Model Question Paper 2

Half-Yearly Examination 2026-27

MATHEMATICS

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

General Instructions:

1. This question paper has 5 sections: A, B, C, D and E.
2. Section A has 20 objective type questions (Multiple Choice Questions and Assertion-Reason questions) carrying 1 mark each.
3. Section B has 5 questions carrying 2 marks each. Answers to these should not exceed 40-50 words each.
4. Section C has 6 questions carrying 3 marks each. Answers to these should not exceed 60-80 words each.
5. Section D has 4 questions carrying 5 marks each. Answers to these should not exceed 120 words each.
6. Section E has 3 source/case-based questions carrying 4 marks each, with four sub-parts of 1 mark each.
7. There is no overall choice. However, internal choices have been provided in all four questions of Section D and in one sub-part of each case-based question of Section E. A student has to attempt only one of the choices in such questions.
8. Use of calculators is not permitted.
9. Wherever necessary, neat and labelled figures/graphs should be drawn.

SECTION A

Question numbers 1 to 20 carry 1 mark each. Choose the most appropriate answer.

1. Which of the following has a terminating decimal expansion? *[1]*

(a) 5/16
(b) 1/3
(c) 2/7
(d) 5/9

2. Simplify using laws of exponents: 3^4 × 3^-2. *[1]*

(a) 3^2 = 9
(b) 3^6 = 729
(c) 3^-8
(d) 3^8

3. Which of the following numbers is irrational? *[1]*

(a) 0.101001000100001...
(b) 9/4
(c) √16
(d) 22/7

4. On rationalising the denominator, 1/(√6 + √2) is equal to: *[1]*

(a) (√6 - √2)/4
(b) (√6 + √2)/4
(c) (√6 - √2)/8
(d) √6 - √2

5. *This question consists of two statements — Assertion (A) and Reason (R). Choose the correct option:* *[1]*

Assertion (A): 3 + √5 is an irrational number.

Reason (R): The sum of a rational number and an irrational number is always irrational.

(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

6. Using a suitable identity, the value of $(98)^2$ is: *[1]*

(a) 9604
(b) 9608
(c) 9600
(d) 9404

7. The expansion of $(x + 7)(x - 4)$ is: *[1]*

(a) $x^2 + 3x - 28$
(b) $x^2 - 3x - 28$
(c) $x^2 + 3x + 28$
(d) $x^2 - 11x - 28$

8. If $a - b = 6$ and $ab = 16$, the value of $a^2 + b^2$ is: *[1]*

(a) 68
(b) 36
(c) 52
(d) 16

9. One of the factors of $4x^2 + 12x + 9$ is: *[1]*

(a) $(2x + 3)$
(b) $(2x - 3)$
(c) $(4x + 3)$
(d) $(2x + 9)$

10. *This question consists of two statements — Assertion (A) and Reason (R). Choose the correct option:* *[1]*

Assertion (A): For all real numbers a and b, $(a - b)^3 = a^3 - b^3 - 3ab(a - b)$.

Reason (R): Expanding $(a-b)^3$ gives $a^3 - 3a^2b + 3ab^2 - b^3$, and the middle two terms $-3a^2b + 3ab^2$ can be regrouped as $-3ab(a-b)$.

(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

11. Which of the following is a linear polynomial in one variable? *[1]*

(a) $7 - 2x$
(b) $x^2 - 4$
(c) $2x^3 + 1$
(d) $1/x + 3$

12. The zero of the linear polynomial $p(x) = 9 - 3x$ is: *[1]*

(a) 3

(b) -3
(c) 9
(d) 1/3

13. A car rental company charges C(d) = 15d + 100 (in ₹) for a trip of d km. The fixed charge, applied even for a zero-distance booking, is: *[1]*

(a) ₹100
(b) ₹15
(c) ₹115
(d) ₹0

14. The value of k for which x = -2 is a zero of the polynomial p(x) = 4x + k is: *[1]*

(a) 8
(b) -8
(c) 2
(d) 4

15. The point (4, -7) lies in which quadrant? *[1]*

(a) Quadrant IV
(b) Quadrant I
(c) Quadrant II
(d) Quadrant III

16. The distance of the point (-5, 12) from the origin is: *[1]*

(a) 13 units
(b) 17 units
(c) 7 units
(d) 60 units

17. The coordinates of the midpoint of the segment joining A(-4, 6) and B(8, -2) are: *[1]*

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

18. A cyclist rides in a straight line from P(2, 3) to Q(10, 9) on a coordinate grid (units in km). The distance covered is: *[1]*

(a) 10 km
(b) 14 km
(c) 100 km
(d) 8 km

19. A triangular flag has sides 9 cm, 10 cm and 11 cm. Its semi-perimeter s is: *[1]*

(a) 15 cm
(b) 30 cm
(c) 9.5 cm
(d) 10 cm

20. Using Heron's formula, the area of a triangle with sides 9 m, 40 m and 41 m is: *[1]*

(a) 180 m²
(b) 360 m²
(c) 90 m²
(d) 1476 m²

SECTION B

Question numbers 21 to 25 carry 2 marks each.

21. Using the distance formula, find the distance between the points A(0, 5) and B(12, 0). *[2]*

22. Simplify $(\sqrt{7} - \sqrt{3})^2$ and state, with reason, whether the result is rational or irrational. *[2]*

23. Using a suitable identity, evaluate 95×105. *[2]*

24. The height of a candle remaining after burning for t minutes is given by the linear polynomial H(t) = 20 - 2t (in cm). Find the zero of this polynomial and explain what it represents physically. *[2]*

25. A triangular warning sign has sides 9 cm, 10 cm and 17 cm. Using Heron's formula, find its area. *[2]*

SECTION C

Question numbers 26 to 31 carry 3 marks each.

26. Prove that $\sqrt{5}$ is an irrational number. *[3]*

27. If x - y = 8 and xy = 65, find the value of $x^2 + y^2$. *[3]*

28. Simplify using a suitable identity: $(5a+3b)^3 - (5a-3b)^3$. Express your answer in simplest form. *[3]*

29. If p(x) = 3x + 9 is a linear polynomial, find (a) its zero, (b) the value of p(-2), and (c) state the degree of p(x). *[3]*

30. The vertices of a triangle are P(1,1), Q(1,5) and R(4,1). Using the distance formula, verify that triangle PQR is right-angled at P, and find the length of its hypotenuse. *[3]*

31. A quadrilateral field ABCD has AB=7 m, BC=24 m, CD=20 m, DA=15 m, with diagonal AC=25 m and angle ABC=90°. Find the total area of the field by splitting it into two triangles using the diagonal AC. *[3]*

SECTION D

Question numbers 32 to 35 carry 5 marks each.

32. (a) Simplify: $(\sqrt{11}+\sqrt{7})(\sqrt{11}-\sqrt{7})$. (b) Rationalise the denominator of $1/(4-\sqrt{3})$ and express it in the form $a+b\sqrt{3}$. (c) Using laws of exponents, simplify: $(3^{(3/4)})^4 \times 3^{-2}$. *[5]*

OR

Prove that $\sqrt{3}$ is irrational, and hence show that $4 - 2\sqrt{3}$ is also irrational.

33. (a) If $x + 1/x = 9$, find the values of $x^2 + 1/x^2$ and $x^3 + 1/x^3$. (b) Factorise $64a^3 + 27b^3$ using a standard identity. *[5]*

OR

Factorise completely: (a) $a^3 - 27b^3$, using a standard identity. (b) $x^2 - y^2 + 8y - 16$ (Hint: group the last three terms and use the difference-of-squares identity).

34. A bakery's estimated daily profit (in ₹) after selling x cakes is modelled by the linear polynomial $P(x) = 45x - 900$. (a) Find the zero of P(x) and state what it represents. (b) Find P(30) and interpret the sign of your answer. (c) How many cakes must be sold for a profit of ₹2700? (d) Is the profit increasing or decreasing as x increases? Justify. *[5]*

OR

A parking garage charges a linear polynomial $F(h) = 20 + 15h$ (in ₹) for h hours of parking. (a) Find the fixed base charge. (b) Find F(5). (c) If the total charge was ₹185, find the number of hours parked. (d) Find the zero of F(h), and comment on whether it has a meaningful real-life interpretation here.

35. A triangular park has sides 11 m, 60 m and 61 m. (a) Find its area using Heron's formula. (b) Find the perimeter of the park, and the area of a 1 m wide flower border to be planted just inside the 61 m side. (c) If fencing costs ₹40 per metre, find the total cost of fencing the park. *[5]*

OR

The floor of a rectangular hall is 20 m long and 16 m wide. A triangular stage with sides 9 m, 12 m and 15 m is to be built in one corner. (a) Find the area of the rectangular floor. (b) Find the area of the triangular stage using Heron's formula. (c) Find the area of the floor that remains after building the stage.

SECTION E

Question numbers 36 to 38 are source/case-based questions carrying 4 marks each, with four sub-parts of 1 mark each.

Case Study 1 — Question 36 [4 Marks]

A theme park's map is laid out on a coordinate grid (in hundreds of metres), with the Main Gate taken as the origin O(0,0). On this map, the Ferris Wheel is at F(6,8), the Food Court is at C(-5,12), and the Exit Gate is at E(6,-8).

(i) In which quadrant does the Food Court C(-5,12) lie? *[1]*

(ii) Write the coordinates of the mirror image of the Exit Gate E(6,-8) in the x-axis. *[1]*

(iii) Find the distance between the Ferris Wheel F(6,8) and the Exit Gate E(6,-8). *[1]*

(iv) Find the coordinates of the midpoint of the segment joining the Main Gate O(0,0) and the Food Court C(-5,12). *[1]*

OR Find the distance of the Ferris Wheel F(6,8) from the Main Gate O(0,0).

Case Study 2 — Question 37 [4 Marks]

In a class activity titled 'Numbers Around Us', students measured the diagonal of a square tile of side 1 m and found it to be $\sqrt{2}$ m — a length that cannot be written as a simple fraction p/q. They also noted that 3.14 is commonly used as a rational approximation for the irrational number π, and looked at the decimal expansion of 5/6.

(i) Is $\sqrt{2}$ a rational or an irrational number? Give a reason. *[1]*

(ii) Is 3.14, used to approximate π, itself a rational or an irrational number? *[1]*

(iii) What type of decimal expansion does 5/6 have? *[1]*

(iv) Briefly outline why $\sqrt{2}$ cannot be written in the form p/q (p, q integers, $q \neq 0$) — the key idea of the proof that $\sqrt{2}$ is irrational. *[1]*

OR Find one rational number that lies between 5/6 and 2/9.

Case Study 3 — Question 38 [4 Marks]

A municipal corporation is developing a small triangular traffic island with sides 21 m, 20 m and 13 m. The cost of laying topsoil and planting a garden is proportional to the island's area, while the cost of building a concrete curb around it is proportional to its perimeter.

(i) Find the perimeter of the triangular traffic island. *[1]*

(ii) Find the semi-perimeter s of the triangle, to be used in Heron's formula. *[1]*

(iii) Using Heron's formula, find the area of the traffic island. *[1]*

(iv) If topsoil and planting costs ₹15 per square metre, find the total cost for the island. *[1]*

OR If curbing costs ₹60 per metre, find the total cost of curbing the island.