SET-I

DESIGN OF THE QUESTION PAPER

MATHEMATICS – CLASS IX

Time : 3 Hours **Maximum Marks : 80**

The weightage or the distribution of marks over different dimensions of the question paper shall be as follows:

1. Weightage to Content/ Subject Units

S.No.	Units	Marks
1.	Number Systems	06
2.	Algebra	20
3.	Coordinate Geometry	06
4.	Geometry	22
5.	Mensuration	14
6.	Statistics and Probability	12

2. Weightage to Forms of Questions

S.No.	Forms of Questions	Marks for each Question	Number of Questions	Total Marks
1.	MCQ	01	10	10
2.	SAR	02	05	10
3.	SA	03	10	30
4.	LA	06	05	30
		Total	**30**	**80**

3. Scheme of Options

All questions are compulsory, i.e., there is no overall choice. However, internal choices are provided in two questions of 3 marks each and 1 question of 6 marks.

4. Weightage to Difficulty level of Questions

S.No.	Estimated Difficulty Level of Questions	Percentage of Marks
1.	Easy	20
2.	Average	60
3.	Difficult	20

Note

A question may vary in difficulty level from individual to individual. As such, the assessment in respect of each question will be made by the paper setter/ teacher on the basis of general anticipation from the groups as whole taking the examination. This provision is only to make the paper balanced in its weight, rather to determine the pattern of marking at any stage.

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Forms of Questions → Content Units ↓	MCQ	SAR	SA	LA	Total
NUMBER SYSTEMS	1 (1)	2 (1)	3 (1)	–	6 (3)
ALGEBRA Polynomials, Linear Equations in Two Variables	1 (1)	4 (2)	9 (3)	6 (1)	20 (7)
COORDINATE GEOMETRY	1 (1)	2 (1)	3 (1)	–	6 (3)
GEOMETRY Introduction to Euclid's Geometry, Lines and Angles, Triangles, Quadrilaterals, Areas, Circles, Constructions	4 (4)	–	6 (2)	12 (2)	22 (8)
MENSURATION Areas, Surface areas and Volumes	2 (2)	–	6 (2)	6 (1)	14 (5)
STATISTICS AND PROBABILITY Statistics, Probability	1 (1)	2 (1)	3 (1)	6 (1)	12 (4)
Total	**10 (10)**	**10 (05)**	**30 (10)**	**30 (05)**	**80 (30)**

SUMMARY

Multiple Choice Questions (MCQ)	Number of Questions: 10	Marks: 10
Short Answer with Reasoning (SAR)	Number of Questions: 05	Marks: 10
Short Answer (SA)	Number of Questions: 10	Marks: 30
Long Answer (LA)	Number of Questions: 05	Marks: 30
Total	**30**	**80**

MATHEMATICS
CLASS IX

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

General Instructions

1. All questions are compulsory.

2. The question paper consists of four sections A, B, C and D. Section A has 10 questions of 1 mark each, section B has 5 questions of 2 marks each, section C has 10 questions of 3 marks each and section D is of 5 questions of 6 marks each.

3. There is no overall choice. However internal choices are provided in 2 questions of 3 marks each and 1 question of 6 marks.

4. Construction should be drawn neatly and exactly as per the given measurements.

5. Use of calculators is not allowed.

SECTION A

In Questions 1 to 10, four options of answer are given in each, out of which only one is correct. Write the correct option.

1. Every rational number is:

(A) a natural number (B) an integer
(C) a real number (D) a whole number

2. The distance of point (2, 4) from x-axis is

(A) 2 units (B) 4 units (C) 6 units (D) $\sqrt{2^2+4^2}$ units

3. The degree of the polynomial $(x^3 + 7)(3 - x^2)$ is:

(A) 5 (B) 3
(C) 2 (D) –5

4. In Fig. 1, according to Euclid's 5th postulate, the pair of angles, having the sum less than 180° is:

(A) 1 and 2 (B) 2 and 4
(C) 1 and 3 (D) 3 and 4

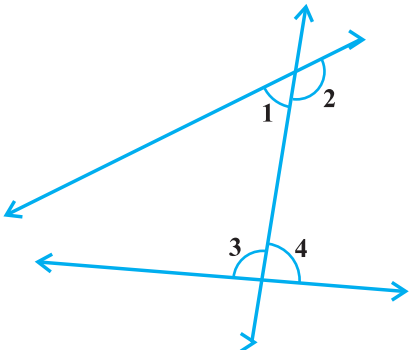


Fig. 1

5. The length of the chord which is at a distance of 12 cm from the centre of a circle of radius 13cm is:

(A) 5 cm (B) 12 cm
(C) 13 cm (D) 10 cm

6. If the volume of a sphere is numerically equal to its surface area, then its diameter is:

(A) 2 units (B) 1 units (C) 3 units (D) 6 units

7. Two sides of a triangle are 5 cm and 13 cm and its perimeter is 30 cm. The area of the triangle is:

(A) 30 cm^2 (B) 60 cm^2 (C) 32.5 cm^2 (D) 65 cm^2

8. Which of the following cannot be the empiral probability of an event.

(A) $\frac{2}{3}$ (B) $\frac{3}{2}$ (C) 0 (D) 1

9. In Fig. 2, if $l \parallel m$, then the value of x is:

(A) 60 (B) 80

(C) 40 (D) 140

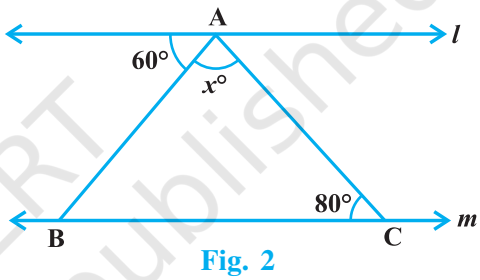


Fig. 2

10. The diagonals of a parallelogram :

(A) are equal

(B) bisect each other

(C) are perpendicular to each other

(D) bisect each other at right angles.

SECTION B

11. Is – 5 a rational number? Give reasons to your answer.

12. Without actually finding $p(5)$, find whether $(x–5)$ is a factor of $p(x) = x^3 – 7x^2 + 16x – 12$. Justify your answer.

13. Is (1, 8) the only solution of $y = 3x + 5$? Give reasons.

14. Write the coordinates of a point on x-axis at a distance of 4 units from origin in the positive direction of x-axis and then justify your answer.

15. Two coins are tossed simultaneously 500 times. If we get two heads 100 times, one head 270 times and no head 130 times, then find the probability of getting one or more than one head. Give reasons to your answer also.

SECTION C

16. Simplify the following expression

$$\left(\sqrt{3}+1\right)\left(1-\sqrt{12}\right)+\frac{9}{\sqrt{3}+\sqrt{12}}$$

OR

Express $0.12\overline{3}$ in the form of $\frac{p}{q}, q \neq 0$, p and q are integers.

17. Verify that:

$$x^3 + y^3 + z^3 - 3xyz = \frac{1}{2}(x+y+z)\left[(x-y)^2 + (y-z)^2 + (z-x)^2\right]$$

18. Find the value of k, if $(x-2)$ is a factor of $4x^3 + 3x^2 - 4x + k$.

19. Write the quadrant in which each of the following points lie :

(i) (–3, –5)

(ii) (2, –5)

(iii) (–3, 5)

Also, verify by locating them on the cartesian plane.

20. In Figure 3, ABC and ABD are two triangles on the same base AB. If the line segment CD is bisected by AB at O, then show that:

area (Δ ABC) = area (Δ ABD)

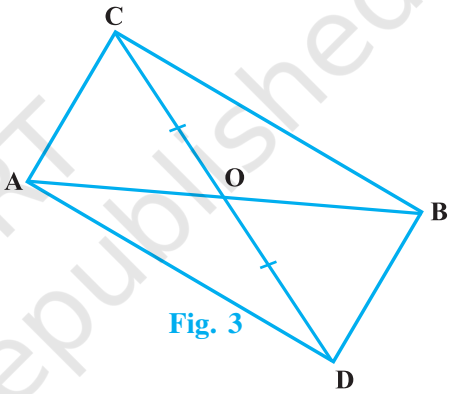


Fig. 3

21. Solve the equation $3x + 2 = 2x - 2$ and represent the solution on the cartesian plane.

22. Construct a right triangle whose base is 12 cm and the difference in lengths of its hypotenuse and the other side is 8cm. Also give justification of the steps of construction.

23. In a quadrilateral ABCD, AB = 9 cm, BC = 12 cm, CD = 5 cm, AD = 8 cm and $\angle C = 90°$. Find the area of ΔABD

24. In a hot water heating system, there is a cylindrical pipe of length 35 m and diameter 10 cm. Find the total radiating surface in the system.

OR

The floor of a rectangular hall has a perimeter 150 m. If the cost of painting the four walls at the rate of Rs 10 per m^2 is Rs 9000, find the height of the hall.

25. Three coins are tossed simultaneously 200 times with the following frequencies of different outcomes:

Outcome	3 tails	2 tails	1 tail	no tail
Frequency	20	68	82	30

If the three coins are simultaneously tossed again, compute the probability of getting less than 3 tails.

SECTION D

26. The taxi fair in a city is as follows:

For the first kilometer, the fare is Rs 10 and for the subsequent distance it is Rs 6 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.

From the graph, find the fare for travelling a distance of 4 km.

27. Prove that the angles opposite to equal sides of an isosceles triangle are equal.

Using the above, find $\angle$ B in a right triangle ABC, right angled at A with AB = AC.

28. Prove 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.

Using the above result, find x in figure 4 where O is the centre of the circle.

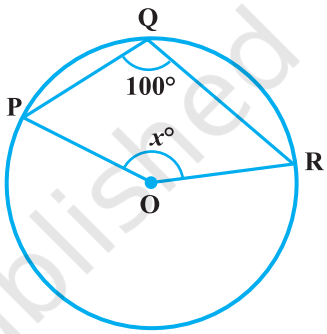


Fig. 4

29. A heap of wheat is in the form of a cone whose diameter is 48 m and height is 7 m. Find its volume. If the heap is to be covered by canvas to protect it from rain, find the area of the canvas required.

OR

A dome of a building is in the form of a hollow hemisphere. From inside, it was white-washed at the cost of Rs 498.96. If the rate of white washing is Rs 2.00 per square meter, find the volume of air inside the dome.

30. The following table gives the life times of 400 neon lamps:

Life time (in hours)	300-400	400-500	500-600	600-700	700-800	800-900	900-1000
Number of Lamps	14	56	60	86	74	62	48

(i) Represent the given information with the help of a histogram.
(ii) How many lamps have a lifetime of less than 600 hours?

Marking Scheme

MATHEMATICS – CLASS IX

SECTION A

MARKS

1. (C) **2.** (B) **3.** (A) **4.** (C) **5.** (D)

6. (D) **7.** (A) **8.** (B) **9.** (C) **10.** (B)

$(1 \times 10 = 10)$

SECTION B

11. Yes, $(\frac{1}{2})$

since $-5 = \frac{-5}{1}$ and –5, 1 are integers and $1 \neq 0$. $(1\frac{1}{2})$

12. $(x - 5)$ is not a factor of $p(x)$, $(\frac{1}{2})$

since, 5 is not a factor of –12 $(1\frac{1}{2})$

13. No, $(\frac{1}{2})$

since, $y = 3x + 5$ have many solutions like (–1, 2), (2, 11) etc. $(1\frac{1}{2})$

14. (4, 0) $(\frac{1}{2})$

since, any point on x-axis have coordinates $(x, 0)$, where x is the distance from origin. $(1\frac{1}{2})$

15. $p = \frac{37}{50}$ $(\frac{1}{2})$

Since, frequency of one or more than one head = 100 + 270 = 370

Therefore, P(one or more Heads) $= \frac{370}{500} = \frac{37}{50}$ $(1\frac{1}{2})$

SECTION C

16. $\left(\sqrt{3}+1\right)\left(1-\sqrt{12}\right)+\frac{9}{\sqrt{3}+\sqrt{12}}$

$=\left(\sqrt{3}-\sqrt{36}+1-\sqrt{12}\right)+\frac{9}{\sqrt{12}+\sqrt{3}}\cdot\frac{\sqrt{12}-\sqrt{3}}{\sqrt{12}-\sqrt{3}}$ (1)

$=\left(\sqrt{3}-5-\sqrt{12}\right)+\frac{9\left(\sqrt{12}-\sqrt{3}\right)}{(12-3)}$ (1)

$=\left(\sqrt{3}-5-\sqrt{12}\right)+\left(\sqrt{12}-\sqrt{3}\right)=-5$. (1)

OR

Let $x=0.12\overline{3}=0.123333...$

Therefore, $100x=12.\overline{3}$ (1)

and $1000x=123.\overline{3}$ $(\frac{1}{2})$

Therefore, $900x=111$, i.e., $x=\frac{111}{900}$ $(1\frac{1}{2})$

17. LHS = $x^3+y^3+z^3-3xyz$

$=(x+y+z)\left(x^2+y^2+z^2-xy-yz-xz\right)$ (1)

$=\frac{1}{2}(x+y+z)\left(2x^2+2y^2+2z^2-2xy-2yz-2xz\right)$ $(\frac{1}{2})$

$=\frac{1}{2}(x+y+z)\left[\left(x^2+y^2-2xy\right)+\left(x^2+z^2-2xy\right)+\left(y^2+z^2-2xz\right)\right]$ (1)

$=\frac{1}{2}(x+y+z)\left[(x-y)^2+(z-x)^2+(y-z)^2\right]$ $(\frac{1}{2})$

18. When $(x-2)$ is a factor of $p(x)=4x^3+3x^2-4x+k$, then $p(2)=0$ (1)

Therefore, $4(2)^3+3(2)^2-4(2)+k=0$ (1)

or $32+12-8+k=0$, i.e., $k=-36$ (1)

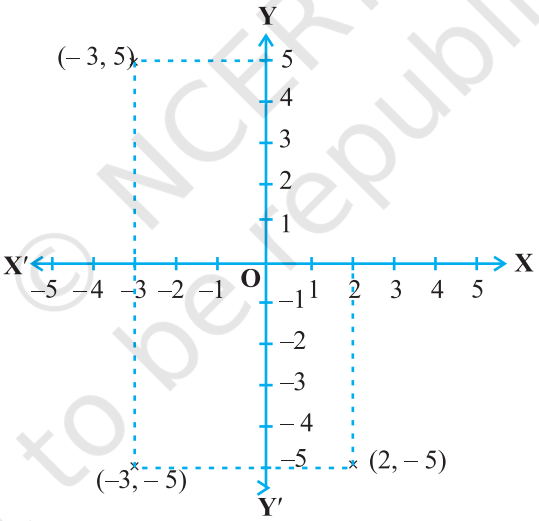
19. $(-3,-5)$ lies in 3rd Quadrant

$(2,-5)$ lies in 4th Quadrant

$(-3,5)$ lies in 2nd Quadrant $(\frac{1}{2}\times 3=1\frac{1}{2})$

For correctly

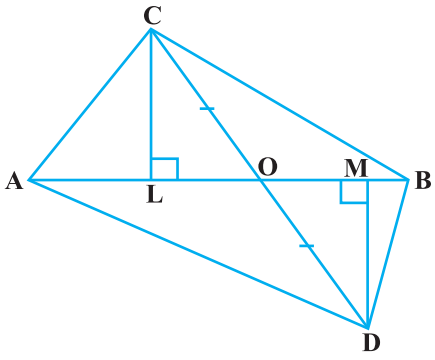
locating the points $(\frac{1}{2}\times 3=1\frac{1}{2})$



20. Draw $CL\perp AB$ and $DM\perp AB$ $(\frac{1}{2})$

$\Delta COL\cong\Delta DOM$ (AAS) $(\frac{1}{2})$

Therefore, CL = DM $(\frac{1}{2})$



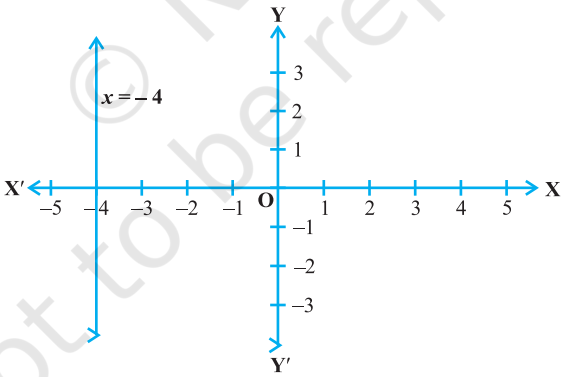
Therefore, Area (Δ ABC) = $\frac{1}{2}$AB · CL ($\frac{1}{2}$)

= $\frac{1}{2}$AB · DM ($\frac{1}{2}$)

= Area (Δ ABD) ($\frac{1}{2}$)

21. $3x + 2 = 2x - 2$

i.e., $3x - 2x = -2 - 2$, i.e., $x = -4$ (1)

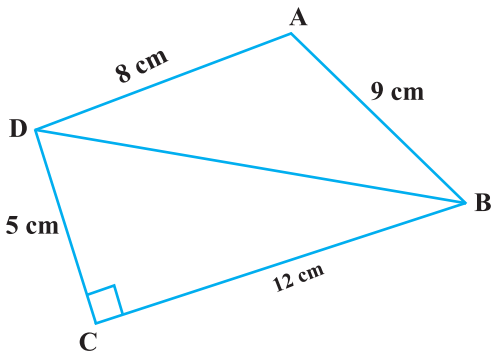


(2)

22. For correct geometrical construction (2)

For Justification (1)

23. Getting BD = $\sqrt{12^2 + 5^2} = 13$ cm (1)



$S = \frac{13+9+8}{2} = 15 \text{ cm}$ $(\frac{1}{2})$

$\Delta ABD = \sqrt{(15)(15-13)(15-8)(15-9)}$

$= \sqrt{840} = 28.98 \text{ cm}^2$

$= 29 \text{ cm}^2$ (approx) $(1\frac{1}{2})$

24. Radiating surface = curved surface of cylinder $(\frac{1}{2})$

$= 2\pi rh$ $(\frac{1}{2})$

$= 2 \cdot \frac{22}{7} \cdot \frac{5}{100} 35 \text{ m}^2$ $(1\frac{1}{2})$

$= 11 \text{ m}^2$ $(\frac{1}{2})$

OR

If l, b represent the length, breadth of the hall, respectively,

then $2(l+b) = 150$ m $(\frac{1}{2})$

Area of four walls = $2(l+b)h$, where h is the height (1)

Therefore, $2(l+b)h \cdot 10 = 9000$ $(\frac{1}{2})$

or $(150)h(10) = 9000$, i.e., $h = 6$ m

Therefore, height of the hall = 6 m (1)

25. Total number of trials = 200 $(\frac{1}{2})$

Frequency of the outcomes, less than 3 trials,
= 68 + 82 +30 = 180 (1)

Therefore, required probability = $\frac{180}{200} = \frac{9}{10}$ $(1\frac{1}{2})$

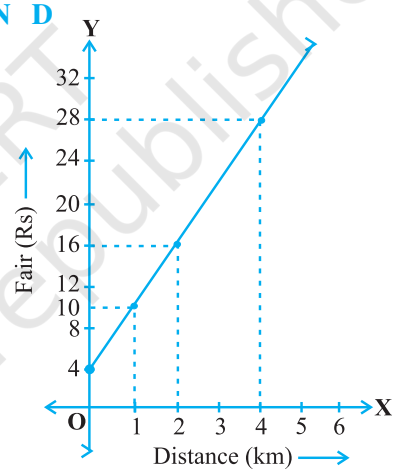
SECTION D

26. Let the distance covered be x km and total fare for x km = Rs y

Therefore, $10 + 6(x - 1) = y$ (2)

or $6x - y + 4 = 0$ (1)

x	0	1	2
y	4	10	16



(2)

From the graph, when $x = 4$, $y = 28$
Therefore, fare is Rs 28 for a distance of 4 km. (1)

27. For correct given, to prove, construction and figure $(\frac{1}{2} \times 4 = 2)$

For correct proof (2)

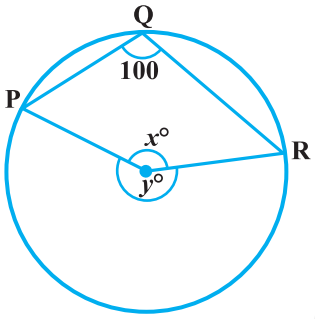
Since, $\angle B = 90°$, therefore, $\angle A + \angle C = 90°$ $(\frac{1}{2})$

AB = AC gives $\angle A = \angle C$ (1)

Therefore, $\angle A = \angle C = 45°$ $(\frac{1}{2})$

28. For correct given, to prove, construction and figure $(\frac{1}{2} \times 4 = 2)$

For correct proof (2)



Since $\angle PQR = 100°$

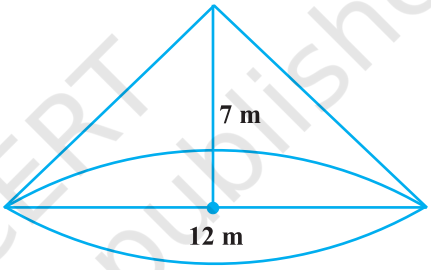
Therefore, $\angle y = 200°$ (1)

Since $\angle x + \angle y = 360°$ $(\frac{1}{2})$

Therefore, $\angle x = 360° - 200° = 160°$ $(\frac{1}{2})$

29. Radius of conical heap = 24 m

Height = 7 m



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

$= \frac{1}{3} \cdot \frac{22}{7} \cdot 24.24.7\ m^3$ $(1\frac{1}{2})$

$= 4224\ m^3$

Area of canvas = curved surface area of cone $= \pi rl$ $(\frac{1}{2})$

where $l = \sqrt{r^2 + h^2} = \sqrt{24^2 + 7^2} = \sqrt{625} = 25\,m$ (1)

Therefore, Area $= \frac{22}{7} \times 24 \times 25 = 1885.7\ m^2$ (2)

OR

Total cost = Rs 498.96, rate = Rs 2 per m^2

Therefore, Area $= \frac{498.96}{2} = 249.48\ m^2$ (1 + 1 = 2)

If r is the radius, then,

$2\pi r^2 = 249.47$, i.e., $r^2 = 249.48 \times \frac{1}{2} \times \frac{7}{22}$ (1)

i.e., $r^2 = \frac{567 \times 7}{100}$ which gives $r = 6.3$ m (1)

Therefore, volume of dome = $\frac{2}{3}\pi r^3 = \frac{2}{3} \cdot \frac{22}{7} \cdot \left(\frac{63}{10}\right)^3$ (1)

= 523.91 m^3 (1)

30. For correctly making the histogram (4)

No. of lamps having life time less than 600

= 14 + 56 + 60 = 130 (2)