STD 10 Maths First Term exam Answer Key

Summative Assessment I (2026-27) — Standard X — Mathematics

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Code: E-1003 (A-E-1003) | **Time: 2½ Hours** | **Total Score: 80 Marks**

SECTION A — (Scores: 8 × 1 = 8 Marks)

Q1. The 5^{th} term of the arithmetic sequence 1, 11, 21, ... [1 Mark]

First term $a = 1$, common difference $d = 11 - 1 = 10$.

$x_5 = a + 4d = 1 + 4(10) = 41$.

Answer: A. 41

Q2. In the circle with centre O, ∠COB = 70°. Find ∠CAB. [1 Mark]

Angle subtended by arc BC at the centre is ∠COB = 70°. The angle subtended on the alternate arc is half the central angle.

$\angle CAB = \frac{1}{2} \times \angle COB = \frac{1}{2} \times 70° = 35°$.

Answer: A. 35°

Q3. Algebraic form is $4n - 3$. To get its 21^{st} term from the 20^{th} term: [1 Mark]

The common difference of sequence with algebraic form $x_n = dn + c$ is $d = 4$.

To get the next consecutive term (x_{21} from x_{20}), add the common difference 4.

Answer: C. add 4

Q4. Side increased by 3 cm makes area 64 cm². Original side length: [1 Mark]

Let side of original square be x. New side = $x + 3$.

Area = $(x + 3)^2 = 64 \Rightarrow x + 3 = 8 \Rightarrow x = 5$ cm.

Answer: D. 5

Q5. P, Q, R are midpoints of sides of ΔABC. Probability that dot falls in parallelogram APQR: [1 Mark]

Joining midpoints divides ΔABC into 4 congruent triangles of equal area.

Parallelogram APQR consists of 2 such triangles (ΔAPR + ΔPQR).

$P(APQR) = 2/4 = 1/2$.

Answer: C. 1/2

Q6. Letters of MATHEMATICS in a box. Identify true statements: [1 Mark]

Total letters = 11 (M:2, A:2, T:2, H:1, E:1, I:1, C:1, S:1).

(i) P(M) = 2/11 (True) | (ii) P(E) = 1/11 (False) | (iii) P(not A) = 1 - 2/11 = 9/11 (True) | (iv) P(not C) = 1 - 1/11 = 10/11 (False).

Statements (i) and (iii) are true.

Answer: (D) (i) and (iii) are true.

Q7. Statements on circle angles: [1 Mark]

Statement I: ∠AOB = 40° ⇒ ∠ACB = 20° (True, angle at circle is half central angle).

Statement II: In a cyclic quadrilateral, opposite angles sum to 180° (True statement, but NOT the reason for Statement I).

Answer: D. Both statements are true. Statement II is not the reason of Statement I.

Q8. **Statements on arithmetic sequences:** [1 Mark]

Statement I: $x_5 + x_7 = 90 \Rightarrow x_6 = 90/2 = 45$ (True).

Statement II: Sum of terms equidistant from a middle term is twice that term (True, and directly explains Statement I).

Answer: C. Both statements are true. Statement II is the reason of Statement I.

SECTION B — (Questions 9 to 15)

Q9. A **Arithmetic sequence: $x_5 = 40, x_9 = 22$.** [3 Marks]

- Term difference: $x_9 - x_5 = 4d \Rightarrow 22 - 40 = -18 \Rightarrow d = -18/4 = -4.5$
- (i) First term: $x_1 = x_5 - 4d = 40 - 4(-4.5) = 40 + 18 = 58$. **[2 Marks]**
- (ii) 7^{th} term: $x_7 = (x_5 + x_9)/2 = (40 + 22)/2 = 62/2 = 31$ (or $58 + 6(-4.5) = 31$). **[1 Mark]**

— OR —

Q9. B **Arithmetic sequence: $x_1 = 15, S_5 = 135$.** [3 Marks]

- (i) For 5 terms, middle term is x_3: $S_5 = 5 \times x_3 \Rightarrow 135 = 5x_3 \Rightarrow x_3 = 27$. **[1 Mark]**
- (ii) Common difference $2d = x_3 - x_1 = 27 - 15 = 12 \Rightarrow d = 6$.
  First 5 terms: $15, 21, 27, 33, 39$. **[2 Marks]**

Q10. **Probability of dot falling in shaded region (large circle radius R, two semicircles with diameter = radius R):** [2 Marks]

- **Answer: Let the radius of the large circle be R. Each semicircle has radius R/2. Area of two semicircles =**
- **$2\times(1/2)\pi(R/2)^2 = \pi R^2/4$. Shaded area = $\pi R^2 - \pi R^2/4 = 3\pi R^2/4$. Probability = shaded area / whole area = 3/4**

Q11. **Arithmetic sequence 3, 7, 11, ... ($a = 3, d = 4$)** [3 Marks]

- (i) Check 2026: The algebraic form is $x_n = 4n - 1$ (or terms leave remainder 3 when divided by 4).
  $2026 / 4 = 506$ with remainder 2. Since the remainder is 2 (not 3), **2026 is NOT a term**. **[2 Marks]**
- (ii) Position of 211: $4n - 1 = 211 \Rightarrow 4n = 212 \Rightarrow n = 53$. Position is 53^{rd} term. **[1 Mark]**

Q12. **Bag with 12 black beads and some white beads. $P(White) = 3/5$.** [4 Marks]

- (i) $P(Black) = 1 - 3/5 = 2/5$. **[1 Mark]**
- (ii) Total beads N: $P(Black) = 12/N = 2/5 \Rightarrow 2N = 60 \Rightarrow N = 30$ beads.
  (Number of white beads = $30 - 12 = 18$). **[2 Marks]**
- (iii) Let k black beads be added. For $P(White) = 1/2$, total beads must be $2 \times 18 = 36$.
  New black beads = $18 \Rightarrow k = 18 - 12 = 6$ more black beads. **[1 Mark]**

Q13. A Sum of first 5 terms is 110 and sum of first 9 terms is 270. [4 Marks]

- (i) Middle term of first 5 terms: $x_3 = S_5 / 5 = 110 / 5 = 22$. **[1 Mark]**
- (ii) Middle term of first 9 terms: $x_5 = S_9 / 9 = 270 / 9 = 30$. **[1 Mark]**
- (iii) $2d = x_5 - x_3 = 30 - 22 = 8 \Rightarrow d = 4$.
  Middle term of first 13 terms is $x_7 = x_5 + 2d = 30 + 8 = 38$.
  $S_{13} = 13 \times x_7 = 13 \times 38 = 494$. **[2 Marks]**

— OR —

Q13. B Sum of terms from 4^{th} to 6^{th} is 75; sum of terms from 14^{th} to 18^{th} is 350. [4 Marks]

- (i) Sum of 3 terms $(x_4 + x_5 + x_6) = 3x_5 = 75 \Rightarrow x_5 = 25$. **[1 Mark]**
- (ii) Sum of 5 terms $(x_{14} + ... + x_{18}) = 5x_{16} = 350 \Rightarrow x_{16} = 70$. **[1 Mark]**
- (iii) $11d = x_{16} - x_5 = 70 - 25 = 45 \Rightarrow d = 45/11$.
  $x_1 = x_5 - 4d = 25 - 4(45/11) = 25 - 180/11 = 95/11$.
  $S_{20} = 20/2\ [2x_1 + 19d] = 10\ [2(95/11) + 19(45/11)] = 10\ [(190 + 855)/11] = 10 \times (1045/11) = 10 \times 95 = 950$. **[2 Marks]**

Q14. A Box 1: {1, 2, 3, 4, 5}, Box 2: {2, 3, 5}. One slip drawn from each. [4 Marks]

- (i) Total possible pairs = $5 \times 3 = 15$ pairs. **[1 Mark]**
- (ii) Pairs with sum as prime: (1,2)=3, (1,-), (2,3)=5, (2,5)=7, (3,2)=5, (4,3)=7, (5,2)=7 ⇒ 6 pairs: {(1,2), (2,3), (2,5), (3,2), (4,3), (5,2)}.
  Probability = 6/15 = 2/5. **[2 Marks]**
- (iii) Product is a multiple of 5 (pair has at least one 5):
  Pairs: (1,5), (2,5), (3,5), (4,5), (5,2), (5,3), (5,5) ⇒ 7 pairs.
  Probability = 7/15. **[1 Mark]**

— OR —

Q14. B 10A: 25 boys, 20 girls (Total 45). 10B: 30 boys, 20 girls (Total 50). [4 Marks]

- (i) Total pairs = $45 \times 50 = 2250$. **[1 Mark]**
- (ii) Both girls = $20 \times 20 = 400 \Rightarrow P(\text{both girls}) = 400/2250 = 8/45$. **[1 Mark]**
- (iii) One boy and one girl = $(25 \times 20) + (20 \times 30) = 500 + 600 = 1100$.
  Probability = 1100/2250 = 22/45. **[1 Mark]**
- (iv) At least one boy = $1 - P(\text{both girls}) = 1 - 8/45 = 37/45$. **[1 Mark]**

Q15. $x_1 + x_{21} = 180,\ x_4 = 34$. [4 Marks]

- (i) Middle term $x_{11} = (x_1 + x_{21}) / 2 = 180 / 2 = 90$. **[1 Mark]**
- (ii) $x_4 + x_{18} = x_1 + x_{21} = 180 \Rightarrow 34 + x_{18} = 180 \Rightarrow x_{18} = 146$. **[1 Mark]**
- (iii) $7d = x_{11} - x_4 = 90 - 34 = 56 \Rightarrow d = 8$.
  $x_1 = x_4 - 3d = 34 - 24 = 10$.
  $S_{28} = 28/2 \times [2(10) + 27(8)] = 14 \times [20 + 216] = 14 \times 236 = 3304$. **[2 Marks]**

SECTION C — (Questions 16 to 21)

Q16. Algebraic form is $x_n = 3n + 2$. [3 Marks]

- (i) Sequence: For $n = 1, 2, 3, 4, ...$: $5, 8, 11, 14, ...$ **[1 Mark]**
- (ii) The terms of this sequence leave a remainder of 2 when divided by 3.
  Any integer k is of the form $3m, 3m+1$, or $3m+2$.
  Their squares are: $(3m)^2 = 9m^2 = 3(3m^2)$ (remainder 0); $(3m\pm1)^2 = 9m^2 \pm 6m + 1 = 3(3m^2 \pm 2m) + 1$ (remainder 1).
  A perfect square can only leave remainder 0 or 1 upon division by 3, never remainder 2. Hence, this sequence contains **no perfect squares**. **[2 Marks]**

Q17. One added to product of two consecutive odd numbers is 196. [3 Marks]

- (i) Let the consecutive odd numbers be $2x - 1$ and $2x + 1$ (or x and $x + 2$).
  Equation: $x(x + 2) + 1 = 196 \Rightarrow x^2 + 2x + 1 = 196 \Rightarrow (x + 1)^2 = 196$. **[1 Mark]**
- (ii) $x + 1 = \sqrt{196} = 14 \Rightarrow x = 13$.
  The numbers are 13 and 15 (or -15 and -13). **[2 Marks]**

Q18. Arithmetic sequence: 5, 9, 13, ... ($a = 5, d = 4$) [4 Marks]

- (i) Algebraic form: $x_n = dn + (a - d) = 4n + (5 - 4) = 4n + 1$. **[1 Mark]**
- (ii) 25^{th} term: $x_{25} = 4(25) + 1 = 101$. **[1 Mark]**
- (iii) Sum of first 25 terms: $S_{25} = 25/2 \times (x_1 + x_{25}) = 25/2 \times (5 + 101) = 25/2 \times 106 = 25 \times 53 = 1325$. **[2 Marks]**

Q19. A Sum sequences: [4 Marks]

- (i) $1 + 2 + 3 + ... + 20 = (20 \times 21) / 2 = 210$. **[1 Mark]**
- (ii) $3 + 6 + 9 + ... + 60 = 3(1 + 2 + ... + 20) = 3 \times 210 = 630$. **[1 Mark]**
- (iii) For $x_n = 3n + 1$, $S_{20} = \sum(3n + 1) = 3\sum n + 20(1) = 630 + 20 = 650$. **[2 Marks]**

— OR —

Q19. B Differences in sums of arithmetic sequences: [4 Marks]

- (i) Term-by-term difference between 11, 17, 23... and 4, 10, 16... is $11 - 4 = 7$, $17 - 10 = 7$, etc.
  Difference for 15 terms = $15 \times 7 = 105$. **[2 Marks]**
- (ii) For $x_n = 5n + 3$, $d = 5$.
  Difference between next 10 terms (x_{11} to x_{20}) and first 10 terms (x_1 to x_{10}):
  Each corresponding pair difference is $x_{n+10} - x_n = 10d = 10(5) = 50$.
  Total difference = $10 \times 50 = 500$ (or $10^2 \times d = 100 \times 5 = 500$). **[2 Marks]**

Q20. Multiples of 6 between 100 and 400: [5 Marks]

- (i) First term = 102 (since 102/6 = 17); Last term = 396 (since 396/6 = 66). **[2 Marks]**
- (ii) Number of terms: $n = (Last - First)/d + 1 = (396 - 102)/6 + 1 = 294/6 + 1 = 49 + 1 = 50$ terms. **[1 Mark]**
- (iii) Sum = $n/2 \times (First + Last) = 50/2 \times (102 + 396) = 25 \times 498 = 12450$. **[2 Marks]**

Q21. A Arithmetic sequence: $x_n = 6n + 2$ [5 Marks]

- (i) When $6n + 2$ is divided by 6, the quotient is n and the **remainder is 2**. **[1 Mark]**
- (ii) Difference between any two terms is a multiple of the common difference $d = 6$.
  Checking 192: $192 / 6 = 32$ (an integer). **Yes, 192 can be a difference** (it is the difference between terms separated by 32 positions, e.g., $x_{33} - x_1$). **[2 Marks]**
- (iii) Sum of first n terms: $S_n = n/2\ [x_1 + x_n] = n/2\ [8 + (6n + 2)] = n/2\ [6n + 10] = 3n^2 + 5n$. **[2 Marks]**

— OR —

Q21. B Sum of first n terms is $S_n = 5n^2 - 2n$. [5 Marks]

- (i) Sum of first 10 terms: $S_{10} = 5(10)^2 - 2(10) = 500 - 20 = 480$. **[1 Mark]**
- (ii) $x_1 = S_1 = 5(1)^2 - 2(1) = 3$.
  $S_2 = 5(4) - 2(2) = 16 \Rightarrow x_2 = S_2 - S_1 = 16 - 3 = 13$.
  $S_3 = 5(9) - 2(3) = 39 \Rightarrow x_3 = S_3 - S_2 = 39 - 16 = 23$.
  First three terms: **3, 13, 23**. **[2 Marks]**
- (iii) Common difference $d = 13 - 3 = 10$. Algebraic form: $x_n = dn + (x_1 - d) = 10n + (3 - 10) = 10n - 7$. **[2 Marks]**

SECTION D — (Questions 22 to 26)

Q22. Circle with centre O, ∠ABO = 25°, ∠BCO = 40°. [3 Marks]

- (i) In ΔOBC, $OB = OC$ (radii) ⇒ ΔOBC is isosceles.
  Therefore, **∠CBO = ∠BCO = 40°**. **[1 Mark]**
- (ii) ∠ABC = ∠ABO + ∠CBO = 25° + 40° = 65°.
  In ΔOBC, ∠BOC = 180° - (40° + 40°) = 100°. Also, in ΔOAB, $OA = OB$ ⇒ ∠BAO = 25°, so ∠AOB = 180° - 50° = 130°.
  Central angle of arc BC is ∠BOC = 100°. Thus, angle on circle **∠CAB = ½ × ∠BOC = ½ × 100° = 50°**. **[1 Mark]**
- (iii) In ΔABC, the sum of angles is 180°:
  ∠ACB = 180° - (∠CAB + ∠ABC) = 180° - (50° + 65°) = 180° - 115° = 65°. **[1 Mark]**

Q23. A Theorem: Prove that the outer angle at any vertex of a cyclic quadrilateral is equal to the inner angle at the opposite vertex. [3 Marks]

- Let ABCD be a cyclic quadrilateral. Let the side AB be extended to a point E, forming outer angle ∠CBE.
- Since opposite angles of a cyclic quadrilateral are supplementary: $\angle ADC + \angle ABC = 180° \Rightarrow \angle ADC = 180° - \angle ABC$.
- Angles on a straight line (linear pair) are supplementary: $\angle CBE + \angle ABC = 180° \Rightarrow \angle CBE = 180° - \angle ABC$.
- Comparing the two equations: **∠CBE = ∠ADC** (Outer angle at vertex B equals inner angle at opposite vertex D).
  Hence proved. **[3 Marks]**

— OR —

Q23. B Three circles intersecting in order: Prove ABCD is cyclic. [3 Marks]

- In the left circle, ABQP is cyclic ⇒ Outer angle at P: $\angle QPR = \angle B$ (or $\angle A + \angle P_{in} = 180°$).
- In the middle circle, PQSR is cyclic ⇒ Outer angle at R: $\angle SRD = \angle QPR = \angle B$.
- In the right circle, RSCD is cyclic ⇒ The sum of opposite angles: $\angle SRD + \angle C = 180°$.
  Substituting $\angle SRD = \angle B$ gives: $\angle B + \angle C = 180°$.
- Similarly, tracing angles at the top line gives $\angle A + \angle D = 180°$ and $\angle A + \angle C = 180°$ (opposite angles of quadrilateral ABCD).
  Since the sum of opposite angles of ABCD is 180°, **ABCD is a cyclic quadrilateral**. Hence proved. **[3 Marks]**

Q24. A Chords AB and CD intersect at P inside circle. ∠ABD = 20°, ∠APC = 110°. [4 Marks]

- (i) Angles in the same segment subtended by arc AD are equal: **∠ACD = ∠ABD = 20°**. **[1 Mark]**
- (ii) In ΔBPD, angle ∠APC and ∠BPD are vertically opposite: ∠BPD = 110°.
  In ΔBPD: **∠CDB (or ∠PDB) = 180° - (110° + 20°) = 50°**. **[1 Mark]**
- (iii) Central angle of arc AMD = $2 \times \angle ACD = 2 \times 20° = 40°$.
  Central angle of arc BNC = $2 \times \angle CDB = 2 \times 50° = 100°$ (subtended by arc BNC at point D on circle).
  Sum of central angles = 40° + 100° = 140° (or $2 \times (180° - 110°) = 140°$). **[2 Marks]**

— OR —

Q24. B Chords PS and QR extended to B. Central angle ∠POQ = 130°. [4 Marks]

- (i) ∠PSQ is subtended by arc PQ at circle: **∠PSQ = ½ × ∠POQ = ½ × 130° = 65°**. **[1 Mark]**
- (ii) Similarly, ∠PRQ = ½ × 130° = 65°. On straight line QRB, **∠PRB = 180° - 65° = 115°**. **[1 Mark]**
- (iii) In ΔSAB, the exterior angle at S of cyclic quad PQRS satisfies $\angle ASB = \angle PQR$.
  Using property of intersecting lines/angles: $\angle RAS = 180° - \angle PAQ$ and ∠SBR is angle between secants.
  Since ∠PSQ = 65° and ∠QPR = ∠QSR, in ΔSAB & ΔRAB, $\angle RAS + \angle SBR = \angle PSQ + \angle PRQ = 65° + 65° = 130°$. **[2 Marks]**

Q25. Circle with centre O, AC is diameter, ∠ACD = 70°, ∠ADB = 55°. [5 Marks]

- (i) Since AC is a diameter, ∠ADC is an angle in a semicircle: **∠ADC = 90°**. **[1 Mark]**
- (ii) In right ΔADC: **∠CAD = 180° - (90° + 70°) = 20°**. **[1 Mark]**
- (iii) Angles in the same segment subtended by arc AB are equal: **∠ACB = ∠ADB = 55°**.
  Also in right ΔABC (∠ABC = 90°), ∠BAC = 90° - 55° = 35°.
  Angle ∠CBD is subtended by arc CD: **∠CBD = ∠CAD = 20°**. **[1 Mark]**
- (iv) ∠DAB = ∠CAD + ∠BAC = 20° + 35° = 55°.
  On line segment extending to E (linear pair with ∠BAC or cyclic quad outer angle):
  If line CA is extended to E: **∠BAE = 180° - ∠BAC = 180° - 35° = 145°** (or if DA extended, $180° - 55° = 125°$). **[2 Marks]**

Q26. Draw a triangle with circumradius 3.5 cm and two angles 52½° and 65°. [5 Marks]

Step	Construction Details & Mathematical Principle
1. Calculate Third Angle	Third angle = $180° - (52.5° + 65°) = 180° - 117.5° = 62.5°$ (or $62½°$).
2. Calculate Central Angles	The central angle subtended by each side is twice the opposite angle of the triangle: • Arc 1 central angle = $2 \times 52.5° = 105°$ • Arc 2 central angle = $2 \times 65° = 130°$ • Arc 3 central angle = $2 \times 62.5° = 125°$ *(Check: 105° + 130° + 125° = 360°)*
3. Draw Circumcircle	With any point O as centre, draw a circle of radius $R = 3.5 ext{ cm}$. Draw a radius OA.
4. Subtend Angles at Centre	Using a protractor at centre O: • Draw radius OB such that $\angle AOB = 105°$. • Draw radius OC such that $\angle BOC = 130°$ (the remaining angle ∠COA will automatically be $125°$).
5. Form the Triangle	Join AB, BC, and CA to get the required ΔABC. **Verification:** ∠ACB = ½ × 105° = 52½°, ∠BAC = ½ × 130° = 65°, and ∠ABC = 62½°.
