MIND CURVE — Half Yearly Maths Practice Paper Series 2026-27

CLASS X — TERM 1 — PRACTICE PAPER 02

ANSWER KEY WITH FULL STEP-WISE SOLUTIONS (MM: 80, Time: 3 Hrs)

Section A — MCQs (1 mark each)

Q.No	Answer	Reasoning / Working
1	(b) (-3, 0)	x=-3 and y=0 intersect at the point where x=-3, y=0, i.e. (-3,0).
2	(a) -8	2 is a root: 4+2b+12=0 ⇒ 2b=-16 ⇒ b=-8.
3	(d) none of these	$(\sec\theta-\tan\theta)(\sec\theta+\tan\theta)=\sec^2\theta-\tan^2\theta=1$. So $\sec\theta+\tan\theta=1\div(1/3)=3$, which is not among (a)-(c).
4	(b) $x^2 - 4x + 1$	Sum=4, product=$(2)^2-(\sqrt{3})^2=1 \Rightarrow x^2-4x+1$.
5	(b) 1632	LCM×HCF=product of numbers ⇒ LCM=(96×408)/24=1632.
6	(a) 0,7	Let u=x-1: $u^2-5u-6=0 \Rightarrow (u-6)(u+1)=0 \Rightarrow u=6$ or $-1 \Rightarrow x=7$ or 0.
7	(a) 4	Let $x=\sqrt{(12+\sqrt{(12+...)})}$. Then $x^2=12+x \Rightarrow x^2-x-12=0 \Rightarrow (x-4)(x+3)=0 \Rightarrow x=4$ (positive root).
8	(c) 1/2	
9	(a) 1	$(1+\cos A)(1-\cos A)\mathrm{cosec}^2A=(1-\cos^2A)\mathrm{cosec}^2A=\sin^2A\times(1/\sin^2A)=1$.
10	(a) (0,-3)	At x=0: 3(0)-y=3 ⇒ y=-3.
11	(b) (3,4)	In rectangle BEST, S=E+T-B=(3,0)+(0,4)-(0,0)=(3,4) (diagonals of a rectangle bisect each other).
12	(c) 5:1	Let x-axis divide in ratio k:1: y=0 ⇒ [k(-1)+1(5)]/(k+1)=0 ⇒ k=5, ratio 5:1.
13	(d) $\sqrt{3}/2$	$\tan A=\sqrt{3} \Rightarrow A=60°$; right angle at B ⇒ C=30°. $\cos A\cos C+\sin A\sin C=\cos(A-C)=\cos 30°=\sqrt{3}/2$.
14	(d) indefinitely many	$x^2+y^2=25$ with $x<0, y<0$ traces a continuous quarter-circle arc in the third quadrant — infinitely many points.
15	(d) 80°	∠A=∠P=31°, ∠C=∠R=69° (similar triangles) ⇒ ∠Q=180-31-69=80°.
16	(d) 2:3	For similar triangles, ratio of altitudes = ratio of corresponding sides = $\sqrt{(AB^2/PQ^2)}=\sqrt{(4/9)}=2/3$.
17	(c) $(5/2)\sqrt{2}$	Diameter=$\sqrt{[(2+3)^2+(4+1)^2]}=\sqrt{50}=5\sqrt{2} \Rightarrow$ radius=$5\sqrt{2}/2=(5/2)\sqrt{2}$.
18	(a) 3x(3x-5)	Zeroes 0, 5/3 ⇒ polynomial ∝ x(3x-5)×3=3x(3x-5) — check: 3x(3x-5)=0 gives x=0 or x=5/3 ✓ (option (b) gives x=5, not 5/3).
19	(a) Both true, R is the correct explanation	Required HCF = HCF(70-5, 125-8) = HCF(65,117) = 13 (both are 5×13 and 9×13). This is exactly what R computes, and it directly gives A.
20	(a) Both true, R is the correct explanation	Midpoint: x=(3+k)/2, y=5. x+y=10 ⇒ (3+k)/2=5 ⇒ k=7, confirming A; R correctly states the midpoint formula used to derive it.

Section B — 2 marks each

Q21 *[2 marks]* **Value of k for no solution (or infinitely many solutions) — internal choice.**

$3x+y=1$, $(2k-1)x+(k-1)y=2k+1$ — no solution

Step 1: For no solution (inconsistent lines): $a1/a2 = b1/b2 \neq c1/c2$.

Step 2: $3/(2k-1) = 1/(k-1) \Rightarrow 3(k-1) = 2k-1 \Rightarrow 3k-3 = 2k-1 \Rightarrow k = 2$.

Step 3: Check: at $k=2$, a-ratio = $3/3 = 1$, b-ratio = $1/1 = 1$, but c-ratio = $1/5 \neq 1$ — confirms no solution.

Answer: **$k = 2$.**

OR — $kx+3y=k-3$, $12x+ky=k$ — infinitely many solutions

Step 1: Condition: $a1/a2 = b1/b2 = c1/c2 \Rightarrow k/12 = 3/k = (k-3)/k$.

Step 2: From $k/12 = 3/k$: $k^2 = 36 \Rightarrow k = \pm 6$.

Step 3: Check $k=6$: $3/k=1/2$, $(k-3)/k=3/6=1/2$, $k/12=1/2$ — all match ✓. Check $k=-6$: ratios don't all match (rejected).

Answer: **$k = 6$.**

Q22 *[2 marks]* **Value of k for which kx^2+x+k has equal zeroes.**

Solution

Step 1: Equal zeroes $\Rightarrow$ discriminant = 0: $(1)^2 - 4(k)(k) = 0$.

Step 2: $1 - 4k^2 = 0 \Rightarrow k^2 = 1/4 \Rightarrow k = \pm 1/2$.

Answer: **$k = \pm 1/2$.**

Q23 *[2 marks]* **Point on the y-axis equidistant from (5,-2) and (-3,2).**

Solution

Step 1: Let the point be (0,y). Equate squared distances: $(0-5)^2+(y+2)^2 = (0+3)^2+(y-2)^2$.

Step 2: $25+(y^2+4y+4) = 9+(y^2-4y+4) \Rightarrow 25+4y = 9-4y+0$ (after cancelling y^2, simplifying constants).

Step 3: $8y = 9-25 = -16 \Rightarrow y = -2$.

Answer: **The point is (0, -2).**

OR — Points of trisection of (12,0) and (-6,15)

Step 1: First point (ratio 1:2 from (12,0)): $x=[1(-6)+2(12)]/3 = 6$; $y=[1(15)+2(0)]/3 = 5 \Rightarrow (6,5)$.

Step 2: Second point (ratio 2:1 from (12,0)): $x=[2(-6)+1(12)]/3 = 0$; $y=[2(15)+1(0)]/3 = 10 \Rightarrow (0,10)$.

Answer: **The points of trisection are (6, 5) and (0, 10).**

Q24 *[2 marks]* **Find x, given $\sin 2x = \sin 60° \cos 30° - \cos 60° \sin 30°$.**

Solution

Step 1: RHS is the expansion of $\sin(A-B)$: $\sin 60°\cos 30° - \cos 60°\sin 30° = \sin(60°-30°) = \sin 30° = 1/2$.

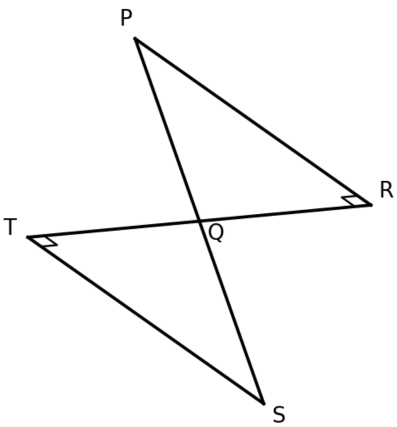
Step 2: So $\sin 2x = 1/2 \Rightarrow 2x = 30°$ (principal value).

Answer: **$x = 15°$.**

Q25 *[2 marks]* **PQR and QST are right angles at R, T respectively. Prove $QR \times QS = QP \times QT$.**

Solution

ΔPQR and ΔQST, right angled at R and T; P-Q-S and R-Q-T are straight lines



P-Q-S and R-Q-T are straight lines through Q; right angles at R and T

Step 1: Since P, Q, S are collinear and R, Q, T are collinear (the two lines cross at Q), ∠PQR = ∠SQT (vertically opposite angles).

Step 2: Also ∠PRQ = ∠STQ = 90° (given).

Step 3: By AA similarity, ΔPQR ~ ΔSQT (P↔S, Q↔Q, R↔T).

Step 4: Corresponding sides are proportional: QR/QT = QP/QS.

Answer: **Cross-multiplying: QR × QS = QP × QT, as required.**

Section C — 3 marks each

Q26 *[3 marks]* Evaluate [$\tan^2 60°+4\sin^2 45°+3\sec^2 30°+5\cos^2 90°$] / [cosec30°+sec60°-$\cot^2 30°$].

Solution

Step 1: tan60°=√3 ⇒ $\tan^2 60°$=3. sin45°=1/√2 ⇒ $4\sin^2 45°$=4×(1/2)=2.

Step 2: sec30°=2/√3 ⇒ $3\sec^2 30°$=3×(4/3)=4. cos90°=0 ⇒ $5\cos^2 90°$=0.

Step 3: Numerator = 3+2+4+0 = 9.

Step 4: cosec30°=2, sec60°=2, cot30°=√3 ⇒ $\cot^2 30°$=3. Denominator = 2+2-3 = 1.

Answer: **Value = 9/1 = 9.**

Q27 *[3 marks]* E is on side AD produced of parallelogram ABCD; BE meets CD at F. Show ΔABE ~ ΔCFB.

Solution

Step 1: In parallelogram ABCD, AB ∥ DC, and opposite angles are equal: ∠A = ∠C.

Step 2: Since E lies on ray AD (produced), ∠BAE = ∠BAD = ∠A. Since F lies on DC, ∠BCF = ∠BCD = ∠C. So ∠BAE = ∠BCF. ...(i)

Step 3: Since AB ∥ DC and B, E, F are collinear (BE extended meets DC at F), BF is a transversal cutting the parallel lines: ∠ABE = ∠CFB (alternate interior angles). ...(ii)

Step 4: From (i) and (ii), by the AA similarity criterion, ΔABE ~ ΔCFB.

Q28 *[3 marks]* Prove that 5√3/√2 is irrational.

Solution

Step 1: Note 5√3/√2 = 5√3/√2 × √2/√2 = 5√6/2. Assume, for contradiction, that this is rational, say = r.

Step 2: Then √6 = 2r/5, which would be rational (since r is rational).

Step 3: But √6 is irrational: if √6 = a/b (coprime integers), then $6b^2 = a^2$, so 2 and 3 both divide a^2, hence divide a, contradicting that a, b are coprime.

Step 4: This contradicts √6 being irrational.

Answer: **Hence 5√3/√2 is irrational.**

Q29 *[3 marks]* **Solve $2[(2x-1)/(x+3)] - 3[(x+3)/(2x-1)] = 5$, $x \neq -3, 1/2$.**

Solution

Step 1: Let $u = (2x-1)/(x+3)$, so $(x+3)/(2x-1) = 1/u$. The equation becomes $2u - 3/u = 5$.

Step 2: Multiply by u: $2u^2 - 5u - 3 = 0 \Rightarrow (2u+1)(u-3) = 0 \Rightarrow u = -1/2$ or $u = 3$.

Step 3: Case u=3: $(2x-1)/(x+3)=3 \Rightarrow 2x-1=3x+9 \Rightarrow x = -10$.

Step 4: Case u=-1/2: $(2x-1)/(x+3)=-1/2 \Rightarrow 2(2x-1)=-(x+3) \Rightarrow 4x-2=-x-3 \Rightarrow 5x=-1 \Rightarrow x=-1/5$.

Answer: **$x = -10$ or $x = -1/5$.**

OR — $(1+m^2)x^2+2mcx+(c^2-a^2)=0$ has equal roots; show $c^2=a^2(1+m^2)$

Step 1: Equal roots $\Rightarrow$ discriminant = 0: $(2mc)^2 - 4(1+m^2)(c^2-a^2) = 0$.

Step 2: Divide by 4: $m^2c^2 - (1+m^2)(c^2-a^2) = 0$.

Step 3: Expand: $m^2c^2 - c^2 + a^2 - m^2c^2 + m^2a^2 = 0 \Rightarrow -c^2 + a^2 + m^2a^2 = 0$.

Step 4: Rearranging: $a^2(1+m^2) = c^2$.

Answer: **Hence $c^2 = a^2(1+m^2)$, as required.**

Q30 *[3 marks]* **$f(x)=x^2-(k-6)x+(2k+1)$; find k if sum of zeroes = product of zeroes.**

Solution

Step 1: Sum of zeroes = $-(-(k-6))/1 = k-6$. Product of zeroes = $(2k+1)/1 = 2k+1$.

Step 2: Set sum = product: $k-6 = 2k+1$.

Step 3: $-6-1 = 2k-k \Rightarrow k = -7$.

Answer: **$k = -7$.**

Q31 *[3 marks]* **Two-digit number; digit sum = 8; adding 18 reverses the digits. Find the number.**

Solution

Step 1: Let the tens digit be a and units digit be b, so $a+b = 8$ and the number is $10a+b$.

Step 2: Adding 18 reverses the digits: $10a+b+18 = 10b+a \Rightarrow 9a-9b = -18 \Rightarrow a-b = -2$, i.e. $b-a = 2$.

Step 3: Solve $a+b=8$ and $b-a=2$: adding gives $2b=10 \Rightarrow b=5$, then $a=3$.

Answer: **The number is 35 (check: 35+18=53, digits reversed ✓).**

OR — $x+2y=1$; $(a-b)x+(a+b)y=a+b-2$ have infinitely many solutions

Step 1: Condition: $1/(a-b) = 2/(a+b) = 1/(a+b-2)$.

Step 2: From $1/(a-b)=2/(a+b)$: $a+b = 2(a-b) \Rightarrow a+b=2a-2b \Rightarrow a=3b$.

Step 3: From $2/(a+b)=1/(a+b-2)$: $2(a+b-2)=a+b \Rightarrow a+b=4$.

Step 4: Substitute $a=3b$ into $a+b=4$: $4b=4 \Rightarrow b=1$, so $a=3$. Check all three ratios equal 1/2 ✓.

Answer: **$a = 3$, $b = 1$.**

Section D — 5 marks each

Q32 *[5 marks]* **P divides A(-1,3), B(9,8) with AP:PB=k:1; P lies on $x-y+2=0$. Find k and P.**

Solution

Step 1: By the section formula: $P = ([9k-1]/(k+1), [8k+3]/(k+1))$.

Step 2: Substitute into $x-y+2=0$: $[(9k-1)-(8k+3)]/(k+1) + 2 = 0 \Rightarrow (k-4)/(k+1) = -2$.

Step 3: $k-4 = -2(k+1) = -2k-2 \Rightarrow 3k = 2 \Rightarrow k = 2/3$.

Step 4: P: $x = (9(2/3)-1)/((2/3)+1) = 5/(5/3) = 3$; $y = (8(2/3)+3)/(5/3) = (25/3)/(5/3) = 5$.

Answer: **$k = 2/3$; P = (3, 5) (check: 3-5+2=0 ✓).**

Q33 *[5 marks]* **Prove $\sqrt{[(1+\sin A)/(1-\sin A)]} = \sec A + \tan A$.**

Solution

Step 1: Multiply inside the root by $(1+\sin A)/(1+\sin A)$: $\sqrt{[(1+\sin A)^2/((1-\sin A)(1+\sin A))]} = \sqrt{[(1+\sin A)^2/(1-\sin^2 A)]}$.

Step 2: Since $1-\sin^2 A = \cos^2 A$: expression $= (1+\sin A)/\sqrt{(\cos^2 A)} = (1+\sin A)/\cos A$ (taking $\cos A > 0$).

Step 3: Split the fraction: $(1+\sin A)/\cos A = 1/\cos A + \sin A/\cos A = \sec A + \tan A$.

OR — $(1+\tan^2 A)/(1+\cot^2 A) = [(1-\tan A)/(1-\cot A)]^2 = \tan^2 A$

Step 1: First part: $(1+\tan^2 A)/(1+\cot^2 A) = \sec^2 A/\mathrm{cosec}^2 A = (1/\cos^2 A) \div (1/\sin^2 A) = \sin^2 A/\cos^2 A = \tan^2 A$.

Step 2: Second part: $1-\cot A = 1-(1/\tan A) = (\tan A-1)/\tan A = -(1-\tan A)/\tan A$.

Step 3: So $(1-\tan A)/(1-\cot A) = (1-\tan A) \div [-(1-\tan A)/\tan A] = -\tan A \Rightarrow$ squaring gives $\tan^2 A$.

Answer: **Both expressions equal $\tan^2 A$, so the full chain of equalities holds.**

Q34 *[5 marks]* **Boy sees bird at 100 m, elevation 30°; girl on a 20 m building sees it at 45°, opposite sides. Find distance of bird from girl.**

Solution

Step 1: From the boy: $\sin 30° = h/100$ (100 m is the direct/slant distance) $\Rightarrow h = 100\times(1/2) = 50$ m (bird's height).

Step 2: Horizontal distance from boy: $d1 = 100\times\cos 30° = 50\sqrt{3}$ m.

Step 3: From the girl (at 20 m): vertical gap to bird $= h-20 = 30$ m. $\tan 45° = 30/d2 \Rightarrow d2 = 30$ m (horizontal distance).

Step 4: Distance of bird from girl (slant) $= \sqrt{(d2^2 + (h-20)^2)} = \sqrt{(30^2+30^2)} = \sqrt{1800} = 30\sqrt{2}$ m.

Answer: **Distance of the bird from the girl $= 30\sqrt{2}$ m ≈ 42.4 m.**

OR — Tower of height H with flagstaff of height h on top; angles of elevation of bottom and top are α, β. Prove $H = h \tan\alpha/(\tan\beta-\tan\alpha)$

Step 1: Let d be the horizontal distance to the tower's base. $\tan\alpha = H/d \Rightarrow d = H/\tan\alpha$.

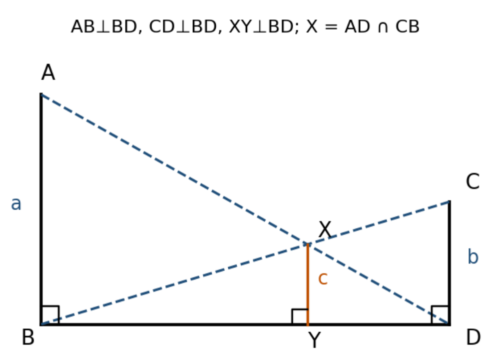
Step 2: $\tan\beta = (H+h)/d$. Substitute d: $\tan\beta = (H+h)\tan\alpha/H \Rightarrow H \tan\beta = H \tan\alpha + h \tan\alpha$.

Step 3: $H \tan\beta - H \tan\alpha = h \tan\alpha \Rightarrow H(\tan\beta-\tan\alpha) = h \tan\alpha$.

Answer: **$H = h \tan\alpha/(\tan\beta-\tan\alpha)$, as required.**

Q35 *[5 marks]* **∠ABD=∠XYD=∠CDB=90°, AB=a, XY=c, CD=b. Prove c(a+b)=ab.**

Solution



AB⊥BD at B, CD⊥BD at D; X = AD∩CB; XY⊥BD at Y

Step 1: Place B at the origin and D on the x-axis at distance p, so BD is along the x-axis. Since AB⊥BD, A = (0,a); since CD⊥BD, C = (p,b).

Step 2: Line AD: $y = a(p-x)/p$. Line CB: $y = (b/p)x$.

Step 3: At their intersection X: $a(p-x)/p = (b/p)x \Rightarrow a(p-x) = bx \Rightarrow ap = x(a+b) \Rightarrow x = ap/(a+b)$.

Step 4: The height of X above BD (= XY = c): $c = (b/p) \times ap/(a+b) = ab/(a+b)$.

Answer: **So $c(a+b) = ab$, as required (equivalently, $1/c = 1/a + 1/b$).**

Section E — Case-Based Questions (4 marks each)

Q36 *[4 marks]* **Kumar's project on real numbers.**

(i) Two bells toll at 12 and 15 min intervals, together at 9 am — when next together?

Step 1: LCM(12,15): $12=2^2\times3$, $15=3\times5 \Rightarrow$ LCM $= 2^2\times3\times5 = 60$ min = 1 hour.

Answer: **They will next toll together at 10 am.**

(ii) HCF of two numbers is 27, LCM is 162, one number is 54 — find the other.

Step 1: Product of the two numbers = HCF × LCM = $27\times162 = 4374$.

Step 2: Other number = $4374 \div 54 = 81$.

Answer: **The other number is 81.**

(iii) HCF of 85 and 153 is expressible as 85n-153 — find n.

Step 1: Euclid's algorithm: $153 = 1\times85+68$; $85 = 1\times68+17$; $68 = 4\times17+0 \Rightarrow$ HCF(85,153) = 17.

Step 2: Set $85n-153 = 17 \Rightarrow 85n = 170 \Rightarrow n = 2$.

Answer: **$n = 2$.**

Q37 *[4 marks]* **Raj's car speed = x km/h; Ajay's car is 5 km/h faster; Raj takes 4 h more than Ajay for a 400 km journey.**

(i) Distance covered by Ajay's car in 2 hours, in terms of x

Step 1: Ajay's speed = $(x+5)$ km/h, so distance in 2 h = $2(x+5)$.

Answer: **Distance = $(2x+10)$ km.**

(ii) Speed of Raj's car

Step 1: Time for Raj = $400/x$; time for Ajay = $400/(x+5)$. Given Raj takes 4 h more: $400/x - 400/(x+5) = 4$.

Step 2: $400[(x+5-x)]/[x(x+5)] = 4 \Rightarrow 400\times5 = 4x(x+5) \Rightarrow 2000 = 4x^2+20x \Rightarrow x^2+5x-500 = 0$.

Step 3: $x = [-5\pm\sqrt{(25+2000)}]/2 = [-5\pm45]/2 \Rightarrow x = 20$ (rejecting the negative root).

Answer: **Raj's speed = 20 km/h.**

OR — How much time did Ajay take?

Step 1: With $x=20$, Ajay's speed = 25 km/h. Time = 400/25.

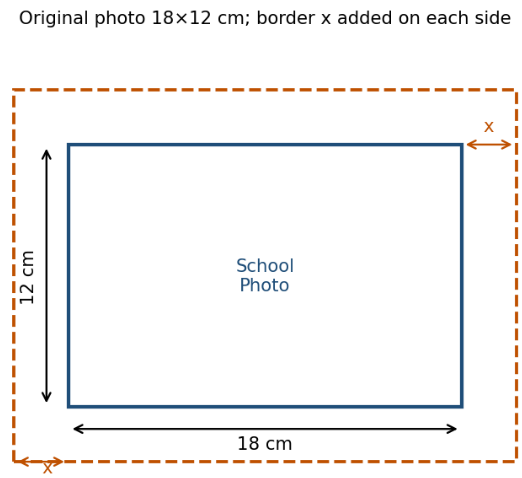
Answer: **Ajay took 16 hours (Raj took 20 hours, a 4-hour difference, consistent with the given data).**

(iii) Speed of Ajay's car

Answer: **Ajay's speed = $x+5 = 25$ km/h.**

Q38 *[4 marks]* **Photo 18 cm × 12 cm; length and width each increased by x to double the area.**

(i) Algebraic equation



Original 18×12 photo with a border of width x added on each side

Step 1: New area = 2 × original area: $(18+x)(12+x) = 2\times18\times12 = 432$.

Answer: **$(18+x)(12+x) = 432$.**

(ii) Standard quadratic form

Step 1: Expand: $216+18x+12x+x^2 = 432 \Rightarrow x^2+30x+216-432 = 0$.

Answer: **$x^2 + 30x - 216 = 0$.**

(iii) New dimensions of the enlarged photo

Step 1: Solve $x^2+30x-216=0$: $x = [-30\pm\sqrt{(900+864)}]/2 = [-30\pm\sqrt{1764}]/2 = [-30\pm42]/2$.

Step 2: $x = 6$ (rejecting the negative root $x=-36$).

Answer: **New length = 24 cm, new width = 18 cm.**

OR — Can a rational x make the new area 220 cm²?

Step 1: $(18+x)(12+x) = 220 \Rightarrow 216+30x+x^2 = 220 \Rightarrow x^2+30x-4 = 0$.

Step 2: Discriminant = $900+16 = 916 = 4\times229$, so $\sqrt{916} = 2\sqrt{229}$, and 229 is not a perfect square — $\sqrt{916}$ is irrational.

Answer: **No — since the discriminant is not a perfect square, x cannot be rational for a new area of 220 cm².**