Mind Curve Mid-Term Test Series 2026–27

Class X | Test 02 – Answer Key

Chapters 3–5: Pair of Linear Equations in Two Variables, Quadratic Equations & Arithmetic Progression

Q.No	Step-by-Step Solution	Marks per Step
SECTION – A (Q1–10, 1 mark each)		
1	**Q1** For rational roots, the discriminant D = $k^2 - 4(2)(-4) = k^2 + 32$ must be a perfect square Try k = ±2: D = 4 + 32 = 36 = 6^2, a perfect square — the smallest such |k| Roots $= \frac{-k \pm 6}{4}$ which are then rational **Answer: (c) ±2**	*1 mark for the correct option.*
2	**Q2** D = $b^2 - 4ac = (-2)^2 - 4(3)(c) = 4 - 12c$ Given D = 16: 4 − 12c = 16 ⇒ −12c = 12 ⇒ c = −1 **Answer: (c) −1**	*1 mark for the correct option.*
3	**Q3** Equal zeroes ⇒ discriminant = 0, and both zeroes equal −b/2a Product of zeroes = c/a = $(-b/2a)^2 \geq 0$, so c/a is never negative Since c ≠ 0, the zero itself is non-zero, so c/a > 0 strictly, meaning c and a have the same sign **Answer: (d) c and a have same signs**	*1 mark for the correct option.*
4	**Q4** $S_n = \frac{n}{2}(a + a_n) = \frac{n}{2}(7 + 84)$ So $S_n = \frac{91n}{2}$ Given $S_n = \frac{2093}{2}$ Equating: 91n = 2093 ⇒ n = 23 **Answer: (c) 23**	*1 mark for the correct option.*
5	**Q5** For $kx^2 + 6x + 1 = 0$ to be quadratic with real, distinct roots, need k ≠ 0 and D > 0 D = 36 − 4k > 0 ⇒ k < 9 **Answer: (b) k < 9**	*1 mark for the correct option.*
6	**Q6** x + 2 = 0 ⇒ x = −2 (a vertical line); y = 3 (a horizontal line) Their intersection is (−2, 3) **Answer: (d) (−2, 3)**	*1 mark for the correct option.*
7	**Q7** As printed, $S_n = n(4n^2 + 1)$ is cubic in n (= $4n^3$+n); this is impossible for an AP, since S_n must always be a quadratic expression in n with no constant term	*1 mark for the correct option.*

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	SECTION – A (Q1–10, 1 mark each)	
	The valid reading is $S_n = n(4n+1) = 4n^2 + n$ $a_1 = S_1$ = 4(1)+1 = 5 S_2 = 4(4)+2 = 18, so $a_2 = S_2 - a_1$ = 18 − 5 = 13 **Answer: a_2 = 13** *Note: The printed formula Sn=n(4n²+1) is not mathematically valid for an AP (it's cubic in n). Reading it as Sn=n(4n+1) gives a2=13, which does not match any of the four printed options — two of which are both printed as '18' (likely a typo where one option should have read '13'). The value above is the mathematically correct one for this reading of the question.*	
8	**Q8** Writing both equations in standard form: 3x+y−1=0 and (2k−1)x+(k−1)y−(2k+1)=0 For no solution (inconsistent): $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ First ratio: $\frac{3}{2k-1}$ equals second ratio: $\frac{1}{k-1}$ Cross-multiplying: 3(k−1) = 2k−1 ⇒ 3k−3=2k−1 ⇒ k=2 Checking at k=2: $\frac{a_1}{a_2} = \frac{3}{3} = 1,\ \frac{b_1}{b_2} = \frac{1}{1} = 1,\ \frac{c_1}{c_2} = \frac{1}{5}$ — the third ratio differs, confirming no solution **Answer: (d) 2**	*1 mark for the correct option.*
9	**Q9** f(x) = x^2−2x+2: discriminant = $(−2)^2$−4(1)(2) = 4−8 = −4 < 0 Since D < 0, f(x) has no real zeroes at all, so Assertion (A) is FALSE Reason (R) — a quadratic polynomial can have at most two real zeroes — is a correct general statement, so R is TRUE **Answer: (d) A is false but R is true**	*1 mark for the correct option.*
10	**Q10** Expand LHS: $(3x−4)^2$−2 = $9x^2$−24x+16−2 = $9x^2$−24x+14 Expand RHS: $5x^2$+$(2x+1)^2$ = $5x^2$+$4x^2$+4x+1 = $9x^2$+4x+1 Equating: $9x^2$−24x+14 = $9x^2$+4x+1 ⇒ the x^2 terms cancel, leaving −24x+14=4x+1, a LINEAR equation So the given equation is NOT quadratic — Assertion (A) is FALSE Reason (R) correctly defines a quadratic equation in general — R is TRUE **Answer: (d) A is false but R is true**	*1 mark for the correct option.*
	SECTION – B (Q11–13, 2 marks each)	
11(A)	**Q11(A)** Standard form: 3x+y−1=0 and (2k−1)x+(k−1)y−(2k+1)=0 No solution ⇒ $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ $\frac{3}{2k-1} = \frac{1}{k-1}$ ⇒ 3(k−1)=2k−1 ⇒ k=2	*1 mark for forming the equation in k* *1 mark for the value of k.*

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	SECTION – A (Q1–10, 1 mark each)	
	Checking the third ratio at k=2 confirms it differs from 1, so k=2 does give no solution **Answer: k = 2**	
11(B)	**Q11(B)** Standard form: $kx+3y-(k-3)=0$ and $12x+ky-k=0$ Infinitely many solutions ⇒ $k/12 = 3/k = (3-k)/(-k)$ $\frac{k}{12} = \frac{3}{k}$ ⇒ $k^2=36$ ⇒ $k=\pm 6$ Checking k=6: all three ratios equal 1/2 — valid Checking k=−6: first two ratios equal −1/2, but the third ratio works out to 3/2 — invalid **Answer: k = 6**	*1 mark for forming the equation in k* *1 mark for the value of k (with the k=−6 case correctly rejected).*
12	**Q12** Using the quadratic formula on $4x^2-4a^2x+(a^4-b^4)=0$: $x = \frac{4a^2 \pm \sqrt{16a^4 - 16(a^4-b^4)}}{8}$ $x = \frac{4a^2 \pm \sqrt{16b^4}}{8} = \frac{4a^2 \pm 4b^2}{8}$ **Answer:** $x = \frac{a^2+b^2}{2}$ **or** $x = \frac{a^2-b^2}{2}$	*1 mark for applying the quadratic formula correctly* *1 mark for both values of x.*
13(A)	**Q13(A)** AP: a=108, d=2. $S_n = (n/2)[2a+(n-1)d] = (n/2)[216+2(n-1)] = n(107+n)$ Set $S_n=1170$: $n^2+107n-1170=0$ Discriminant = $107^2+4(1170) = 11449+4680 = 16129 = 127^2$ $n = \frac{-107+127}{2} = 10$ (the negative root is rejected) **Answer: n = 10**	*1 mark for forming the quadratic in n* *1 mark for the value of n.*
13(B)	**Q13(B)** Multiples of 3 between 1 and 200: 3, 6, 9, ..., 198 $n = \frac{198-3}{3} + 1 = 66$ $\text{Sum} = \frac{n}{2}(a+l) = \frac{66}{2} \times (3+198) = 33 \times 201 = 6633$ **Answer: 6633**	*1 mark for finding n* *1 mark for the sum.*
	SECTION – C (Q14–15, 3 marks each)	
14(A)	**Q14(A)** Let the train's usual speed be x km/h and usual time be y hours, so distance = xy Speed 6 km/h faster, time 4 hours less: $(x+6)(y-4) = xy$ ⇒ $6y - 4x - 24 = 0$ ⇒ $3y - 2x = 12$ ...(i) Speed 6 km/h slower, time 6 hours more: $(x-6)(y+6) = xy$ ⇒ $6x - 6y - 36 = 0$ ⇒ $x - y = 6$ ...(ii) From (ii): $y = x-6$. Substituting into (i): $3(x-6) - 2x = 12$ ⇒ $x - 18 = 12$ ⇒ $x = 30$	*1 mark for each equation (2 marks total)* *1 mark for the final distance.*

Q.No	Step-by-Step Solution	Marks per Step
	SECTION – A (Q1–10, 1 mark each)	
	Then y = 30−6 = 24, so distance = xy = 30×24 = 720 km **Answer: Length of the journey = 720 km**	
14(B)	**Q14(B)** Let lot A have x chocolates and lot B have y chocolates Scenario 1: $\frac{2}{3}x + 1 \cdot y = 400 \;\Rightarrow\; 2x + 3y = 1200$ ...(i) Scenario 2: $1 \cdot x + \frac{4}{5}y = 460 \;\Rightarrow\; 5x + 4y = 2300$ ...(ii) Multiply (i) by 4 and (ii) by 3: 8x+12y=4800 and 15x+12y=6900 Subtracting: 7x = 2100 ⇒ x = 300, then from (i): 3y=1200−600=600 ⇒ y=200 **Answer: Total chocolates = x+y = 300+200 = 500**	*1 mark for each equation (2 marks total)* *1 mark for the total.*
15	**Q15** $u = \frac{2x-1}{x+3}$, so the equation becomes $2u - \frac{3}{u} = 5$ Multiplying by u: $2u^2 - 5u - 3 = 0$ Discriminant = 25+24 = 49, so $u = \frac{5 \pm 7}{4}$ ⇒ u = 3 or u = −1/2 Case u=3: $\frac{2x-1}{x+3} = 3$ ⇒ 2x−1=3x+9 ⇒ x=−10 Case u=−1/2: $\frac{2x-1}{x+3} = -\frac{1}{2}$ ⇒ 4x−2=−x−3 ⇒ 5x=−1 ⇒ x=−1/5 Both values avoid the excluded x=−3, 1/2 **Answer: x = −10 or** $x = -\frac{1}{5}$	*1 mark for the substitution u=(2x−1)/(x+3)* *1 mark for solving the quadratic in u* *1 mark for both values of x.*
	SECTION – D (Q16–17, 4 marks each)	
16	**Q16** **(i) & (ii)** Let the fast train's speed be x km/h, so the slow train's speed is (x−10) km/h Time for fast train = 600/x; time for slow train = 600/(x−10) Fast train takes 3 hours less: $\frac{600}{x-10} - \frac{600}{x} = 3$ 600 × [10 / (x(x−10))] = 3 ⇒ 6000 = 3(x²−10x) ⇒ x²−10x−2000=0 Discriminant = 100+8000=8100=90² ⇒ x=(10+90)/2=50 (rejecting the negative root) **Answer: Speed of fast train = 50 km/h; speed of slow train = x−10 = 40 km/h** **(iii)(A)** Time for the slow train to cover 600 km = $\frac{600}{40} = 15 \text{ hours}$ **Answer: 15 hours** **(iii)(B) — OR**	*1 mark for the speed of the slow train* *1 mark for the speed of the fast train* *2 marks for the time (iii)(A) or (iii)(B).*

Q.No	Step-by-Step Solution	Marks per Step
SECTION – A (Q1–10, 1 mark each)		
	Time for the fast train to cover 600 km = $\frac{600}{50} = 12 \text{ hours}$ **Answer: 12 hours**	
17	**Q17** **(i) & (ii)** Let the AP be a, a+d, a+2d, ... where a = first year's production, d = yearly increase a_6 = a+5d = 800; a_9 = a+8d = 1130 Subtracting: 3d = 330 ⇒ d = 110 From a_6: a = 800 − 5(110) = 250 **Answer: First year's production a = 250 rollers; yearly increase d = 110 rollers** **(iii)(A)** a_n = a+(n−1)d = 250+(n−1)(110) = 1350 (n−1)(110) = 1100 ⇒ n−1=10 ⇒ n=11 **Answer: The 11th year** **(iii)(B) — OR** a_8 = a+7d = 250+7(110) = 250+770 **Answer: 1020 rollers**	*1 mark for the first year's production* *1 mark for the yearly increase* *2 marks for (iii)(A) or (iii)(B).*
SECTION – E (Q18–19, 5 marks each)		
18	**Q18** 2x−y=1: when x=0, y=−1 (point (0,−1)); when y=0, x=0.5 (point (0.5,0)) x+2y=13: when x=0, y=6.5 (point (0,6.5)); when y=0, x=13 (point (13,0)) Plotting both lines, they intersect at the point found by solving algebraically: from 2x−y=1, y=2x−1; substituting into x+2y=13 gives x+2(2x−1)=13 ⇒ 5x=15 ⇒ x=3, y=5 The triangle formed with the y-axis has vertices (3,5), (0,−1), and (0,6.5) Base (along the y-axis) = 6.5−(−1) = 7.5; height (perpendicular distance from (3,5) to the y-axis) = 3 $\text{Area} = \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 7.5 \times 3 = 11.25 \text{ sq units}$ **Answer: Solution from the graph: (3, 5); area of the triangle = 11.25 sq units**	*1 mark for each table of values (2 marks)* *1 mark for the correct graph and intersection point* *2 marks for the area.*
19(A)	**Q19(A)** $S_4 = \frac{4}{2}(2a+3d) = 40 \Rightarrow 2a+3d = 20$ ...(i) $S_{14} = \frac{14}{2}(2a+13d) = 280 \Rightarrow 2a+13d = 40$ ...(ii) Subtracting (i) from (ii): 10d=20 ⇒ d=2 From (i): 2a+6=20 ⇒ a=7 $S_n = \frac{n}{2}[2a+(n-1)d] = n(n+6)$ **Answer:** $S_n = n^2 + 6n$	*1 mark for each equation (2 marks)* *1 mark for a and d* *1 mark for the formula for Sn.*

Q.No	Step-by-Step Solution	Marks per Step
SECTION – A (Q1–10, 1 mark each)		
19(B)	**Q19(B)** Given: $m \cdot a_m = n \cdot a_n$, where a_m=a+(m−1)d, a_n=a+(n−1)d m[a+(m−1)d] = n[a+(n−1)d] a(m−n) + d[m(m−1)−n(n−1)] = 0 m(m−1)−n(n−1) = (m^2−n^2)−(m−n) = (m−n)(m+n)−(m−n) = (m−n)(m+n−1) So a(m−n) + d(m−n)(m+n−1) = 0 ⇒ (m−n)[a+d(m+n−1)] = 0 Since m ≠ n, we must have a + d(m+n−1) = 0, which is exactly the formula for a_{m+n} (the (m+n)th term) **Answer:** $a_{m+n} = 0$ **(hence proved)**	*2 marks for setting up m·am=n·an* *2 marks for factoring correctly* *1 mark for the conclusion.*

Prepared by Deepika Bhati | Infinity Think Beyond