KARNATAKA SCHOOL EXAMINATION AND ASSESSMENT BOARD

FIRST SUMMATIVE ASSESSMENT (SA-1) / HALF-YEARLY EXAMINATION — 2026-27

Class: X (SSLC)   Subject: Mathematics

Time: 3 Hours 15 Minutes (including 15 minutes for reading the question paper)
Max. Marks: 80

ANSWER KEY / SCHEME OF VALUATION

Scheme of Valuation — Notes

- Award marks as per the value points listed. Equivalent correct points/expressions may be given full credit.
- Where a question carries an internal choice, evaluate only the part attempted by the candidate.
- For numerical problems, award part marks for correct method/steps even if the final answer is not reached, as indicated.

PART – A

Answer ALL the questions. Each question carries 1 mark.

1. The HCF of 12 and 18 is: *[1]*

(a) 2
(b) 6
(c) 36
(d) 1
Ans: (b) 6

2. The degree of the polynomial $p(x) = 4x^3 - x^2 + 5$ is: *[1]*

(a) 0
(b) 1
(c) 2
(d) 3
Ans: (d) 3

3. The pair of linear equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ has a unique solution if: *[1]*

(a) $a_1/a_2 = b_1/b_2$
(b) $a_1/a_2 \neq b_1/b_2$
(c) $a_1/a_2 = b_1/b_2 = c_1/c_2$
(d) $a_1/a_2 = b_1/b_2 \neq c_1/c_2$
Ans: (b) $a_1/a_2 \neq b_1/b_2$

4. The roots of the quadratic equation $x^2 - 5x + 6 = 0$ are: *[1]*

(a) 1, 6
(b) 2, 3
(c) −2, −3
(d) 5, 6
Ans: (b) 2, 3

5. The common difference of the AP 3, 7, 11, 15, … is: *[1]*

(a) 3
(b) 4
(c) 7
(d) 11
Ans: (b) 4

6. In two similar triangles, the corresponding sides are: *[1]*

(a) equal

(b) proportional
(c) parallel
(d) perpendicular
Ans: (b) proportional

7. Every rational number can be expressed as a terminating decimal or a: *[1]*
(a) terminating decimal only
(b) non-terminating repeating decimal
(c) non-terminating non-repeating decimal
(d) none of these
Ans: (b) non-terminating repeating decimal

8. If the discriminant $b^2 - 4ac = 0$, the quadratic equation has: *[1]*
(a) two distinct real roots
(b) two equal real roots
(c) no real roots
(d) none of these
Ans: (b) two equal real roots

PART – B

Answer ALL the questions. Each question carries 2 marks.

1. Find the HCF and LCM of 6 and 20 by the prime factorisation method. *[2]*
Ans: $6 = 2 \times 3$, $20 = 2^2 \times 5$.
Ans: HCF = 2. LCM = $2^2 \times 3 \times 5 = 60$.

2. Find the zeroes of the polynomial $p(x) = x^2 - 3x - 4$. *[2]*
Ans: $x^2 - 3x - 4 = (x - 4)(x + 1) = 0$
Ans: Zeroes are $x = 4$ and $x = -1$.

3. Check whether the pair of equations $x + 2y = 5$ and $2x + 4y = 10$ is consistent or inconsistent. *[2]*
Ans: $a_1/a_2 = 1/2$, $b_1/b_2 = 2/4 = 1/2$, $c_1/c_2 = 5/10 = 1/2$.
Ans: Since $a_1/a_2 = b_1/b_2 = c_1/c_2$, the pair is consistent with infinitely many solutions (coincident lines).

4. Solve the quadratic equation $x^2 + 2x - 8 = 0$ by factorisation. *[2]*
Ans: $x^2 + 2x - 8 = (x + 4)(x - 2) = 0$
Ans: $x = -4$ or $x = 2$.

5. Find the 10th term of the AP 2, 7, 12, 17, … *[2]*
Ans: $a = 2$, $d = 5$, $n = 10$
Ans: $a_{10} = a + 9d = 2 + 45 = 47$.

6. State the Basic Proportionality Theorem (Thales' Theorem). *[2]*
Ans: If a line is drawn parallel to one side of a triangle intersecting the other two sides at distinct points, the other two sides are divided in the same ratio.

7. Express 0.375 in the form p/q, where p and q are integers and $q \neq 0$. *[2]*
Ans: $0.375 = 375/1000 = 3/8$.

8. If the sum and product of the zeroes of a quadratic polynomial are 4 and 1 respectively, find the polynomial. *[2]*
Ans: $p(x) = x^2 - (\text{sum})x + (\text{product}) = x^2 - 4x + 1$.

PART – C

Answer ALL the questions. Each question carries 3 marks.

1. Prove that $\sqrt{5}$ is an irrational number. *[3]*
Ans: Assume $\sqrt{5}$ is rational, so $\sqrt{5} = p/q$ (in lowest terms, $q \neq 0$, p, q coprime).

Ans: Then $p^2 = 5q^2$, so 5 divides p^2, hence 5 divides p. Let $p = 5m \Rightarrow 25m^2 = 5q^2 \Rightarrow q^2 = 5m^2$, so 5 divides q as well.

Ans: This contradicts p, q being coprime. Hence $\sqrt{5}$ is irrational.

2. Find a quadratic polynomial whose sum and product of zeroes are −3 and 2 respectively, and verify the relationship between the zeroes and the coefficients. *[3]*

Ans: $p(x) = x^2 - (-3)x + 2 = x^2 + 3x + 2 = (x+1)(x+2)$

Ans: Zeroes: −1, −2. Sum = −3 = −(coefficient of x)/(coefficient of x^2) ✓. Product = 2 = constant/(coefficient of x^2) ✓.

3. Solve the pair of linear equations $x + 2y = 8$ and $2x - 3y = 2$ by the elimination method. *[3]*

Ans: Multiply first equation by 2: $2x + 4y = 16$. Subtract second: $7y = 14 \Rightarrow y = 2$.

Ans: Substitute in $x + 2y = 8$: $x = 4$.

Ans: $x = 4$, $y = 2$.

4. Find the roots of the quadratic equation $3x^2 - 2x - 1 = 0$ using the quadratic formula. *[3]*

Ans: $x = [2 \pm \sqrt{(4 + 12)}]/6 = [2 \pm 4]/6$

Ans: $x = 1$ or $x = -1/3$.

5. Which term of the AP 3, 8, 13, 18, … is 78? *[3]*

Ans: a = 3, d = 5. $a_n = 3 + (n-1)5 = 78 \Rightarrow (n-1) = 15 \Rightarrow n = 16$.

Ans: The 16th term is 78.

6. Find the sum of the first 15 terms of the AP 7, 13, 19, … *[3]*

Ans: a = 7, d = 6, n = 15

Ans: $S_{15} = 15/2\ [2(7) + 14(6)] = 15/2\ [14 + 84] = 15/2 \times 98 = 735$.

7. In triangle ABC, DE ∥ BC, D and E lie on AB and AC respectively. If AD = 2 cm, DB = 3 cm and AC = 10 cm, find AE and EC using the Basic Proportionality Theorem. *[3]*

Ans: By BPT, AD/DB = AE/EC ⟹ 2/3 = AE/EC.

Ans: AE + EC = 10. So AE = (2/5)×10 = 4 cm, EC = (3/5)×10 = 6 cm.

8. Use Euclid's Division Algorithm to find the HCF of 210 and 55. *[3]*

Ans: $210 = 55\times3 + 45$

Ans: $55 = 45\times1 + 10$

Ans: $45 = 10\times4 + 5$

Ans: $10 = 5\times2 + 0 \Rightarrow$ HCF = 5.

PART – D

Answer ALL the questions. Each question carries 4 marks.

1. State and prove the Basic Proportionality Theorem (Thales' Theorem). *[4]*

Ans: Statement: If a line is drawn parallel to one side of a triangle intersecting the other two sides at distinct points, the other two sides are divided in the same ratio.

Ans: Proof (outline): In ΔABC, draw DE ∥ BC meeting AB at D and AC at E. Join BE and CD, and draw EM ⊥ AB and DN ⊥ AC.

Ans: ar(ADE)/ar(DBE) = AD/DB and ar(ADE)/ar(ECD) = AE/EC (triangles with equal height, bases AD & DB / AE & EC).

Ans: ar(DBE) = ar(ECD) since ΔDBE and ΔECD lie between the same parallels DE and BC and on the same base DE.

Ans: Hence AD/DB = AE/EC, which proves the theorem.

2. Solve the pair of linear equations $x + y = 7$ and $x - y = 1$ graphically. *[4]*

Ans: For $x + y = 7$: table (0,7), (7,0), (3,4).

Ans: For $x - y = 1$: table (0,−1), (1,0), (4,3).

Ans: The two lines intersect at (4, 3), so x = 4, y = 3.

3. The sum of the first 14 terms of an AP is 1050 and its first term is 10. Find the 20th term of the AP. *[4]*

Ans: $S_{14} = 14/2[2(10) + 13d] = 1050 \Longrightarrow 7[20 + 13d] = 1050 \Longrightarrow 20 + 13d = 150 \Longrightarrow d = 10$.

Ans: $a_{20} = a + 19d = 10 + 190 = 200$.

4. The sum of the squares of two consecutive positive integers is 313. Find the integers. *[4]*

Ans: Let the integers be x and x+1. $x^2 + (x+1)^2 = 313 \Longrightarrow 2x^2 + 2x - 312 = 0 \Longrightarrow x^2 + x - 156 = 0$.

Ans: $(x - 12)(x + 13) = 0 \Longrightarrow x = 12$ (rejecting the negative value).

Ans: The integers are 12 and 13.

5. Prove that in a right triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides (Pythagoras Theorem). *[4]*

Ans: In right ΔABC, right-angled at B, draw $BD \perp AC$.

Ans: $\Delta ADB \sim \Delta ABC$ (AA similarity) $\Longrightarrow AD/AB = AB/AC \Longrightarrow AB^2 = AD \cdot AC$.

Ans: $\Delta BDC \sim \Delta ABC \Longrightarrow CD/BC = BC/AC \Longrightarrow BC^2 = CD \cdot AC$.

Ans: Adding: $AB^2 + BC^2 = AD \cdot AC + CD \cdot AC = AC(AD+CD) = AC \cdot AC = AC^2$. Hence proved.

6. A sum of ₹700 is to be paid in 7 instalments such that each instalment is ₹20 more than the preceding one, the first instalment being ₹40. Find all seven instalments. *[4]*

Ans: $a = 40$, $d = 20$, $n = 7$. Instalments: 40, 60, 80, 100, 120, 140, 160.

Ans: Check: $S_7 = 7/2[2(40)+6(20)] = 7/2[80+120] = 7/2 \times 200 = 700$ ✓.

PART – E

Answer the following question. It carries 8 marks.

1. A motorboat whose speed is 18 km/h in still water takes 1 hour more to go 24 km upstream than to return downstream to the same spot. Find the speed of the stream. *[8]*

Ans: Let the speed of the stream be x km/h. Upstream speed = $(18-x)$ km/h; downstream speed = $(18+x)$ km/h.

Ans: Time upstream − Time downstream = 1 hour: $24/(18-x) - 24/(18+x) = 1$.

Ans: $24(18+x) - 24(18-x) = (18-x)(18+x) \Longrightarrow 48x = 324 - x^2 \Longrightarrow x^2 + 48x - 324 = 0$.

Ans: Using the quadratic formula: $x = [-48 \pm \sqrt{(2304+1296)}]/2 = [-48 \pm 60]/2 \Longrightarrow x = 6$ (rejecting the negative value).

Ans: The speed of the stream is 6 km/h.