Solved Paper–3

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. Signs of the abscissa and ordinate of a point in the second quadrant are respectively

   (A) +, + (B) –, –

   (C) –, + (D) +, –

2. Which of the following is not a criterion for congruence of triangles?

   (A) SAS (B) ASA

   (C) SSA (D) SSS

3. If AB = 12 cm, BC = 16 cm and AB is perpendicular to BC, then the radius of the circle passing through the points A, B and C is :

   (A) 6 cm (B) 8 cm

   (C) 10 cm (D) 12 cm

4. Any point on the y-axis is of the form

   (A) (x, 0) (B) (x, y)

   (C) (0, y) (D) ( y, y)

5. The range of the data :

   25, 18, 20, 22, 16, 6, 17, 15, 12, 30, 32, 10, 19, 8, 11, 20 is

   (A) 10 (B) 15

   (C) 18 (D) 26

6. The radius of a hemispherical balloon increases from 6 cm to 12 cm as air is being pumped into it. The ratios of the surface areas of the balloon in the two cases is

   (A) 1 : 4 (B) 1 : 3

   (C) 2 : 3 (D) 2 : 1

7. In a survey of 364 children aged 19-36 months, it was found that 91 liked to eat potato chips. If a child is selected at random, the probability that he/she does not like to eat potato chips is :

(A) 0.25 (B) 0.50

(C) 0.75 (D) 0.80

8. The length of the longest pole that can be put in a room of dimensions ($10\text{ m} \times 10\text{ m} \times 5\text{m}$) is

(A) 15 m (B) 16 m

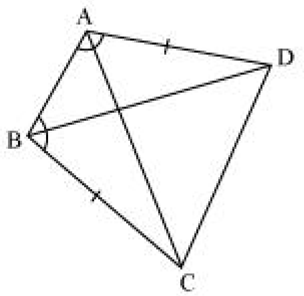
(C) 10 m (D) 12 m

9. ABCD is a quadrilateral in which AD = BC and $\angle DAB = \angle CBA$ (See the given figure). Prove that

(i) $\Delta ABD \cong \Delta BAC$

(ii) BD = AC

(iii) $\angle ABD = \angle BAC$.




10. The height of a cone is 15 cm. If its volume is 1570 $cm^3$, find the diameter of its base. [Use $\pi = 3.14$]

11. The heights of 50 students, measured to the nearest centimeters, have been found to be as follows:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 161 | 150 | 154 | 165 | 168 | 161 | 154 | 162 | 150 | 151 |
| 162 | 164 | 171 | 165 | 158 | 154 | 156 | 172 | 160 | 170 |
| 153 | 159 | 161 | 170 | 162 | 165 | 166 | 168 | 165 | 164 |
| 154 | 152 | 153 | 156 | 158 | 162 | 160 | 161 | 173 | 166 |
| 161 | 159 | 162 | 167 | 168 | 159 | 158 | 153 | 154 | 159 |

(i) Represent the data given above by a grouped frequency distribution table, taking the class intervals as 160 - 165, 165 - 170, etc.

(ii) What can you conclude bout their heights from the table?

12. To know the opinion of the students about the subject *statistics*, a survey of 200 students was conducted. The data is recorded in the following table.

| **Opinion** | **Number of students** |
|---|---|
| like | 135 |
| dislike | 65 |

Find the probability that a student chosen at random
(i) likes statistics, (ii) does not like it

13. If circles are drawn taking two sides of a triangle as diameters, prove that the point of intersection of these circles lie on the third side.

14. Thirty children were asked about the number of hours they watched TV programmes in the previous week. The results were found as follows:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 6 | 2 | 3 | 5 | 12 | 5 | 8 | 4 | 8 |
| 10 | 3 | 4 | 12 | 2 | 8 | 15 | 1 | 17 | 6 |
| 3 | 2 | 8 | 5 | 9 | 6 | 8 | 7 | 14 | 12 |

(i) Make a grouped frequency distribution table for this data, taking class width 5 and one of the class intervals as 5 - 10.
(ii) How many children watched television for 15 or more hours a week?

15. Give the equations of two lines passing through (2, 14). How many more such lines are there, and why?

16. Show that the diagonals of a square are equal and bisect each other at right angles.

17. Construct a right triangle whose base is 12 cm and sum of its hypotenuse and other side is 18 cm.

18. 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.

19. Given below are the seats won by different political parties in the polling outcome of a state assembly elections:

| Political Party | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| **Seats Won** | 75 | 55 | 37 | 29 | 10 | 37 |

(i) Draw a bar graph to represent the polling results.

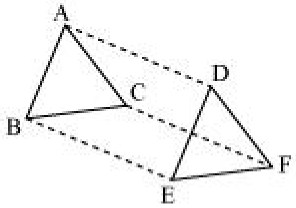
(ii) Which political party won the maximum number of seats?

20. If the point (3, 4) lies on the graph of the equation $3y = ax + 7$, find the value of $a$.

21. Find the amount of water displaced by a solid spherical ball of diameter

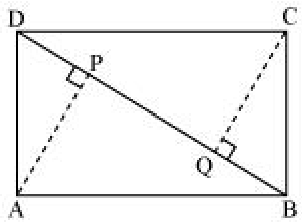
(i) 28 cm (ii) 0.21 m $\left[\text{Assume } \pi = \frac{22}{7}\right]$

22. In ΔABC and ΔDEF, AB = DE, AB || DE, BC = EF and BC || EF. Vertices A, B and C are joined to vertices D, E and F respectively (see the given figure). Show that




(i) Quadrilateral ABED is a parallelogram
(ii) Quadrilateral BEFC is a parallelogram
(iii) AD || CF and AD = CF
(iv) Quadrilateral ACFD is a parallelogram
(v) AC = DF
(vi) ΔABC ≅ ΔDEF.

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 runs scored by two teams A and B on the first 60 balls in a cricket match are given below:

| Number of balls | Team A | Team B |
|---|---|---|
| 1 − 6 | 2 | 5 |
| 7 − 12 | 1 | 6 |
| 13 − 18 | 8 | 2 |
| 19 − 24 | 9 | 10 |
| 25 − 30 | 4 | 5 |
| 31 − 36 | 5 | 6 |
| 37 − 42 | 6 | 3 |
| 43 − 48 | 10 | 4 |
| 49 − 54 | 6 | 8 |
| 55 − 60 | 2 | 10 |

Represent the data of both the teams on the same graph by frequency polygons.
[**Hint:** First make the class intervals continuous.]

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

26. Construct the angles of the following measurements:

(i) 30° (ii) $22\frac{1}{2}^\circ$ (iii) 15°

27. Give the geometric representations of $2x + 9 = 0$ as an equation
(1) in one variable
(2) in two variables

28. A hemispherical tank is made up of an iron sheet 1 cm thick. If the inner radius is 1 m, then find the volume of the iron used to make the tank. $\left[\text{Assume } \pi = \frac{22}{7}\right]$

29. ABCD is a parallelogram. The circle through A, B and C intersect CD (produced if necessary) at E. Prove that AE = AD.

30. ABC is a triangle right angled at C. A line through the mid-point M of hypotenuse AB and parallel to BC intersects AC at D. Show that
(i) D is the mid-point of AC

(ii) MD ⊥ AC

(iii) $CM = MA = \frac{1}{2}AB$

31. In a mathematics test given to 15 students, the following marks (out of 100) are recorded:
41, 39, 48, 52, 46, 62, 54, 40, 96, 52, 98, 40, 42, 52, 60
Find the mean, median and mode of this data.

32. In any triangle ABC, if the angle bisector of ∠A and perpendicular bisector of BC intersect, prove that they intersect on the circum circle of the triangle ABC.

33. A capsule of medicine is in the shape of a sphere of diameter 3.5 mm. How much medicine (in $mm^3$) is needed to fill this capsule? $\left[\text{Assume } \pi = \frac{22}{7}\right]$

34. Give one example of a situation in which
(i) The mean is an appropriate measure of central tendency.
(ii) The mean is not an appropriate measure of central tendency but the median is an appropriate measure of central tendency.

# Solutions

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

9. In $\Delta ABD$ and $\Delta BAC$,
AD = BC (Given)
$\angle DAB = \angle CBA$ (Given)
AB = BA (Common)
$\therefore \Delta ABD \cong \Delta BAC$ (By SAS congruence rule)
$\therefore$ BD = AC (By CPCT)
And, $\angle ABD = \angle BAC$ (By CPCT)
10. Height ($h$) of cone = 15 cm
Let the radius of the cone be $r$.
Volume of cone = 1570 $cm^3$

$$\frac{1}{3}\pi r^2 h = 1570\ \text{cm}^3$$

$$\Rightarrow \left(\frac{1}{3}\times 3.14\times r^2\times 15\right)\ \text{cm} = 1570\ \text{cm}^3$$

$$\Rightarrow r^2 = 100\ \text{cm}^2$$

$\Rightarrow r = 10$ cm
Therefore, the radius of the base of cone is 10 cm.

11. (i) A grouped frequency distribution table has to be constructed taking class intervals 160 − 165, 165 − 170, etc. By observing the data given above, the required table can be constructed as follows.

| **Height (in cm)** | **Number of students (frequency )** |
|---|---|
| 150 − 155 | 12 |
| 155 − 160 | 9 |

| | |
|---|---|
| 160− 165 | 14 |
| 165 − 170 | 10 |
| 170 − 175 | 5 |
| Total | 50 |

(ii) It can be concluded that more than 50% of the students are shorter than 165 cm.

12. Total number of students = 135 + 65 = 200

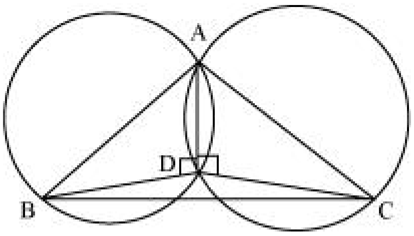
(i) Number of students liking statistics = 135

$$P(\text{students liking statistics}) = \frac{135}{200} = \frac{27}{40}$$

(ii) Number of students who do not like statistics = 65

$$P(\text{students not liking statistics}) = \frac{65}{200} = \frac{13}{40}$$

13.




Consider a ΔABC.

Two circles are drawn while taking AB and AC as the diameter.

Let they intersect each other at D and let D not lie on BC.

Join AD.

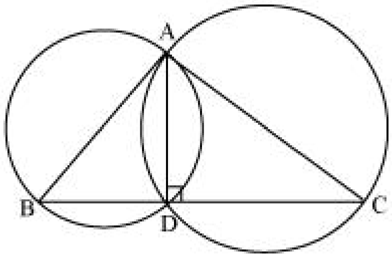
∠ADB = 90° (Angle subtended by semi-circle)

∠ADC = 90° (Angle subtended by semi-circle)

∠BDC = ∠ADB + ∠ADC = 90° + 90° = 180°

Therefore, BDC is a straight line and hence, our assumption was wrong.

Thus, Point D lies on third side BC of ΔABC.



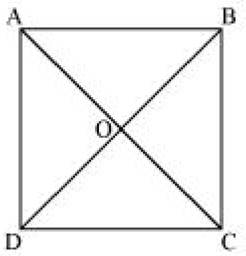

14. (i) Our class intervals will be 0 − 5, 5 − 10, 10 −15…..
The grouped frequency distribution table can be constructed as follows.

| **Hours** | **Number of children** |
|---|---|
| 0 − 5 | 10 |
| 5 − 10 | 13 |
| 10 − 15 | 5 |
| 15 − 20 | 2 |
| Total | 30 |

(ii) The number of children who watched TV for 15 or more hours a week is 2 (i.e., the number of children in class interval 15 − 20).

15. It can be observed that point (2, 14) satisfies the equation $7x - y = 0$ and $x - y + 12 = 0$.
Therefore, $7x - y = 0$ and $x - y + 12 = 0$ are two lines passing through point (2, 14).
As it is known that through one point, infinite number of lines can pass through, therefore, there are infinite lines of such type passing through the given point.

16.



Let ABCD be a square. Let the diagonals AC and BD intersect each other at a point O. To prove that the diagonals of a square are equal and bisect each other at right angles, we have to prove AC = BD, OA = OC, OB = OD, and ∠AOB = 90º.

In ΔABC and ΔDCB,

AB = DC (Sides of a square are equal to each other)

∠ABC = ∠DCB (All interior angles are of 90°)

BC = CB (Common side)

∴ ΔABC ≅ ΔDCB (By SAS congruency)

∴ AC = DB (By CPCT)

Hence, the diagonals of a square are equal in length.

In ΔAOB and ΔCOD,

∠AOB = ∠COD (Vertically opposite angles)

∠ABO = ∠CDO (Alternate interior angles)

AB = CD (Sides of a square are always equal)

∴ ΔAOB ≅ ΔCOD (By AAS congruence rule)

∴ AO = CO and OB = OD (By CPCT)

Hence, the diagonals of a square bisect each other.

In ΔAOB and ΔCOB,

As we had proved that diagonals bisect each other, therefore,

AO = CO

AB = CB (Sides of a square are equal)

BO = BO (Common)

∴ ΔAOB ≅ ΔCOB (By SSS congruency)

∴ ∠AOB = ∠COB (By CPCT)

However, ∠AOB + ∠COB = 180º (Linear pair)

2∠AOB = 180º

∠AOB = 90º

Hence, the diagonals of a square bisect each other at right angles.

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

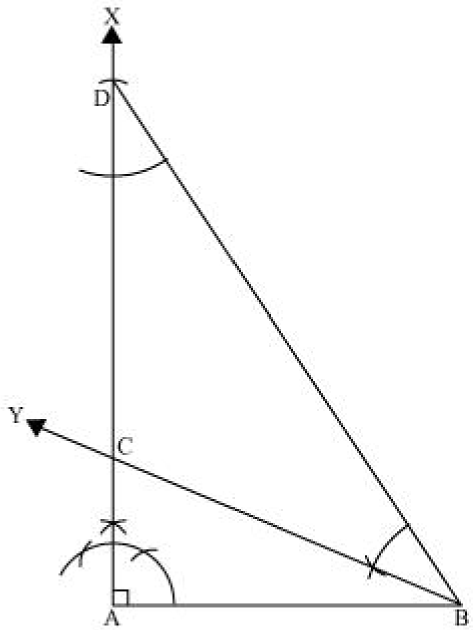
Step I: Draw line segment AB of 12 cm. Draw a ray AX making 90° with AB.

Step II: Cut a line segment AD of 18 cm (as the sum of the other two sides is 18) from ray AX.

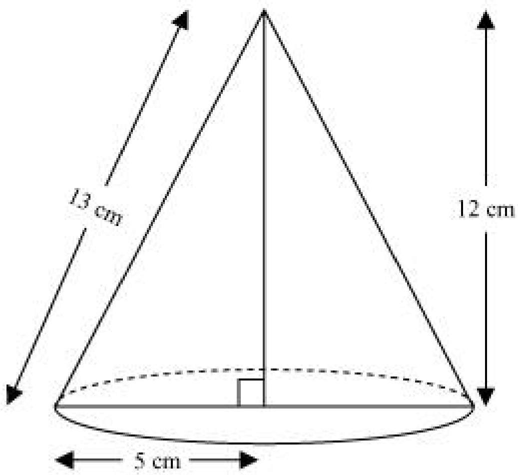
Step III: Join DB and make an angle DBY equal to ADB.

Step IV: Let BY intersect AX at C. Join AC, BC.

ΔABC is the required triangle.




18.




When right-angled ΔABC is revolved about its side 12 cm, a cone with height (*h*) as 12 cm, radius (*r*) as 5 cm, and slant height (*l*) 13 cm will be formed.

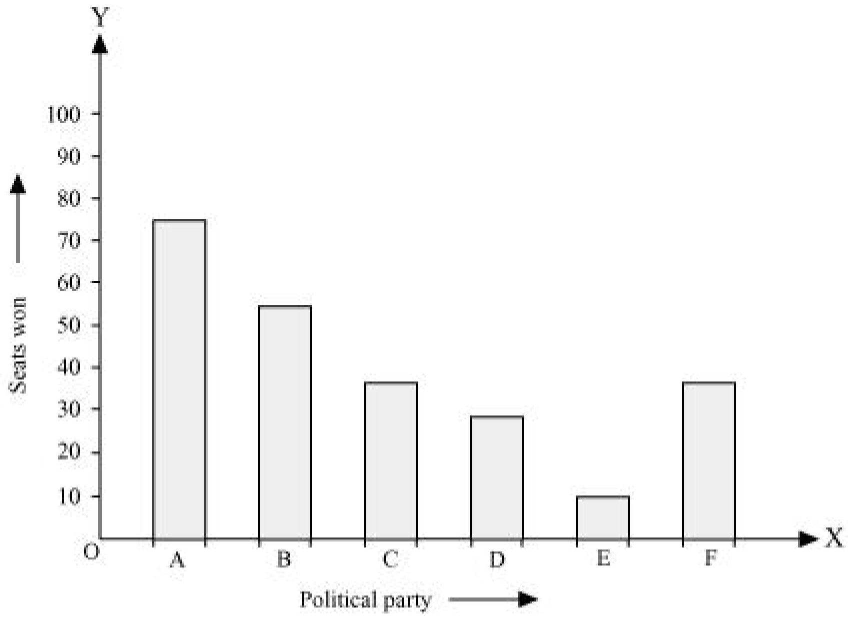
Volume of cone $= \frac{1}{3}\pi r^2 h$

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

= 100π cm$^3$

Therefore, the volume of the cone so formed is 100π cm$^3$.

19. (i) By taking polling results on $x$-axis and seats won as $y$-axis and choosing an appropriate scale (1 unit = 10 seats for $y$-axis), the required graph of the above information can be constructed as follows.




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

(ii) Political party 'A' won maximum number of seats.

20. Putting $x = 3$ and $y = 4$ in the given equation,

$3y = ax + 7$

$3\ (4) = a\ (3) + 7$

$5 = 3a$

$$a = \frac{5}{3}$$

21. (i) Radius ($r$) of ball = $\left(\frac{28}{2}\right)$ cm = 14 cm

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

$$= \left[\frac{4}{3} \times \frac{22}{7} \times (14)^3\right] \text{ cm}^3$$

$$= 11498\frac{2}{3} \text{ cm}^3$$

Therefore, the volume of the sphere is $11498\frac{2}{3}$ $\text{cm}^3$.

(ii)Radius ($r$) of ball = $\left(\frac{0.21}{2}\right)$ m = 0.105 m

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

$= \left[\frac{4}{3} \times \frac{22}{7} \times (0.105)^3\right] \text{ m}^3$

$= 0.004851 \text{ m}^3$

Therefore, the volume of the sphere is 0.004851 $m^3$.

22. (i) It is given that AB = DE and AB || DE.

If two opposite sides of a quadrilateral are equal and parallel to each other, then it will be a parallelogram.

Therefore, quadrilateral ABED is a parallelogram.

(ii) Again, BC = EF and BC || EF

Therefore, quadrilateral BCEF is a parallelogram.

(iii) As we had observed that ABED and BEFC are parallelograms, therefore

AD = BE and AD || BE

(Opposite sides of a parallelogram are equal and parallel)

And, BE = CF and BE || CF

(Opposite sides of a parallelogram are equal and parallel)

∴ AD = CF and AD || CF

(iv) As we had observed that one pair of opposite sides (AD and CF) of quadrilateral ACFD are equal and parallel to each other, therefore, it is a parallelogram.

(v) As ACFD is a parallelogram, therefore, the pair of opposite sides will be equal and parallel to each other.

∴ AC || DF and AC = DF

(vi) ΔABC and ΔDEF,

AB = DE (Given)

BC = EF (Given)

AC = DF (ACFD is a parallelogram)

∴ ΔABC ≅ ΔDEF (By SSS congruence rule)

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. It can be observed that the class intervals of the given data are not continuous. There is a gap of 1 in between them. Therefore, $\frac{1}{2} = 0.5$ has to be added to the upper class limits and 0.5 has to be subtracted from the lower class limits.

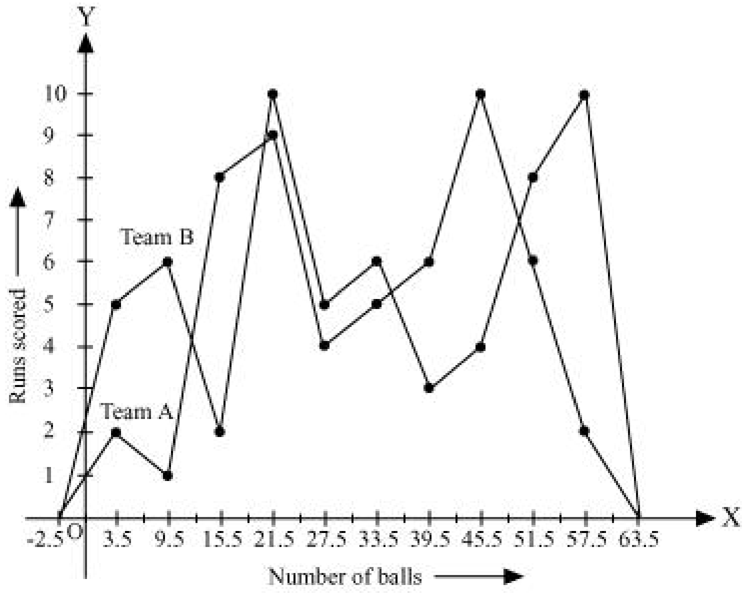
Also, class mark of each interval can be found by using the following formula.

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

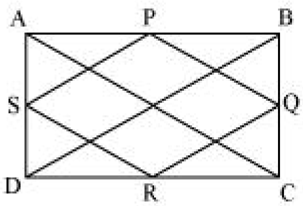
Continuous data with class mark of each class interval can be represented as follows.

| Number of balls | Class mark | Team A | Team B |
|---|---|---|---|
| 0.5 − 6.5 | 3.5 | 2 | 5 |
| 6.5 − 12.5 | 9.5 | 1 | 6 |
| 12.5 − 18.5 | 15.5 | 8 | 2 |
| 18.5 − 24.5 | 21.5 | 9 | 10 |
| 24.5 − 30.5 | 27.5 | 4 | 5 |
| 30.5 − 36.5 | 33.5 | 5 | 6 |
| 36.5 − 42.5 | 39.5 | 6 | 3 |
| 42.5 − 48.5 | 45.5 | 10 | 4 |
| 48.5 − 54.5 | 51.5 | 6 | 8 |
| 54.5 − 60.5 | 57.5 | 2 | 10 |

By taking class marks on *x*-axis and runs scored on *y*-axis, a frequency polygon can be constructed as follows.




25.




Let us join AC and BD.

In ΔABC,

P and Q are the mid-points of AB and BC respectively.

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

Similarly in ΔADC,

SR || AC and SR = $\frac{1}{2}$ AC (Mid-point theorem) ... (2)

Clearly, PQ || SR and PQ = SR

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

∴ PS || QR and PS = QR (Opposite sides of parallelogram)... (3)

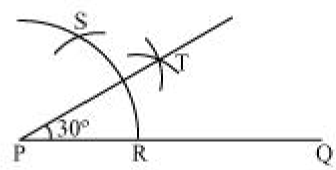
In ΔBCD, Q and R are the mid-points of side BC and CD respectively.

∴ QR || BD and QR = $\frac{1}{2}$ BD (Mid-point theorem) ... (4)

However, the diagonals of a rectangle are equal.

∴ AC = BD …(5)
By using equation (1), (2), (3), (4), and (5), we obtain
PQ = QR = SR = PS
Therefore, PQRS is a rhombus.

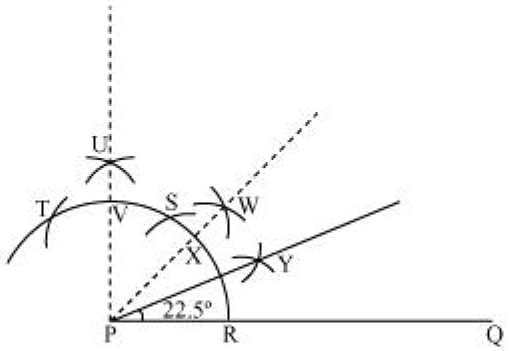
26. (i)30°
The below given steps will be followed to construct an angle of 30°.
Step I: Draw the given ray PQ. Taking P as centre and with some radius, draw an arc of a circle which intersects PQ at R.
Step II: Taking R as centre and with the same radius as before, draw an arc intersecting the previously drawn arc at point S.
Step III: Taking R and S as centre and with radius more than $\frac{1}{2}$RS, draw arcs to intersect each other at T. Join PT which is the required ray making 30° with the given ray PQ.




(ii) $22\frac{1}{2}^\circ$

The below given steps will be followed to construct an angle of $22\frac{1}{2}^\circ$.
(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 point V.
(6) From R and V, draw arcs with radius more than $\frac{1}{2}$ RV to intersect each other at W. Join PW.
(7) Let it intersect the arc at X. Taking X and R as centre and radius more than $\frac{1}{2}$ RX, draw arcs to intersect each other at Y.

Joint PY which is the required ray making $22\frac{1}{2}°$ with the given ray PQ.




(iii) 15°

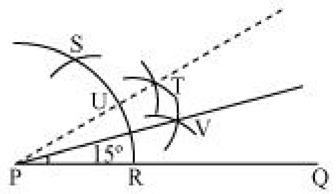
The below given steps will be followed to construct an angle of 15°.

Step I: Draw the given ray PQ. Taking P as centre and with some radius, draw an arc of a circle which intersects PQ at R.

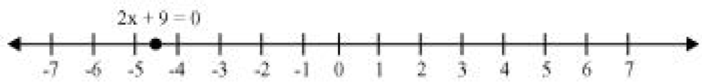
Step II: Taking R as centre and with the same radius as before, draw an arc intersecting the previously drawn arc at point S.

Step III: Taking R and S as centre and with radius more than $\frac{1}{2}$ RS, draw arcs to intersect each other at T. Join PT.

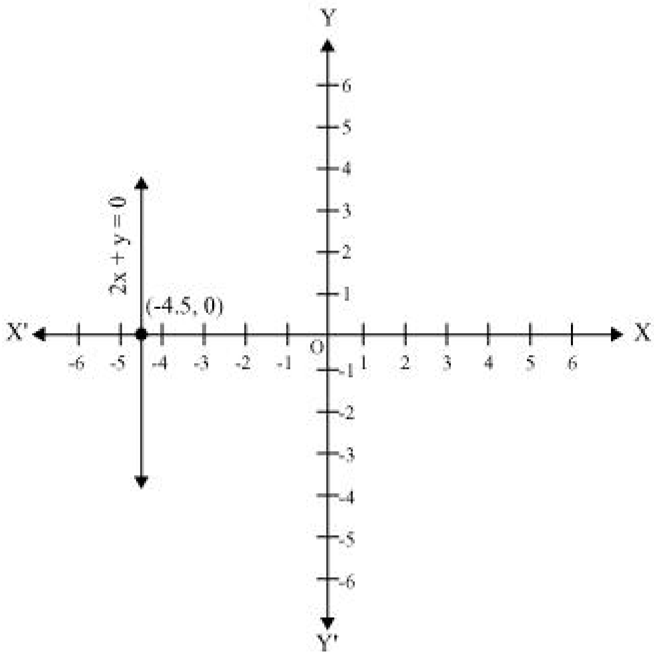
Step IV: Let it intersect the arc at U. Taking U and R as centre and with radius more than $\frac{1}{2}$ RU, draw an arc to intersect each other at V. Join PV which is the required ray making 15° with the given ray PQ.




27. (1) In one variable, $2x + 9 = 0$ represents a point $x = \frac{-9}{2} = -4.5$ as shown in the following figure.



(2) In two variables, $2x + 9 = 0$ represents a straight line passing through point (−4.5, 0) and parallel to $y$-axis. It is a collection of all points of the plane, having their $x$-coordinate as 4.5.




28. Inner radius ($r_1$) of hemispherical tank = 1 m
Thickness of hemispherical tank = 1 cm = 0.01 m
Outer radius ($r_2$) of hemispherical tank = (1 + 0.01) m = 1.01 m

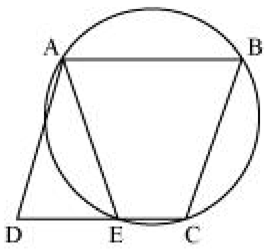
Volume of iron used to make such a tank $= \frac{2}{3}\pi\left(r_2^3 - r_1^3\right)$

$$= \left[\frac{2}{3} \times \frac{22}{7} \times \left\{(1.01)^3 - (1)^3\right\}\right] \text{m}^3$$

$$= \left[\frac{44}{21} \times (1.030301 - 1)\right] \text{m}^3$$

$$= 0.06348 \text{ m}^3 \quad \text{(approximately)}$$

29.



It can be observed that ABCE is a cyclic quadrilateral and in a cyclic quadrilateral, the sum of the opposite angles is 180°.

∠AEC + ∠CBA = 180°

∠AEC + ∠AED = 180° (Linear pair)

∠AED = ∠CBA ... (1)

For a parallelogram, opposite angles are equal.

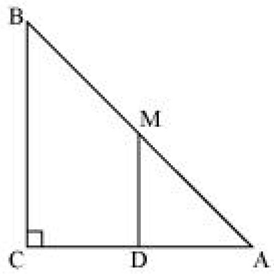
∠ADE = ∠CBA ... (2)

From (1) and (2),

∠AED = ∠ADE

AD = AE (Angles opposite to equal sides of a triangle)

30.




(i) In ΔABC,

It is given that M is the mid-point of AB and MD || BC.

Therefore, D is the mid-point of AC. (Converse of mid-point theorem)

(ii) As DM || CB and AC is a transversal line for them, therefore,

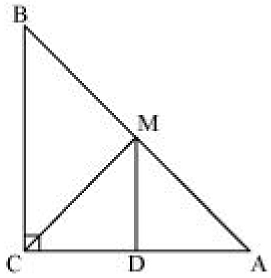
∠MDC + ∠DCB = 180º (Co-interior angles)

∠MDC + 90º = 180º

∠MDC = 90º

∴ MD ⊥ AC

(iii) Join MC.




In ΔAMD and ΔCMD,

AD = CD (D is the mid-point of side AC)

∠ADM = ∠CDM (Each 90º)

DM = DM (Common)

∴ΔAMD ≅ ΔCMD (By SAS congruence rule)

Therefore, AM = CM (By CPCT)

However, AM = $\frac{1}{2}$ AB (M is the mid-point of AB)

Therefore, it can be said that

CM = AM = $\frac{1}{2}$ AB

31. The marks of 15 students in mathematics test are

41, 39, 48, 52, 46, 62, 54, 40, 96, 52, 98, 40, 42, 52, 60

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

$$= \frac{41+39+48+52+46+62+54+40+96+52+98+40+42+52+60}{15}$$

$$= \frac{822}{15} = 54.8$$

Arranging the scores obtained by 15 students in an ascending order,

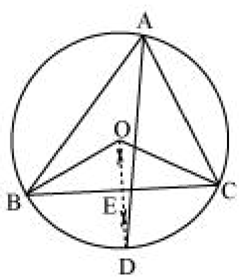
39, 40, 40, 41, 42, 46, 48, 52, 52, 52, 54, 60, 62, 96, 98

As the number of observations is 15 which is odd, therefore, the median of data will be $\frac{15+1}{2}$ = $8^{th}$ observation whether the data is arranged in an ascending or descending order.

Therefore, median score of data = 52

Mode of data is the observation with the maximum frequency in data. Therefore, mode of this data is 52 having the highest frequency in data as 3.

32.




Let perpendicular bisector of side BC and angle bisector of ∠A meet at point D. Let the perpendicular bisector of side BC intersect it at E.

Perpendicular bisector of side BC will pass through circumcentre O of the circle. ∠BOC and ∠BAC are the angles subtended by arc BC at the centre and a point A on the remaining part of the circle respectively. We also know that the angle subtended by an arc at the centre is double the angle subtended by it at any point on the remaining part of the circle.

∠BOC = 2 ∠BAC = 2 ∠A ... (1)

In ΔBOE and ΔCOE,

OE = OE (Common)

OB = OC (Radii of same circle)

∠OEB = ∠OEC (Each 90° as OD ⊥ BC)

∴ ΔBOE ≅ ∠COE (RHS congruence rule)

∠BOE = ∠COE (By CPCT) ... (2)

However, ∠BOE + ∠COE = ∠BOC

⇒ ∠BOE +∠BOE = 2 ∠A [Using equations (1) and (2)]

⇒ 2 ∠BOE = 2 ∠A

⇒ ∠BOE = ∠A

∴ ∠BOE = ∠COE = ∠A

The perpendicular bisector of side BC and angle bisector of ∠A meet at point D.

∴ ∠BOD = ∠BOE = ∠A ... (3)

Since AD is the bisector of angle ∠A,

∠BAD = $\frac{\angle A}{2}$

⇒ 2 ∠BAD = ∠A ... (4)

From equations (3) and (4), we obtain

∠BOD = 2 ∠BAD

This can be possible only when point BD will be a chord of the circle. For this, the point D lies on the circum circle.

Therefore, the perpendicular bisector of side BC and the angle bisector of ∠A meet on the circum circle of triangle ABC.

33. Radius ($r$) of capsule $= \left(\frac{3.5}{2}\right) \text{ mm} = 1.75 \text{ mm}$

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

$= \left[\frac{4}{3}\times\frac{22}{7}\times(1.75)^3\right] \text{ mm}^3$

$= 22.458\ mm^3$
$= 22.46\ mm^3$ (approximately)
Therefore, the volume of the spherical capsule is $22.46\ mm^3$.

34. When any data has a few observations such that these are very far from the other observations in it, it is better to calculate the median than the mean of the data as median gives a better estimate of average in this case.
(i) Consider the following example − the following data represents the heights of the members of a family.
154.9 cm, 162.8 cm, 170.6 cm, 158.8 cm, 163.3 cm, 166.8 cm, 160.2 cm
In this case, it can be observed that the observations in the given data are close to each other. Therefore, mean will be calculated as an appropriate measure of central tendency.
(ii) The following data represents the marks obtained by 12 students in a test.
48, 59, 46, 52, 54, 46, 97, 42, 49, 58, 60, 99
In this case, it can be observed that there are some observations which are very far from other observations. Therefore, here, median will be calculated as an appropriate measure of central tendency.