Future Topper

Annual Examination Practice Paper 1

Class IX Mathematics (041)

Time allowed: 3 hours Maximum marks: 80

Syllabus covered: the full current CBSE Class IX Mathematics curriculum. Unit weightage follows CBSE: Number System 7, Algebra 20, Coordinate Geometry 4, Geometry 25, Mensuration 14, Statistics and Probability 10.

General instructions

1. This paper has 38 questions in five sections, A to E. All questions are compulsory.
2. Section A: questions 1 to 20 carry 1 mark each (18 multiple-choice and 2 assertion-reason).
3. Section B: questions 21 to 25 carry 2 marks each.
4. Section C: questions 26 to 31 carry 3 marks each.
5. Section D: questions 32 to 35 carry 5 marks each.
6. Section E: questions 36 to 38 are case-based, with sub-parts of 1, 1 and 2 marks.
7. Internal choice is given in two questions each of Sections B, C and D, and in the 2-mark part of every case study.
8. Draw neat figures wherever needed. Take $\pi = \frac{22}{7}$ unless stated otherwise. Calculators are not allowed.

Section A

Questions 1 to 20 carry 1 mark each

1. $0.\overline{4}$ written in the form $\frac{p}{q}$ is **1**

(a) $\frac{4}{10}$ (b) $\frac{2}{9}$
(c) $\frac{4}{9}$ (d) $\frac{4}{99}$

2. A rational number between $-\frac{1}{2}$ and $\frac{1}{3}$ is **1**

(a) -1 (b) 0
(c) $\frac{1}{2}$ (d) $\frac{2}{3}$

3. The degree of the polynomial $5x^3 - 2x^7 + 4$ is **1**

(a) 3 (b) 5
(c) 4 (d) 7

4. Which of these points lies on the line $2x + y = 7$? **1**

(a) $(1, 5)$ (b) $(2, 2)$
(c) $(3, 2)$ (d) $(0, 6)$

5. The pair of equations $x + y = 5$ and $2x + 2y = 12$ has **1**

(a) a unique solution (b) infinitely many solutions
(c) no solution (d) exactly two solutions

6. The common ratio of the geometric progression $5, -10, 20, -40, \ldots$ is **1**

(a) 2 (b) -2
(c) $\frac{1}{2}$ (d) $-\frac{1}{2}$

7. $(x - 2)(x + 5)$ is equal to **1**

(a) $x^2 + 3x - 10$ (b) $x^2 - 3x - 10$
(c) $x^2 + 3x + 10$ (d) $x^2 - 7x - 10$

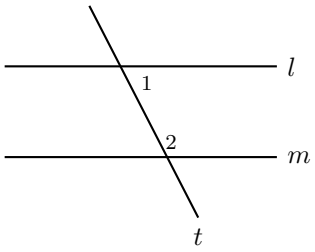
8. The point $(0, -3)$ lies **1**

(a) on the positive x-axis (b) on the negative x-axis
(c) on the positive y-axis (d) on the negative y-axis

9. "Things which are equal to the same thing are equal to one another" is one of Euclid's **1**
(a) postulates (b) axioms (common notions)
(c) definitions (d) theorems

10. Two angles form a linear pair and are in the ratio $3 : 2$. The smaller angle is **1**
(a) $72°$ (b) $36°$
(c) $108°$ (d) $54°$

11. In the figure, $l \parallel m$ and t is a transversal. If $\angle 1 = 65°$, then $\angle 2$ is **1**



(a) $65°$ (b) $25°$
(c) $115°$ (d) $135°$

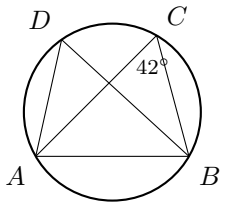
12. The angles of a triangle are in the ratio $2 : 3 : 4$. The largest angle is **1**
(a) $40°$ (b) $60°$
(c) $90°$ (d) $80°$

13. Which of the following is **not** a rule for the congruence of triangles? **1**
(a) SAS (b) ASA
(c) SSA (d) RHS

14. In parallelogram $ABCD$, $\angle A = 70°$. Then $\angle B$ is **1**
(a) $70°$ (b) $110°$
(c) $90°$ (d) $140°$

15. In triangle ABC, D and E are the midpoints of AB and AC. If $BC = 14$ cm, then DE is **1**
(a) 7 cm (b) 14 cm
(c) 28 cm (d) 3.5 cm

16. In the figure, A, B, C and D lie on the circle. If $\angle ACB = 42°$, then $\angle ADB$ is **1**



(a) $84°$ (b) $21°$
(c) $138°$ (d) $42°$

17. The curved surface area of a cylinder of radius 7 cm and height 10 cm is **1**
(a) 220 cm^2 (b) 308 cm^2
(c) 440 cm^2 (d) 1540 cm^2

18. The mode of the data 2, 3, 3, 5, 7, 3, 5 is **1**
(a) 5 (b) 3
(c) 7 (d) 2

19. **Assertion (A):** A cone and a cylinder have the same base radius and the same height. The volume of the cone is one-third of the volume of the cylinder. **1**
Reason (R): The volume of a cone is $\frac{1}{3}\pi r^2 h$ and the volume of a cylinder is $\pi r^2 h$.

(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not the correct explanation of A.
(c) A is true, but R is false.
(d) A is false, but R is true.

20. **Assertion (A):** The probability of an event can be 1.5. **1**
Reason (R): The probability of any event lies between 0 and 1, both included.

(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

Questions 21 to 25 carry 2 marks each

21. Express $0.\overline{37}$ in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$. **2**

OR

Rationalise the denominator of $\frac{1}{\sqrt{5}-\sqrt{3}}$.

22. If $x = 2$, $y = 1$ is a solution of $3x + ky = 10$, find k. Then write one more solution of the equation. **2**

23. Two lines intersect at a point. One of the angles formed is four times the angle next to it. Find all four angles. **2**

OR

The angles of a quadrilateral are in the ratio $3 : 5 : 9 : 13$. Find all its angles.

24. Find the total surface area of a solid hemisphere of radius 7 cm. **2**

25. A student scores 80 in a test that carries 40% of the final grade and 70 in a test that carries 60%. Find the weighted average score. **2**

OR

Find the median of 12, 7, 15, 9, 20, 11.

Section C

Questions 26 to 31 carry 3 marks each

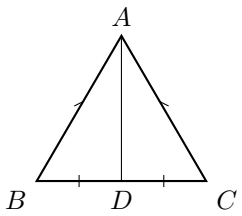
26. (i) Rationalise the denominator of $\frac{6}{3\sqrt{2}-2\sqrt{3}}$. **3**
(ii) Is $(2-\sqrt{5})(2+\sqrt{5})$ rational or irrational? Give a reason.

27. Find the point on the y-axis that is equidistant from $A(-5,-2)$ and $B(3,2)$. **3**

OR

$A(1,2)$, $B(4,3)$ and $C(6,6)$ are three vertices of parallelogram $ABCD$. Using the fact that the diagonals of a parallelogram bisect each other, find the fourth vertex D.

28. In the figure, $AB = AC$ and D is the midpoint of BC. Prove that $\triangle ABD \cong \triangle ACD$, and hence show that $AD \perp BC$. **3**



29. Prove that the quadrilateral formed by joining the midpoints of the sides of any quadrilateral, taken in order, is a parallelogram. **3**

30. Solve by the elimination method: $3x + 2y = 11$ and $2x - y = 5$. Check your answer. **3**

31. Two coins are tossed together. **3**

(i) Write the sample space.

(ii) Find the probability of getting exactly one head.

(iii) Find the probability of getting at least one tail.

OR

A die was thrown 300 times and a six came up 54 times.

(i) Find the empirical probability of getting a six.

(ii) Find the theoretical probability of getting a six.

(iii) Why are the two values different, and what would you expect if the die were thrown many more times?

Section D

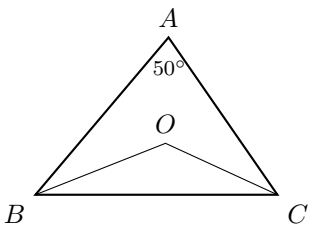
Questions 32 to 35 carry 5 marks each

32. A school sold 120 tickets for its annual day. Adult tickets cost ₹50 and child tickets cost ₹30. The school collected ₹5,000 in all. Form a pair of linear equations, solve them, and find how many tickets of each kind were sold. Check your answer. **5**

OR

(i) Draw the graph of $2x + y = 6$.
(ii) Write the points where it meets the x-axis and the y-axis.
(iii) Find the area of the triangle formed by the line and the two axes.
(iv) Check whether the point $(1, 4)$ lies on this line.

33. (i) Prove that the sum of the angles of a triangle is $180°$. **5**
(ii) In the figure, $\angle A = 50°$, and BO and CO bisect $\angle B$ and $\angle C$. Find $\angle BOC$.



34. A conical tent is 8 m high and the radius of its base is 6 m. Take $\pi = 3.14$. **5**

(i) Find its slant height.

(ii) Find the area of canvas needed to make the tent (ignore the base).

(iii) Find the cost of the canvas at ₹50 per m^2.

(iv) Find the volume of air inside the tent.

OR

A metal sphere of radius 4.2 cm is melted and recast into a cylinder of radius 6 cm.

(i) Find the height of the cylinder.

(ii) Find the surface area of the original sphere.

35. The marks (out of 50) scored by 20 students in a class test are given below. **5**

Marks	10	20	30	40	50
Number of students	2	4	7	5	2

Find the mean, the median and the mode of the marks. Which of the three best describes a "typical" student here? Give a reason.

OR

In Class 9A (40 students), 20 like cricket, 12 like football and 8 like badminton best. In Class 9B (50 students), 20 like cricket, 20 like football and 10 like badminton best.

(i) Convert each class's numbers into percentages.

(ii) Draw a 100% stacked bar graph for the two classes.

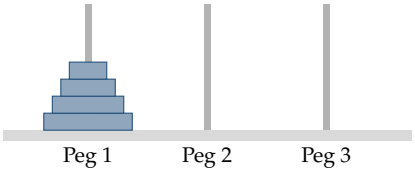
(iii) In which class is football more popular in proportion?

(iv) Why is a 100% stacked bar graph better than an ordinary stacked bar graph for this comparison?

Section E

Questions 36 to 38 are case-based and carry 4 marks each

36. **The Tower of Hanoi.** In this puzzle, discs of different sizes sit on one of three pegs, largest at the bottom. You must move the whole stack to another peg, one disc at a time, never placing a larger disc on a smaller one. The least number of moves needed for 1, 2, 3 and 4 discs is 1, 3, 7 and 15. **4**



(i) Write a recursive rule that gives the next number of moves from the previous one. (1)

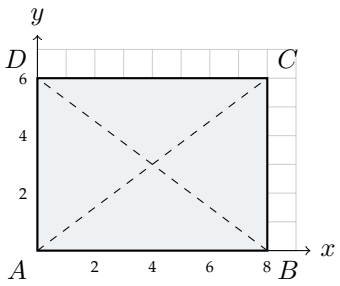
(ii) Find the least number of moves for 5 discs. (1)

(iii) Write an explicit rule for the least number of moves for n discs and use it to find the moves for 6 discs. (2)

OR

Add 1 to each of 1, 3, 7, 15. What kind of sequence do you get? Use it to find the least number of moves for 10 discs. (2)

37. **Planning a room.** An architect draws a rectangular room on a grid where 1 unit is 1 metre. The corners are $A(0,0)$, $B(8,0)$, $C(8,6)$ and $D(0,6)$. A ceiling light is to be fixed at the point where the diagonals cross. **4**



(i) Find the length of diagonal AC. (1)

(ii) Find the point where the light should be fixed. (1)

(iii) Show that the light is at the same distance from all four corners, and find this distance. (2)

OR

Show that the diagonals AC and BD are equal and bisect each other. What does this tell you about $ABCD$? (2)

38. **A triangular plot.** A village panchayat owns a triangular plot with sides 13 m, 14 m and 15 m. It plans to grow grass on it and to make a circular flower bed of radius 2.1 m inside it. **4**

(i) Find the semi-perimeter of the plot. (1)

(ii) Find the area of the plot. (1)

(iii) Find the area left for grass after the flower bed is made. (2)

OR

The plot is to be fenced at ₹12 per metre, leaving a 3 m gap for a gate. Find the cost of fencing. (2)

***** End of question paper *****

Solutions

Marks for each step are not shown. Any correct method should get full credit.

Section A

1. Let $x = 0.444\ldots$. Then $10x = 4.444\ldots$, so $9x = 4$ and $x = \frac{4}{9}$. **Answer: (c)**

2. $-\frac{1}{2} < 0 < \frac{1}{3}$. **Answer: (b)**

3. The highest power of x is 7. **Answer: (d)**

4. $2(1) + 5 = 7$. The others give 6, 8 and 6. **Answer: (a)**

5. Dividing the second equation by 2 gives $x + y = 6$, which cannot hold together with $x + y = 5$. The lines are parallel. **Answer: (c)**

6. $-10 \div 5 = -2$. **Answer: (b)**

7. $x^2 + 5x - 2x - 10 = x^2 + 3x - 10$. **Answer: (a)**

8. The x-coordinate is 0 and the y-coordinate is negative. **Answer: (d)**

9. This is Euclid's first axiom (common notion). **Answer: (b)**

10. $3x + 2x = 180°$, so $x = 36°$. The angles are $108°$ and $72°$. **Answer: (a)**

11. Interior angles on the same side of a transversal add up to $180°$: $180° - 65° = 115°$. **Answer: (c)**

12. $2x + 3x + 4x = 180°$, so $x = 20°$. Largest angle $= 80°$. **Answer: (d)**

13. Two sides and a non-included angle do not fix a triangle. **Answer: (c)**

14. Adjacent angles of a parallelogram add up to $180°$: $180° - 70° = 110°$. **Answer: (b)**

15. By the midpoint theorem, $DE = \frac{1}{2}BC = 7$ cm. **Answer: (a)**

16. Angles in the same segment are equal. **Answer: (d)**

17. CSA $= 2\pi rh = 2 \times \frac{22}{7} \times 7 \times 10 = 440$ cm^2. **Answer: (c)**

18. 3 occurs most often (three times). **Answer: (b)**

19. $\frac{1}{3}\pi r^2 h$ is one-third of $\pi r^2 h$, so R directly explains A. **Answer: (a)**

20. 1.5 is greater than 1, so A is false. R is true. **Answer: (d)**

Section B

21. Let $x = 0.3737\ldots$. Then $100x = 37.3737\ldots$, so $99x = 37$ and $x = \frac{37}{99}$.

OR: $\dfrac{1}{\sqrt{5} - \sqrt{3}} \times \dfrac{\sqrt{5} + \sqrt{3}}{\sqrt{5} + \sqrt{3}} = \dfrac{\sqrt{5} + \sqrt{3}}{5 - 3} = \dfrac{\sqrt{5} + \sqrt{3}}{2}$.

22. $3(2) + k(1) = 10$, so $k = 4$. The equation is $3x + 4y = 10$. Another solution: $x = -2$, $y = 4$, since $-6 + 16 = 10$. (Any correct pair, such as $\left(0, \frac{5}{2}\right)$, gets full marks.)

23. Adjacent angles at the point form a linear pair: $x + 4x = 180°$, so $x = 36°$. Vertically opposite angles are equal, so the four angles are $36°$, $144°$, $36°$ and $144°$.
OR: $3x + 5x + 9x + 13x = 360°$, so $30x = 360°$ and $x = 12°$. The angles are $36°$, $60°$, $108°$ and $156°$.

24. TSA of a solid hemisphere $= 3\pi r^2 = 3 \times \frac{22}{7} \times 7 \times 7 = 462$ cm^2.

25. Weighted average $= 0.4 \times 80 + 0.6 \times 70 = 32 + 42 = 74$.
OR: In order: 7, 9, 11, 12, 15, 20. There are 6 values, so the median is the mean of the 3rd and 4th: $\frac{11+12}{2} = 11.5$.

Section C

26. (i) $\dfrac{6}{3\sqrt{2} - 2\sqrt{3}} \times \dfrac{3\sqrt{2} + 2\sqrt{3}}{3\sqrt{2} + 2\sqrt{3}} = \dfrac{6(3\sqrt{2} + 2\sqrt{3})}{18 - 12} = 3\sqrt{2} + 2\sqrt{3}$.
(ii) $(2 - \sqrt{5})(2 + \sqrt{5}) = 4 - 5 = -1$, which is rational, since it can be written as $\frac{-1}{1}$.

27. Let the point be $P(0, y)$. $PA^2 = PB^2$:
$25 + (y + 2)^2 = 9 + (y - 2)^2 \Rightarrow 25 + 4y + 4 = 9 - 4y + 4 \Rightarrow 8y = -16 \Rightarrow y = -2$.
The point is $(0, -2)$. Check: $PA^2 = 25 + 0 = 25$, $PB^2 = 9 + 16 = 25$.
OR: Midpoint of $AC = \left(\frac{7}{2}, 4\right)$. This is also the midpoint of BD. If $D = (x, y)$: $\frac{4+x}{2} = \frac{7}{2}$ gives $x = 3$, and $\frac{3+y}{2} = 4$ gives $y = 5$. So $D = (3, 5)$.

28. In $\triangle ABD$ and $\triangle ACD$: $AB = AC$ (given), $BD = CD$ (D is the midpoint), and $AD = AD$ (common). So $\triangle ABD \cong \triangle ACD$ by SSS.
Hence $\angle ADB = \angle ADC$ (corresponding parts). They form a linear pair, so each is $90°$. Therefore $AD \perp BC$.

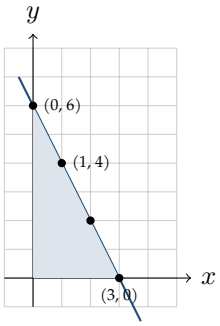
29. Let P, Q, R, S be the midpoints of AB, BC, CD, DA of quadrilateral $ABCD$. Join diagonal AC.
In $\triangle ABC$, P and Q are midpoints, so by the midpoint theorem $PQ \parallel AC$ and $PQ = \frac{1}{2}AC$.
In $\triangle ADC$, S and R are midpoints, so $SR \parallel AC$ and $SR = \frac{1}{2}AC$.
So $PQ \parallel SR$ and $PQ = SR$. A quadrilateral with one pair of opposite sides equal and parallel is a parallelogram, so $PQRS$ is a parallelogram.

30. Multiply the second equation by 2: $4x - 2y = 10$. Add to the first: $7x = 21$, so $x = 3$. Then $2(3) - y = 5$, so $y = 1$.
Check: $3(3) + 2(1) = 11$ and $2(3) - 1 = 5$. Both hold.

31. (i) $\{HH, HT, TH, TT\}$. (ii) Exactly one head: HT, TH, so $P = \frac{2}{4} = \frac{1}{2}$. (iii) At least one tail: HT, TH, TT, so $P = \frac{3}{4}$.
OR: (i) $\frac{54}{300} = \frac{9}{50} = 0.18$. (ii) $\frac{1}{6} \approx 0.167$. (iii) The empirical value comes from a limited number of real throws, so it varies by chance. With many more throws it would be expected to come closer to $\frac{1}{6}$.

Section D

32. Let x = adult tickets and y = child tickets.
$x + y = 120$ and $50x + 30y = 5000$.
From the first, $y = 120 - x$. Substituting: $50x + 30(120 - x) = 5000 \Rightarrow 20x + 3600 = 5000 \Rightarrow x = 70$, so $y = 50$.
70 adult and 50 child tickets were sold. Check: $70 + 50 = 120$ and $3500 + 1500 = 5000$.
OR: (i) Points such as $(0, 6)$, $(1, 4)$, $(2, 2)$ and $(3, 0)$ lie on the line. Plot them and join them.



(ii) It meets the x-axis at $(3, 0)$ and the y-axis at $(0, 6)$.
(iii) The triangle has base 3 and height 6, so its area is $\frac{1}{2} \times 3 \times 6 = 9$ square units.
(iv) $2(1) + 4 = 6$, so $(1, 4)$ lies on the line.

33. (i) Let ABC be a triangle. Through A, draw line $PQ \parallel BC$.
$\angle PAB = \angle ABC$ and $\angle QAC = \angle ACB$ (alternate angles), where P is on the same side of A as B.
$\angle PAB + \angle BAC + \angle QAC = 180°$ (angles on a straight line).
So $\angle ABC + \angle BAC + \angle ACB = 180°$.
(ii) $\angle B + \angle C = 180° - 50° = 130°$, so $\frac{1}{2}\angle B + \frac{1}{2}\angle C = 65°$.
In $\triangle BOC$, $\angle BOC = 180° - 65° = 115°$.

34. (i) $l = \sqrt{8^2 + 6^2} = 10$ m.
(ii) CSA $= \pi rl = 3.14 \times 6 \times 10 = 188.4$ m^2.
(iii) Cost $= 188.4 \times 50 =$ ₹9,420.
(iv) Volume $= \frac{1}{3}\pi r^2 h = \frac{1}{3} \times 3.14 \times 36 \times 8 = 301.44$ m^3.
OR: (i) Volume stays the same: $\frac{4}{3}\pi(4.2)^3 = \pi(6)^2 h$.

$$h = \frac{4 \times 74.088}{3 \times 36} = 2.744 \text{ cm}.$$

(ii) Surface area $= 4\pi r^2 = 4 \times \frac{22}{7} \times 4.2 \times 4.2 = 221.76$ cm^2.

35. Mean $= \dfrac{10(2) + 20(4) + 30(7) + 40(5) + 50(2)}{20} = \dfrac{610}{20} = 30.5$.
Median: with 20 values, the median is the mean of the 10th and 11th values. The running totals are 2, 6, 13, ..., so both are 30. Median $= 30$.
Mode $= 30$ (7 students).
All three are close to 30, so 30 marks describes a typical student well. The mode and median are exactly 30 and are not pulled by the few very low or very high scores.
OR: (i) 9A: cricket 50%, football 30%, badminton 20%. 9B: cricket 40%, football 40%, badminton 20%.
(ii) Two bars of equal height (100%), each split into these three parts.
(iii) Football: 40% in 9B against 30% in 9A, so 9B.
(iv) The classes have different sizes. A 100% stacked bar shows each sport as a share of its own class, so the proportions can be compared directly.

Section E

36. (i) Next $= 2 \times$ previous $+ 1$. (ii) $2 \times 15 + 1 = 31$.
(iii) Moves $= 2^n - 1$. For 6 discs: $2^6 - 1 = 63$.
OR: We get 2, 4, 8, 16, a geometric progression with ratio 2, so moves $+1 = 2^n$. For 10 discs: $2^{10} - 1 = 1023$.

37. (i) $AC = \sqrt{8^2 + 6^2} = 10$ m. (ii) Midpoint of $AC = (4, 3)$.
(iii) Distance from $(4, 3)$ to A, B, C and D: each is $\sqrt{4^2 + 3^2} = 5$ m.
OR: $BD = \sqrt{(0-8)^2 + (6-0)^2} = 10 = AC$. Midpoint of $BD = (4, 3) =$ midpoint of AC. Diagonals that are equal and bisect each other show that $ABCD$ is a rectangle.

38. (i) $s = \frac{13+14+15}{2} = 21$ m.
(ii) Area $= \sqrt{21 \times 8 \times 7 \times 6} = \sqrt{7056} = 84$ m^2.
(iii) Flower bed $= \frac{22}{7} \times 2.1 \times 2.1 = 13.86$ m^2. Grass area $= 84 - 13.86 = 70.14$ m^2.
OR: Perimeter $= 42$ m. Fencing needed $= 42 - 3 = 39$ m. Cost $= 39 \times 12 =$ ₹468.