opposite sides in quadrilateral APCQ are equal to each other, APCQ is a parallelogram.

23. (i) In ΔAPB and ΔCQD,

∠APB = ∠CQD (Each 90°)

AB = CD (Opposite sides of parallelogram ABCD)

∠ABP = ∠CDQ (Alternate interior angles for AB || CD)

∴ ΔAPB ≅ ΔCQD (By AAS congruency)

(ii) By using the above result

ΔAPB ≅ ΔCQD, we obtain

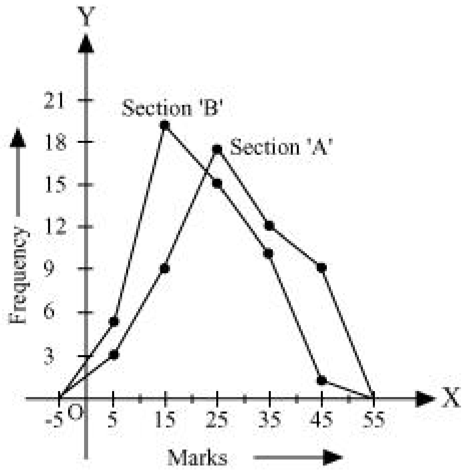
AP = CQ (By CPCT)

24. We can find the class marks of the given class intervals by using the following formula.

$$\text{Class mark} = \frac{\text{Upper class limit} + \text{Lower class limit}}{2}$$

Section A			**Section B**		
Marks	**Class marks**	**Frequency**	**Marks**	**Class marks**	**Frequency**
0 − 10	5	3	0 − 10	5	5
10 − 20	15	9	10 − 20	15	19
20 − 30	25	17	20 − 30	25	15
30 − 40	35	12	30 − 40	35	10
40 − 50	45	9	40 − 50	45	1

Taking class marks on *x*-axis and frequency on *y*-axis and choosing an appropriate scale (1 unit = 3 for *y*-axis), the frequency polygon can be drawn as follows.



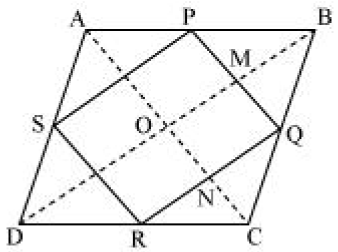
It can be observed that the performance of students of section ‘A’ is better than the students of section ‘B’ in terms of good marks.

25. In ΔABC, P and Q are the mid-points of sides AB and BC respectively.

∴ PQ || AC and PQ = $\frac{1}{2}$ AC (Using mid-point theorem) ... (1)

In ΔADC,

R and S are the mid-points of CD and AD respectively.



∴ RS || AC and RS = $\frac{1}{2}$ AC (Using mid-point theorem) ... (2)

From equations (1) and (2), we obtain

PQ || RS and PQ = RS

Since in quadrilateral PQRS, one pair of opposite sides is equal and parallel to each other, it is a parallelogram.

Let the diagonals of rhombus ABCD intersect each other at point O.

In quadrilateral OMQN,

MQ || ON (∵ PQ || AC)

QN || OM (∵ QR || BD)

Therefore, OMQN is a parallelogram.

⇒ ∠MQN = ∠NOM

⇒ ∠PQR = ∠NOM

However, ∠NOM = 90° (Diagonals of a rhombus are perpendicular to each other)

∴ ∠PQR = 90°

Clearly, PQRS is a parallelogram having one of its interior angles as 90º.

Hence, PQRS is a rectangle.

26. (i) 75°

The below given steps will be followed to construct an angle of 75°.

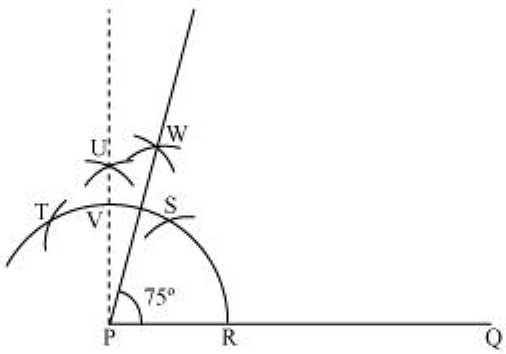
(1) Take the given ray PQ. Draw an arc of some radius taking point P as its centre, which intersects PQ at R.

(2) Taking R as centre and with the same radius as before, draw an arc intersecting the previously drawn arc at S.

(3) Taking S as centre and with the same radius as before, draw an arc intersecting the arc at T (see figure).

(4) Taking S and T as centre, draw an arc of same radius to intersect each other at U.

(5) Join PU. Let it intersect the arc at V. Taking S and V as centre, draw arcs with radius more than $\frac{1}{2}$SV. Let those intersect each other at W. Join PW which is the required ray making 75° with the given ray PQ.



The angle so formed can be measured with the help of a protractor. It comes to be 75º.

(ii) 105°

The below given steps will be followed to construct an angle of 105°.

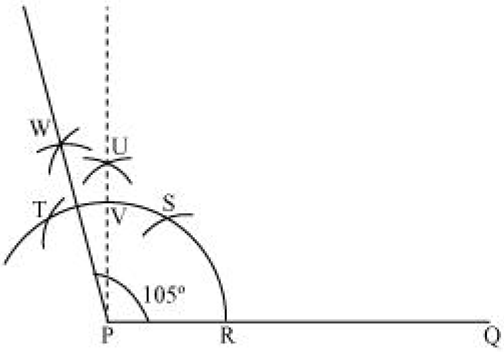
(1) Take the given ray PQ. Draw an arc of some radius taking point P as its centre, which intersects PQ at R.

(2) Taking R as centre and with the same radius as before, draw an arc intersecting the previously drawn arc at S.

(3) Taking S as centre and with the same radius as before, draw an arc intersecting the arc at T (see figure).

(4) Taking S and T as centre, draw an arc of same radius to intersect each other at U.

(5) Join PU. Let it intersect the arc at V. Taking T and V as centre, draw arcs with radius more than $\frac{1}{2}$ TV. Let these arcs intersect each other at W. Join PW which is the required ray making 105° with the given ray PQ.



The angle so formed can be measured with the help of a protractor. It comes to be 105º.

(iii) 135°

The below given steps will be followed to construct an angle of 135°.

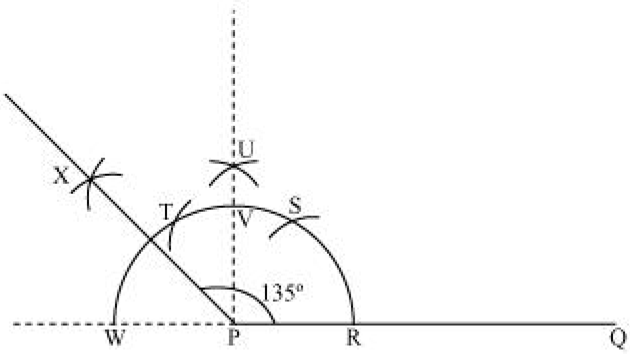
(1) Take the given ray PQ. Extend PQ on the opposite side of Q. Draw a semi-circle of some radius taking point P as its centre, which intersects PQ at R and W.

(2) Taking R as centre and with the same radius as before, draw an arc intersecting the previously drawn arc at S.

(3) Taking S as centre and with the same radius as before, draw an arc intersecting the arc at T (see figure).

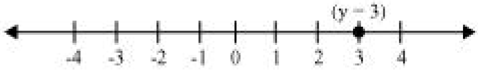
(4) Taking S and T as centre, draw an arc of same radius to intersect each other at U.

(5) Join PU. Let it intersect the arc at V. Taking V and W as centre and with radius more than $\frac{1}{2}$ VW, draw arcs to intersect each other at X. Join PX, which is the required ray making 135°with the given line PQ.

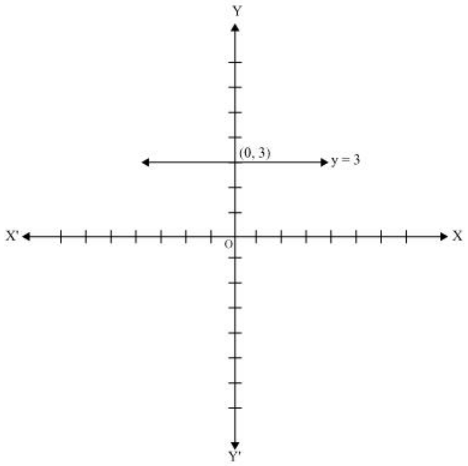


The angle so formed can be measured with the help of a protractor. It comes to be 135º.

27. In one variable, $y = 3$ represents a point as shown in following figure.



In two variables, $y = 3$ represents a straight line passing through point (0, 3) and parallel to x-axis. It is a collection of all points of the plane, having their y-coordinate as 3.



28. Radius (r) of hemispherical bowl = $\left(\frac{10.5}{2}\right)$ cm = 5.25 cm

Volume of hemispherical bowl = $\frac{2}{3}\pi r^3$

$= \left[\frac{2}{3} \times \frac{22}{7} \times (5.25)^3\right] \text{ cm}^3$

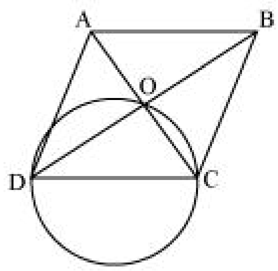
= 303.1875 cm^3

Capacity of the bowl = $\left(\frac{303.1875}{1000}\right)$ litre

=0.3031875 litre=0.303 litre (approximately)

Therefore, the volume of the hemispherical bowl is 0.303 litre.

29. Let ABCD be a rhombus in which diagonals are intersecting at point O and a circle is drawn while taking side CD as its diameter. We know that a diameter subtends 90° on the arc.



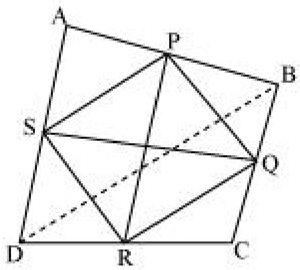
∴ ∠COD = 90°

Also, in rhombus, the diagonals intersect each other at 90°.

∠AOB = ∠BOC = ∠COD = ∠DOA = 90°

Clearly, point O has to lie on the circle.

30. Let ABCD is a quadrilateral in which P, Q, R, and S are the mid-points of sides AB, BC, CD, and DA respectively. Join PQ, QR, RS, SP, and BD.



In ΔABD, S and P are the mid-points of AD and AB respectively. Therefore, by using mid-point theorem, it can be said that

SP || BD and SP = $\frac{1}{2}$ BD ... (1)

Similarly in ΔBCD,

QR || BD and QR = $\frac{1}{2}$ BD ... (2)

From equations (1) and (2), we obtain

SP || QR and SP = QR

In quadrilateral SPQR, one pair of opposite sides is equal and parallel to each other. Therefore, SPQR is a parallelogram.

We know that diagonals of a parallelogram bisect each other.

Hence, PR and QS bisect each other.

31. The number of goals scored by the team is

2, 3, 4, 5, 0, 1, 3, 3, 4, 3

$$\text{Mean of data} = \frac{\text{Sum of all observations}}{\text{Total number of observations}}$$

$$\text{Mean score} = \frac{2+3+4+5+0+1+3+3+4+3}{10}$$

$$= \frac{28}{10} = 2.8$$

$$= 2.8 \text{ goals}$$

Arranging the number of goals in ascending order,

0, 1, 2, 3, 3, 3, 3, 4, 4, 5

The number of observations is 10, which is an even number. Therefore, median score will be the mean of $\frac{10}{2}$ i.e., 5th and $\frac{10}{2}+1$ i.e., 6th observation while arranged in ascending or descending order.

$$\text{Median score} = \frac{5^{th} \text{ observation} + 6^{th} \text{ observation}}{2}$$

$$= \frac{3+3}{2}$$

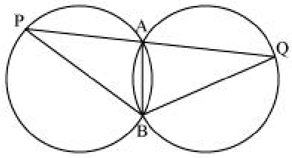
$$= \frac{6}{2}$$

$$= 3$$

Mode of data is the observation with the maximum frequency in data.

Therefore, the mode score of data is 3 as it has the maximum frequency as 4 in the data.

32. AB is the common chord in both the congruent circles.



∴ ∠APB = ∠AQB

In ΔBPQ,

∠APB = ∠AQB

∴ BQ = BP (Angles opposite to equal sides of a triangle)

33. (i) Radius of 1 solid iron sphere = r

Volume of 1 solid iron sphere $= \frac{4}{3}\pi r^3$

Volume of 27 solid iron spheres $= 27 \times \frac{4}{3}\pi r^3$

27 solid iron spheres are melted to form 1 iron sphere. Therefore, the volume of this iron sphere will be equal to the volume of 27 solid iron spheres. Let the radius of this new sphere be r'.

Volume of new solid iron sphere $= \frac{4}{3}\pi r'^3$

$$\frac{4}{3}\pi r'^3 = 27 \times \frac{4}{3}\pi r^3$$

$$r'^3 = 27r^3$$

$$r' = 3r$$

(ii) Surface area of 1 solid iron sphere of radius $r = 4\pi r^2$

Surface area of iron sphere of radius $r' = 4\pi (r')^2$

$= 4\pi (3r)^2 = 36\pi r^2$

$$\frac{S}{S'} = \frac{4\pi r^2}{36\pi r^2} = \frac{1}{9} = 1:9$$

34. We know that

$$\text{Mean} = \frac{\sum f_i x_i}{\sum f_i}$$

The value of $\sum f_i x_i$ and $\sum f_i$ can be calculated as follows.

Salary (in Rs) (x_i)	**Number of workers (f_i)**	**$f_i x_i$**
3000	16	3000 × 16 = 48000
4000	12	4000 × 12 = 48000
5000	10	5000 × 10 = 50000
6000	8	6000 × 8 = 48000
7000	6	7000 × 6 = 42000
8000	4	8000 × 4 = 32000
9000	3	9000 × 3 = 27000
10000	1	10000 × 1 = 10000
Total	$\sum f_i = 60$	$\sum f_i x_i = 305000$

$$\text{Mean salary} = \frac{305000}{60}$$
$$= 5083.33$$

Therefore, mean salary of 60 workers is Rs 5083.33.