Model Question Paper 1

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 should be drawn.

SECTION A

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

1. Which of the following numbers is a perfect square? *[1]*

(a) 48
(b) 64
(c) 90
(d) 150
Answer: (b) — 64 = 8^2, a perfect square; the others are not.

2. The cube root of 1331 is: *[1]*

(a) 9
(b) 10
(c) 11
(d) 12
Answer: (c) — $11^3 = 11 \times 11 \times 11 = 1331$, so the cube root is 11.

3. Using the pattern $1+3=2^2$, $1+3+5=3^2$, $1+3+5+7=4^2$, the sum of the first 6 odd natural numbers (1+3+5+7+9+11) is: *[1]*

(a) 25
(b) 30
(c) 36
(d) 49
Answer: (c) — Sum of first n odd numbers = n^2; here n=6, so the sum = 6^2 = 36.

4. Simplify: $5^3 \times 5^{-5}$. *[1]*

(a) $5^2 = 25$
(b) $5^{-2} = 1/25$
(c) 5^8
(d) 5^{-8}
Answer: (b) — $5^3 \times 5^{-5} = 5$^(3-5) $= 5^{-2} = 1/25$.

5. The standard form of 3,50,000 is: *[1]*

(a) 3.5×10^5
(b) 35×10^4
(c) 3.5×10^6
(d) 0.35×10^6
Answer: (a) — 3,50,000 = $3.5 \times 100000 = 3.5 \times 10^5$.

6. The value of $(2^3)^2 \div 2^4$ is: *[1]*

(a) 2
(b) 4
(c) 8
(d) 16
Answer: (b) — $(2^3)^2 = 2^6 = 64$; $64 \div 2^4 = 64 \div 16 = 4$.

7. The additive inverse of -5/8 is: *[1]*

(a) -5/8
(b) 5/8
(c) 8/5
(d) -8/5
Answer: (b) — The additive inverse of -5/8 is 5/8, since -5/8 + 5/8 = 0.

8. A rational number lying between -1/3 and 1/3 is: *[1]*

(a) -1/2
(b) 0
(c) 2/3
(d) 1
Answer: (b) — 0 lies between -1/3 and 1/3 on the number line.

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

Assertion (A): Division of rational numbers is not commutative.

Reason (R): For rational numbers a and b (b ≠ 0), a ÷ b is generally not equal to b ÷ a; for example, 2 ÷ 4 = 1/2 but 4 ÷ 2 = 2, and these are not equal.

(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
Answer: (a) — Both true; the example in R correctly demonstrates and explains A.

10. The sum of the four interior angles of any quadrilateral is: *[1]*

(a) 180°
(b) 270°
(c) 360°
(d) 540°
Answer: (c) — The angle sum property of a quadrilateral states that its interior angles add up to 360°.

11. In a parallelogram, one angle measures 70°. Its adjacent angle measures: *[1]*

(a) 70°
(b) 110°
(c) 180°
(d) 290°
Answer: (b) — Adjacent (co-interior) angles of a parallelogram are supplementary: 180° - 70° = 110°.

12. Which quadrilateral has diagonals that bisect each other at right angles, but are NOT necessarily equal in length? *[1]*

(a) Rectangle
(b) Rhombus
(c) Trapezium
(d) Kite
Answer: (b) — A rhombus has diagonals that bisect each other at right angles, but they are equal only in the special case of a square.

13. A number is divisible by 12 if it is divisible by: *[1]*
(a) 2 and 3
(b) 3 and 4
(c) 4 and 6
(d) 2 and 6
Answer: (b) — 3 and 4 are co-prime factors of 12 ($3\times4=12$, HCF=1), so divisibility by both guarantees divisibility by 12; 4 and 6 are not co-prime, so that test is unreliable.

14. The HCF of 24 and 36 is: *[1]*
(a) 6
(b) 8
(c) 12
(d) 18
Answer: (c) — $24 = 2^3\times3$, $36 = 2^2\times3^2$; HCF $= 2^2\times3 = 12$.

15. Using the distributive law, $7 \times (20 + 3)$ is equal to: *[1]*
(a) $7\times20 + 7\times3$
(b) $7\times20 + 3$
(c) $7 + 20\times3$
(d) $20 + 7\times3$
Answer: (a) — By the distributive law, $a\times(b+c) = a\times b + a\times c$, so $7\times(20+3) = 7\times20 + 7\times3$.

16. The product of $(3x)$ and $(4x^2)$ is: *[1]*
(a) $7x^3$
(b) $12x^3$
(c) $12x^2$
(d) $7x^2$
Answer: (b) — $(3x)(4x^2) = 3\times4\times x\times x^2 = 12x^3$.

17. Using the distributive law, $a(b - c)$ is equal to: *[1]*
(a) $ab - ac$
(b) $ab + ac$
(c) $a - bc$
(d) $ab - c$
Answer: (a) — $a(b-c) = ab - ac$ by the distributive law.

18. ₹1200 is divided among A, B and C in the ratio 2:3:5. B's share is: *[1]*
(a) ₹240
(b) ₹360
(c) ₹400
(d) ₹600
Answer: (b) — Total parts = 2+3+5 = 10; each part = 1200/10 = ₹120; B's share = 3×120 = ₹360.

19. If 5 pens cost ₹60, the cost of 8 pens (at the same rate) is: *[1]*
(a) ₹90
(b) ₹96
(c) ₹100

(d) ₹75

Answer: (b) — Cost of 1 pen = 60/5 = ₹12; cost of 8 pens = 8×12 = ₹96.

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

Assertion (A): A discount of 20% on a marked price of ₹500 reduces the selling price to ₹400.

Reason (R): Selling Price = Marked Price − Discount, and Discount = 20% of ₹500 = ₹100, so Selling Price = 500 − 100 = ₹400.

(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

Answer: (a) — Both true; R correctly computes the discount and shows how it gives the selling price stated in A.

SECTION B

Question numbers 21 to 25 carry 2 marks each.

21. Find the square root of 225 by the prime factorisation method. *[2]*

Marking Scheme / Value Points:

- $225 = 3 \times 3 \times 5 \times 5$ (prime factorisation) — 1 mark
- Pairing equal factors: $\sqrt{225} = 3 \times 5 = 15$ — 1 mark

22. Find the LCM of 18 and 24 using prime factorisation. *[2]*

Marking Scheme / Value Points:

- $18 = 2 \times 3^2$; $24 = 2^3 \times 3$ — 1 mark
- LCM $= 2^3 \times 3^2 = 8 \times 9 = 72$ — 1 mark

23. Verify that addition of rational numbers is associative for -1/2, 1/3 and -1/6, by checking that (-1/2 + 1/3) + (-1/6) = -1/2 + (1/3 + (-1/6)). *[2]*

Marking Scheme / Value Points:

- LHS: (-1/2+1/3) = -3/6+2/6 = -1/6; then -1/6 + (-1/6) = -2/6 = -1/3 — 1 mark
- RHS: (1/3+(-1/6)) = 2/6-1/6 = 1/6; then -1/2 + 1/6 = -3/6+1/6 = -2/6 = -1/3. Since LHS = RHS = -1/3, associativity is verified — 1 mark

24. Using the distributive law, find the product 3x(2x + 5y - 4). *[2]*

Marking Scheme / Value Points:

- $3x \times 2x = 6x^2$; $3x \times 5y = 15xy$ — 1 mark
- $3x \times (-4) = -12x$; so $3x(2x+5y-4) = 6x^2 + 15xy - 12x$ — 1 mark

25. The four interior angles of a quadrilateral are in the ratio 1:2:3:4. Find the measure of each angle. *[2]*

Marking Scheme / Value Points:

- Sum of ratio parts = 1+2+3+4 = 10; each part = 360°/10 = 36° — 1 mark
- Angles = 1×36°, 2×36°, 3×36°, 4×36° = 36°, 72°, 108°, 144° — 1 mark

SECTION C

Question numbers 26 to 31 carry 3 marks each.

26. Find the smallest number by which 72 must be multiplied so that the product is a perfect square. Also find the square root of the resulting number. *[3]*

Marking Scheme / Value Points:

- $72 = 2\times2\times2\times3\times3 = 2^3\times3^2$; the factor 2 has an odd power (3), so 72 must be multiplied by 2 — 1 mark
- Resulting number $= 72\times2 = 144 = 2^4\times3^2$ — 1 mark

- $\sqrt{144} = 2^2 \times 3 = 4 \times 3 = 12$ — 1 mark

27. The ratio of the number of boys to girls in a class is 4:5. If there are 20 boys, find the number of girls and the total number of students in the class. *[3]*

Marking Scheme / Value Points:

- Boys:Girls = 4:5; one part = 20/4 = 5 — 1 mark
- Number of girls = $5 \times 5 = 25$ — 1 mark
- Total students = 20+25 = 45 — 1 mark

28. Simplify: $2/3 + (-5/6) \times 3/5$. *[3]*

Marking Scheme / Value Points:

- By the rule of order of operations, multiplication is done first: $(-5/6)\times(3/5) = -15/30 = -1/2$ — 1.5 marks
- $2/3 + (-1/2) = 4/6 - 3/6 = 1/6$ — 1.5 marks

29. Multiply $(2x+3)(x-5)$ and simplify your answer. *[3]*

Marking Scheme / Value Points:

- $(2x+3)(x-5) = 2x\times x + 2x\times(-5) + 3\times x + 3\times(-5)$ — 1 mark
- $= 2x^2 - 10x + 3x - 15$ — 1 mark
- $= 2x^2 - 7x - 15$ (combining like terms) — 1 mark

30. In a parallelogram ABCD, angle A = 108°. Diagonal BD bisects angle B into two equal parts. Given AB ∥ DC, find angle B, angle C, angle D, and each half of the bisected angle B. *[3]*

Marking Scheme / Value Points:

- Angle B = 180° - 108° = 72° (adjacent angles A and B of a parallelogram are co-interior angles on the transversal AB between AB and DC, so they are supplementary) — 1 mark
- Angle C = angle A = 108° (opposite angles of a parallelogram are equal); angle D = angle B = 72° — 1 mark
- Each half of the bisected angle B = 72°/2 = 36° — 1 mark

31. Using divisibility tests, check whether the number 47,952 is divisible by (a) 8, and (b) 9. Show your working. *[3]*

Marking Scheme / Value Points:

- (a) Test for 8: check the last 3 digits, 952. 952 ÷ 8 = 119 exactly, so 47,952 is divisible by 8 — 1.5 marks
- (b) Test for 9: sum of digits = 4+7+9+5+2 = 27, which is divisible by 9, so 47,952 is divisible by 9 — 1.5 marks

SECTION D

Question numbers 32 to 35 carry 5 marks each.

32. (a) Simplify using laws of exponents: $3^4 \times 3^{-2} \div 3^{-3}$. (b) Express 5,60,00,000 in standard form. (c) Simplify: $(2/3)^{-2}$. *[5]*

OR

(a) Simplify using laws of exponents: $5^3 \times 5^{-5} \div 5^{-4}$. (b) Express 0.000082 in standard form. (c) Simplify: $(3/5)^{-2}$.

Marking Scheme / Value Points:

- (a) $3^4 \times 3^{-2} \div 3^{-3} = 3^{(4-2-(-3))} = 3^{(4-2+3)} = 3^5 = 243$ — 2 marks
- (b) $5{,}60{,}00{,}000 = 5.6 \times 10^7$ — 1.5 marks
- (c) $(2/3)^{-2} = (3/2)^2 = 9/4$ — 1.5 marks

OR (value points):

- (a) $5^3 \times 5^{-5} \div 5^{-4} = 5^{(3-5+4)} = 5^2 = 25$ — 2 marks
- (b) $0.000082 = 8.2 \times 10^{-5}$ — 1.5 marks
- (c) $(3/5)^{-2} = (5/3)^2 = 25/9$ — 1.5 marks

33. By using suitable properties, find: $2/3 \times 3/5 + 2/3 \times 2/5 - 2/3 \times 1$. *[5]*

OR

By using suitable properties, find: $5/7 \times (-3/4) + 5/7 \times (-1/4) + 5/7 \times 1$.

Marking Scheme / Value Points:

- By the distributive law, factor out 2/3: $2/3 \times (3/5 + 2/5 - 1)$ — 2 marks
- Simplify inside the bracket: $3/5+2/5-1 = 5/5-1 = 1-1 = 0$ — 1.5 marks
- Result = $2/3 \times 0 = 0$ — 1.5 marks

OR (value points):

- By the distributive law, factor out 5/7: $5/7 \times (-3/4 - 1/4 + 1)$ — 2 marks
- Simplify inside the bracket: $-3/4-1/4+1 = -1+1 = 0$ — 1.5 marks
- Result = $5/7 \times 0 = 0$ — 1.5 marks

34. (a) Using the distributive law, expand and simplify: $(x+4)(x+7) - (x+2)(x+3)$. (b) A rectangular garden has length $(2x+5)$ m and breadth $(x+3)$ m. Using distributive multiplication, find an expression for its area in simplest form. *[5]*

OR

(a) Using the distributive law, expand and simplify: $(x+6)(x+2) - (x+1)(x+4)$. (b) A rectangular hall has length $(3x+2)$ m and breadth $(x+4)$ m. Find an expression for its area in simplest form.

Marking Scheme / Value Points:

- (a) $(x+4)(x+7) = x^2+11x+28$; $(x+2)(x+3) = x^2+5x+6$ — 2 marks
- (a) Difference = $(x^2+11x+28) - (x^2+5x+6) = 6x+22$ — 1 mark
- (b) Area = $(2x+5)(x+3) = 2x^2+6x+5x+15 = 2x^2+11x+15$ — 2 marks

OR (value points):

- (a) $(x+6)(x+2) = x^2+8x+12$; $(x+1)(x+4) = x^2+5x+4$ — 2 marks
- (a) Difference = $(x^2+8x+12) - (x^2+5x+4) = 3x+8$ — 1 mark
- (b) Area = $(3x+2)(x+4) = 3x^2+12x+2x+8 = 3x^2+14x+8$ — 2 marks

35. The angles of a quadrilateral are in the ratio 3:4:5:6. (a) Find the measure of each angle. (b) Show that one pair of these (consecutive) angles is supplementary, and explain what this suggests about the quadrilateral possibly being a trapezium. (c) Find the largest angle. *[5]*

OR

The angles of a quadrilateral are in the ratio 2:3:4:6. (a) Find the measure of each angle. (b) Verify that the sum of the angles equals 360°. (c) Find the difference between the largest and smallest angles.

Marking Scheme / Value Points:

- (a) Sum of ratio parts = 3+4+5+6 = 18; each part = 360°/18 = 20°; angles = 60°, 80°, 100°, 120° — 2 marks
- (b) First and fourth angles: 60°+120° = 180°; second and third angles: 80°+100° = 180°. Since both pairs of consecutive angles are supplementary, the sides between them could be parallel, so the quadrilateral could be a trapezium — 2 marks
- (c) The largest angle is 120° — 1 mark

OR (value points):

- (a) Sum of ratio parts = 2+3+4+6 = 15; each part = 360°/15 = 24°; angles = 48°, 72°, 96°, 144° — 2 marks
- (b) Sum = 48°+72°+96°+144° = 360°, which verifies the angle sum property — 1.5 marks
- (c) Largest - smallest = 144° - 48° = 96° — 1.5 marks

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 hall's floor is to be paved with square tiles arranged in a square pattern, and exactly 1225 tiles are used in all, arranged n tiles along each side (n×n tiles). Each tile has a side of 20 cm. The workers later consider whether a bigger tile size would exactly fit the same floor without any cutting.

(i) Is 1225 a perfect square? Find its square root by prime factorisation. *[1]*

Answer: $1225 = 5\times5\times7\times7 = 5^2\times7^2$. Since it is a product of pairs of equal prime factors, 1225 is a perfect square, and $\sqrt{1225} = 5\times7 = 35$.

(ii) Find the area of one tile and the total area covered by all 1225 tiles, in square metres. *[1]*

Answer: One tile: 20 cm × 20 cm = 400 cm^2 = 0.04 m^2. Total area = 1225 × 0.04 = 49 m^2.

(iii) Using n = 35 (from part (i)), find the length of one side of the (square) floor in metres. *[1]*

Answer: Side of floor = 35 × 20 cm = 700 cm = 7 m (which checks out, since 7 m × 7 m = 49 m^2, matching part (ii)).

(iv) The workers want to re-tile the same floor using bigger square tiles of side 25 cm instead, without cutting any tiles. Will the 700 cm side of the floor be exactly covered by a whole number of these bigger tiles? Justify with a calculation. *[1]*

OR If the cost of tiling is ₹150 per square metre, find the total cost of tiling the floor (area 49 m^2, from part (ii)).

Answer: 700 ÷ 25 = 28, which is a whole number, so yes — the floor's side of 700 cm can be exactly covered by 28 tiles of side 25 cm along each side, with no cutting needed.

OR Answer: Total cost = 49 × ₹150 = ₹7,350.

Case Study 2 — Question 37 [4 Marks]

A recipe for a dish serving 5 people needs 250 g of rice, 100 g of dal, and 3 spoons of oil. A family wants to prepare the same dish for 12 people, scaling all the ingredients proportionally using the unitary method.

(i) Write the ratio of the original number of people to the new number of people (5 people to 12 people) in simplest form. *[1]*

Answer: 5:12 — this is already in simplest form since the HCF of 5 and 12 is 1.

(ii) Using the unitary method, find the quantity of rice needed for 12 people. *[1]*

Answer: Rice for 1 person = 250/5 = 50 g; for 12 people = 50 × 12 = 600 g.

(iii) Using the unitary method, find the quantity of dal needed for 12 people. *[1]*

Answer: Dal for 1 person = 100/5 = 20 g; for 12 people = 20 × 12 = 240 g.

(iv) Find the quantity of oil (in spoons) needed for 12 people, given that 3 spoons are needed for 5 people. *[1]*

OR If the family later has only 8 guests instead, find the quantity of rice needed for them using the unitary method.

Answer: Oil for 1 person = 3/5 spoon; for 12 people = (3/5) × 12 = 36/5 = 7.2 spoons.

OR Answer: Rice for 1 person = 50 g; for 8 people = 50 × 8 = 400 g.

Case Study 3 — Question 38 [4 Marks]

A kite-shaped garden ABCD has AB = AD = 10 m and CB = CD = 17 m. The diagonals AC and BD intersect at right angles at point O (a property of a kite), and it is given that AO = 6 m.

(i) State two properties of the diagonals of a kite that apply to this garden. *[1]*

Answer: The diagonals AC and BD intersect at right angles (are perpendicular); diagonal AC bisects diagonal BD (so OB = OD) and also bisects the angles at A and C.

(ii) Using the right triangle AOB (right-angled at O), find the length OB. *[1]*

Answer: $AB^2 = AO^2 + OB^2 \Rightarrow 10^2 = 6^2 + OB^2 \Rightarrow 100 - 36 = 64 \Rightarrow OB = 8$ m.

(iii) Using the right triangle BOC (right-angled at O), where CB = 17 m and OB = 8 m, find the length OC, and hence find the length of diagonal AC. *[1]*

Answer: $OC^2 = CB^2 - OB^2 = 17^2 - 8^2 = 289 - 64 = 225 \Rightarrow OC = 15$ m. Diagonal AC = AO + OC = 6 + 15 = 21 m.

(iv) Find the length of diagonal BD, and hence find the area of the kite-shaped garden using Area = $\frac{1}{2} \times d_1 \times d_2$. *[1]*

OR If fencing wire costs ₹40 per metre and the perimeter of the kite is AB+BC+CD+DA = 10+17+17+10 = 54 m, find the total cost of fencing the garden.

Answer: BD = 2 × OB = 2 × 8 = 16 m. Area = ½ × AC × BD = ½ × 21 × 16 = 168 m^2.

OR Answer: Total cost = 54 × ₹40 = ₹2,160.