SAMPLE PAPER 1

MATHEMATICS STANDARD (041)

CLASS X (2026 – 27)

Answer Key with Step-by-Step Solutions and Marking Scheme

Maximum Marks: 80 **Time Allowed: 3 hours**

SECTION – A (20 × 1 = 20)

Q	Option	Answer	Explanation / calculation	Chapter
Q1	**(B)**	22338	LCM = (306 × 657) ÷ 9 = 201042 ÷ 9 = 22338.	Real Numbers
Q2	**(A)**	-10	$p(2) = 4 + 6 + k = 0 \Rightarrow k = -10$.	Polynomials
Q3	**(C)**	2	Infinitely many solutions $\Rightarrow \frac{3}{6} = \frac{k}{4} = \frac{9}{18} \Rightarrow k = 2$.	Linear Equations
Q4	**(C)**	no real roots	$D = 16 - 24 = -8 < 0$.	Quadratic Equations
Q5	**(D)**	22	$a = -3$, $d = \frac{5}{2}$; $a_{11} = -3 + 10 \times \frac{5}{2} = 22$.	Arithmetic Progressions
Q6	**(B)**	2.1 cm	By BPT, AE : EC = 3 : 5, so AE = $\frac{3}{8} \times 5.6 = 2.1$ cm.	Triangles
Q7	**(B)**	50°	OA ⊥ PA and OP bisects ∠APB, so ∠OPA = 40° and ∠POA = 90° − 40° = 50°.	Circles
Q8	**(D)**	1	$(\sec^2\theta - 1)(\operatorname{cosec}^2\theta - 1) = \tan^2\theta \times \cot^2\theta = 1$.	Trigonometry
Q9	**(A)**	5 cm	Radius = $\sqrt{13^2 - 12^2} = 5$ cm.	Circles
Q10	**(C)**	$\frac{132}{7}$ cm²	$\frac{60}{360} \times \frac{22}{7} \times 36 = \frac{132}{7}$ cm².	Areas Related to Circles
Q11	**(A)**	1 : 3	$\frac{1}{3}\pi r^2 h : \pi r^2 h = 1 : 3$.	Surface Areas and Volumes
Q12	**(C)**	3	3 Median = Mode + 2 Mean ⇒ Mode − Mean = 3 Median − 3 Mean = 3(Median − Mean).	Statistics
Q13	**(D)**	$\frac{2}{5}$	Primes: 2, 3, 5, 7, 11, 13, 17, 19 — 8 of 20 numbers: $\frac{8}{20} = \frac{2}{5}$.	Probability
Q14	**(A)**	5 : 1	Let the ratio be $k : 1$. $x = 0 \Rightarrow \frac{-k + 5}{k + 1} = 0 \Rightarrow k = 5$.	Coordinate Geometry

Q15	**(D)**	$\frac{1}{2}$	Divide by $\cos\theta$: $\frac{4\tan\theta-1}{4\tan\theta+1}=\frac{3-1}{3+1}=\frac{1}{2}$.	Trigonometry
Q16	**(C)**	8 m	$\cos 60° = \frac{4}{l} \Rightarrow l = 8$ m.	Applications of Trigonometry
Q17	**(B)**	36 cm	$\pi r + 2r = 22 + 14 = 36$ cm.	Areas Related to Circles
Q18	**(C)**	20	Highest frequency 12 ⇒ modal class 20 – 30; its lower limit is 20.	Statistics
Q19	**(A)**	Both true; R explains A	HCF = 6, LCM = 36; 6 × 36 = 216 = 12 × 18. R is the general result behind A.	Real Numbers
Q20	**(C)**	A true, R false	$(x+4)(x-1)=0$ gives roots 1 and −4, so A is true. The sum of the roots is $-b/a$, not c/a; R is false.	Quadratic Equations

Marking: 1 mark for each correct option.

SECTION – B **(5 × 2 = 10)**

Q21(A). Largest number leaving remainders 5 and 8 [2 marks]

The number divides 70 − 5 = 65 and 125 − 8 = 117 exactly. Required number = HCF(65, 117).

$65 = 5 \times 13$, $117 = 3^2 \times 13$ ⇒ HCF = 13. (13 > 8, so remainders 5 and 8 are possible.)

Answer: 13

> **Marking scheme:**
> Forming HCF(65, 117): 1 mark
> Answer 13: 1 mark

Q21(B). Can 12^n end with 0? [2 marks]

A number ends with 0 only if it is divisible by 10 = 2 × 5, i.e. 5 must be a prime factor.

$12^n = (2^2 \times 3)^n = 2^{2n} \times 3^n$. By the uniqueness of prime factorisation, 5 is never a factor, so 12^n cannot end with 0.

Answer: No

> **Marking scheme:**
> Prime factorisation of 12^n: 1 mark
> Conclusion with reason: 1 mark

Q22(A). Is DE ∥ BC? [2 marks]

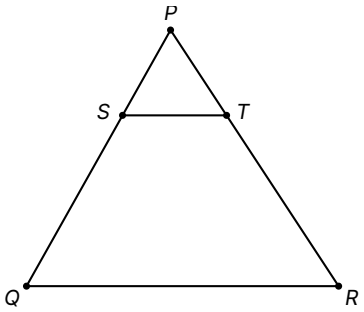
$\frac{AD}{DB} = \frac{4}{4.5} = \frac{8}{9}$, $\frac{AE}{EC} = \frac{8}{9}$.

Since AD/DB = AE/EC, by the converse of the Basic Proportionality Theorem, DE ∥ BC.

Answer: Yes, DE ∥ BC

> **Marking scheme:**
> Both ratios: 1 mark
> Conclusion using the converse of BPT: 1 mark

Q22(B). Find QR [2 marks]



In $\triangle PST$ and $\triangle PQR$: $\angle P$ is common and $\angle PST = \angle PQR$ (corresponding angles, ST $\parallel$ QR). So $\triangle PST \sim \triangle PQR$ (AA).

$\frac{ST}{QR} = \frac{PS}{PQ} = \frac{3}{9} \Rightarrow QR = 3 \times 4 = 12$ cm.

Answer: 12 cm

> **Marking scheme:**
> Similarity with reason: 1 mark
> QR = 12 cm: 1 mark

Q23. Evaluate [2 marks]

Numerator $= 2(1 + \sin\theta)(1 - \sin\theta) = 2(1 - \sin^2\theta) = 2\cos^2\theta$. Denominator $= 2(1 + \cos\theta)(1 - \cos\theta) = 2\sin^2\theta$.

Expression $= \cot^2\theta = (\frac{15}{8})^2 = \frac{225}{64}$.

Answer: $\frac{225}{64}$

> **Marking scheme:**
> Simplifying to $\cot^2\theta$: 1 mark
> Answer 225/64: 1 mark

Q24. Radius and sector area [2 marks]

$\frac{60}{360} \times 2 \times \frac{22}{7} \times r = 44 \Rightarrow \frac{22}{21}r = 44 \Rightarrow r = 42$ cm.

Area of sector $= \frac{60}{360} \times \frac{22}{7} \times 42 \times 42 = 924$ cm^2 (or ½ × arc × r = ½ × 44 × 42).

Answer: r = 42 cm; area = 924 cm^2

> **Marking scheme:**
> r = 42 cm: 1 mark
> Area 924 cm²: 1 mark

Q25. Die thrown twice [2 marks]

Total outcomes = 36. Outcomes in which 5 does not appear on either throw = 5 × 5 = 25.

(i) P = $\frac{25}{36}$. (ii) P(5 at least once) = $1 - \frac{25}{36} = \frac{11}{36}$.

Answer: (i) $\frac{25}{36}$ (ii) $\frac{11}{36}$

> **Marking scheme:**
> (i) 25/36: 1 mark
> (ii) 11/36: 1 mark

SECTION – C (6 × 3 = 18)

Q26. Prove $\sqrt{5}$ is irrational [3 marks]

Assume $\sqrt{5}$ is rational: $\sqrt{5} = \frac{a}{b}$, where a, b are coprime integers and $b \neq 0$.

Then $5b^2 = a^2$, so 5 divides a^2, and hence 5 divides a (5 is prime). Let $a = 5c$.

Then $5b^2 = 25c^2 \Rightarrow b^2 = 5c^2$, so 5 divides b.

So 5 divides both a and b, contradicting that they are coprime. Hence $\sqrt{5}$ is irrational.

Answer: Proved

> **Marking scheme:**
> Assumption and $5b^2 = a^2$: 1 mark
> 5 | a and 5 | b: 1 mark
> Contradiction and conclusion: 1 mark

Q27. Zeroes of $4x^2 - 4x - 15$ [3 marks]

$4x^2 - 10x + 6x - 15 = 2x(2x - 5) + 3(2x - 5) = (2x - 5)(2x + 3)$.

Zeroes: $\frac{5}{2}$ and $-\frac{3}{2}$.

Sum $= \frac{5}{2} - \frac{3}{2} = 1 = -(-4)/4$ ✓. Product $= \frac{5}{2} \times (-\frac{3}{2}) = -\frac{15}{4} = c/a$ ✓.

Answer: $\frac{5}{2}$, $-\frac{3}{2}$

> **Marking scheme:**
> Factorisation: 1 mark
> Zeroes: 1 mark
> Verification: 1 mark

Q28(A). The fraction [3 marks]

Let the fraction be $\frac{x}{y}$. $\frac{x-2}{y} = \frac{1}{3} \Rightarrow y = 3x - 6$ ... (1)

$\frac{x}{y-1} = \frac{1}{2} \Rightarrow y = 2x + 1$ ... (2)

From (1) and (2): $3x - 6 = 2x + 1 \Rightarrow x = 7$, $y = 15$. Fraction $= \frac{7}{15}$. Check: 5/15 = 1/3 ✓, 7/14 = 1/2 ✓

Answer: $\frac{7}{15}$

> **Marking scheme:**
> Equation (1): 1 mark
> Equation (2): 1 mark
> Fraction 7/15: 1 mark

Q28(B). Two-digit number [3 marks]

Let the tens digit be x and the units digit be y. $x + y = 12$ ... (1)

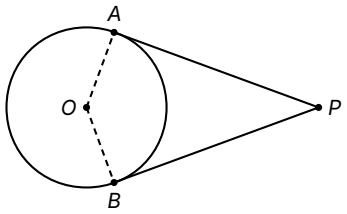
$(10y + x) - (10x + y) = 18 \Rightarrow y - x = 2$ ... (2)

Adding: $2y = 14 \Rightarrow y = 7$, $x = 5$. Number = 57. Check: $75 - 57 = 18$ ✓

Answer: 57

> **Marking scheme:**
> Equation (1): 1 mark
> Equation (2): 1 mark
> Number 57: 1 mark

Q29. Angle between tangents [3 marks]



Given: PA and PB are tangents from an external point P to a circle with centre O.

To prove: ∠APB + ∠AOB = 180°.

Proof: The tangent is perpendicular to the radius at the point of contact, so ∠OAP = ∠OBP = 90°.

In quadrilateral OAPB, ∠OAP + ∠APB + ∠PBO + ∠AOB = 360° ⇒ 90° + ∠APB + 90° + ∠AOB = 360°.

Hence ∠APB + ∠AOB = 180°, i.e. the two angles are supplementary.

Answer: Proved

> **Marking scheme:**
> Figure, given and to prove: 1 mark
> Right angles at A and B: 1 mark
> Angle sum and conclusion: 1 mark

Q30. Point on the x-axis [3 marks]

Let the point be P(x, 0). $PA^2 = PB^2 \Rightarrow (x - 2)^2 + 25 = (x + 2)^2 + 81$.

$x^2 - 4x + 29 = x^2 + 4x + 85 \Rightarrow -8x = 56 \Rightarrow x = -7$. P = (−7, 0).

$PA = \sqrt{(-7 - 2)^2 + 5^2} = \sqrt{106}$ units (= $PB = \sqrt{25 + 81}$).

Answer: (−7, 0); $\sqrt{106}$ units

> **Marking scheme:**
> Equation $PA^2 = PB^2$: 1 mark
> P(−7, 0): 1 mark
> Distance √106: 1 mark

Q31(A). Prove the identity [3 marks]

$\text{LHS} = \dfrac{(1 + \sin A) + (1 - \sin A)}{\sqrt{(1 - \sin A)(1 + \sin A)}}$ (taking the LCM of the two square roots).

$= \dfrac{2}{\sqrt{1 - \sin^2 A}} = \dfrac{2}{\sqrt{\cos^2 A}} = \dfrac{2}{\cos A}$ ($\cos A > 0$ for acute A) = 2 sec A = RHS.

Answer: Proved

> **Marking scheme:**
> Combining the fractions: 1 mark
> Using $1 - \sin^2 A = \cos^2 A$: 1 mark
> Conclusion: 1 mark

Q31(B). Prove $\sin\theta = (p^2 - 1)/(p^2 + 1)$ [3 marks]

$\sec\theta + \tan\theta = p$ ... (1). Since $\sec^2\theta - \tan^2\theta = 1$, $\sec\theta - \tan\theta = \frac{1}{p}$ ... (2).

Adding: $2\sec\theta = p + \frac{1}{p} = \frac{p^2 + 1}{p}$. Subtracting: $2\tan\theta = \frac{p^2 - 1}{p}$.

$\sin\theta = \frac{\tan\theta}{\sec\theta} = \frac{p^2 - 1}{p^2 + 1}$. Hence proved.

Answer: Proved

> **Marking scheme:**
> Obtaining $\sec\theta - \tan\theta = 1/p$: 1 mark
> Expressions for $\sec\theta$ and $\tan\theta$: 1 mark
> Conclusion: 1 mark

SECTION – D (4 × 5 = 20)

Q32. Two taps [5 marks]

Let the smaller tap take x hours; the larger takes $(x - 10)$ hours.

In 1 hour: $\frac{1}{x} + \frac{1}{x-10} = \frac{8}{75}$.

$75(2x - 10) = 8x(x - 10) \Rightarrow 8x^2 - 230x + 750 = 0 \Rightarrow 4x^2 - 115x + 375 = 0$.

$D = 115^2 - 4 \times 4 \times 375 = 13225 - 6000 = 7225 = 85^2$. $x = \frac{115 \pm 85}{8} = 25$ or 3.75.

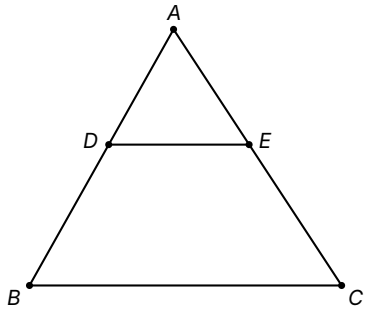
$x = 3.75$ is rejected (then $x - 10 < 0$). So the smaller tap takes 25 hours and the larger tap 15 hours.

Check: $\frac{1}{25} + \frac{1}{15} = \frac{3+5}{75} = \frac{8}{75}$ ✓

Answer: Smaller tap: 25 hours; larger tap: 15 hours

> **Marking scheme:**
> Forming the equation: 1 mark
> Quadratic $4x^2 - 115x + 375 = 0$: 1 mark
> Solving ($x = 25$ or 3.75): 2 marks
> Rejecting 3.75 and final answer: 1 mark

Q33. Basic Proportionality Theorem [5 marks]



Given: In △ABC, DE ∥ BC, D on AB and E on AC. **To prove:** AD/DB = AE/EC.

Construction: Join BE and CD; draw DM ⊥ AC and EN ⊥ AB.

Proof: ar(△ADE)/ar(△BDE) = (½ × AD × EN)/(½ × DB × EN) = $\frac{AD}{DB}$ ... (1)

ar(△ADE)/ar(△DEC) = (½ × AE × DM)/(½ × EC × DM) = $\frac{AE}{EC}$ ... (2)

△BDE and △DEC are on the same base DE and between the same parallels DE and BC, so ar(△BDE) = ar(△DEC) ... (3)

From (1), (2) and (3): AD/DB = AE/EC. Hence proved.

Application: $\frac{x}{x-2} = \frac{x+2}{x-1} \Rightarrow x(x-1) = (x-2)(x+2) \Rightarrow x^2 - x = x^2 - 4 \Rightarrow x = 4$.

Check: AD = 4, DB = 2, AE = 6, EC = 3; 4/2 = 6/3 ✓

Answer: Proved; $x = 4$

> **Marking scheme:**
> Given, to prove, construction and figure: 1 mark
> Area ratios (1) and (2): 1 mark
> Equal areas (3) and conclusion: 1 mark
> Applying BPT to form the equation: 1 mark
> x = 4: 1 mark

Q34(A). Cylinder with hemispheres scooped out [5 marks]

$r = 3.5$ cm, $h = 12$ cm.

TSA = CSA of cylinder + 2 × CSA of hemisphere $= 2\pi rh + 4\pi r^2 = 2 \times \frac{22}{7} \times 3.5 \times 12 + 4 \times \frac{22}{7} \times 12.25 = 264 + 154 = 418$ cm^2.

Volume $= \pi r^2 h - 2 \times \frac{2}{3}\pi r^3 = \frac{22}{7} \times 12.25 \times 12 - \frac{4}{3} \times \frac{22}{7} \times 42.875 = 462 - 179.67 = 282.33$ cm^3.

Answer: TSA = 418 cm^2; volume ≈ 282.33 cm^3

> **Marking scheme:**
> Correct surfaces identified: 1 mark
> TSA 418 cm²: 2 marks
> Volume 282.33 cm³: 2 marks

Q34(B). Hemispherical vessel with cylinder [5 marks]

$r = 21$ cm, $h = 15$ cm.

Inner surface area $= 2\pi r^2 + 2\pi rh = 2 \times \frac{22}{7} \times 441 + 2 \times \frac{22}{7} \times 21 \times 15 = 2772 + 1980 = 4752$ cm^2.

Capacity $= \frac{2}{3}\pi r^3 + \pi r^2 h = \frac{2}{3} \times \frac{22}{7} \times 9261 + \frac{22}{7} \times 441 \times 15 = 19404 + 20790 = 40194$ cm^3 = 40.194 litres.

Answer: 4752 cm^2; 40.194 litres

> **Marking scheme:**
> Inner surface: 2 marks
> Volume of each part: 2 marks
> Capacity in litres: 1 mark

Q35(A). Building and tower [5 marks]

Let the building be AB = 60 m and the tower CD = h m, at a distance d m.

Bottom D, depression 60°: $\tan 60° = \frac{60}{d} \Rightarrow d = \frac{60}{\sqrt{3}} = 20\sqrt{3}$ m.

Top C, depression 30°: $\tan 30° = \frac{60 - h}{d} \Rightarrow 60 - h = 20\sqrt{3} \times \frac{1}{\sqrt{3}} = 20 \Rightarrow h = 40$ m.

Distance $= 20\sqrt{3} = 20 \times 1.73 = 34.6$ m.

Answer: Tower 40 m; distance $20\sqrt{3} \approx 34.6$ m

> **Marking scheme:**
> Correct figure: 1 mark
> $d = 20\sqrt{3}$ m: 2 marks
> $h = 40$ m: 1 mark
> Distance 34.6 m: 1 mark

Q35(B). Tower from two points [5 marks]

Let the tower be AB = h m, and let the second point C be x m from the foot B; the first point D is $(x + 20)$ m away.

$\tan 60° = \dfrac{h}{x} \Rightarrow h = \sqrt{3}x$. $\tan 30° = \dfrac{h}{x + 20} \Rightarrow h = \dfrac{x + 20}{\sqrt{3}}$.

$\sqrt{3}x = \dfrac{x + 20}{\sqrt{3}} \Rightarrow 3x = x + 20 \Rightarrow x = 10$ m.

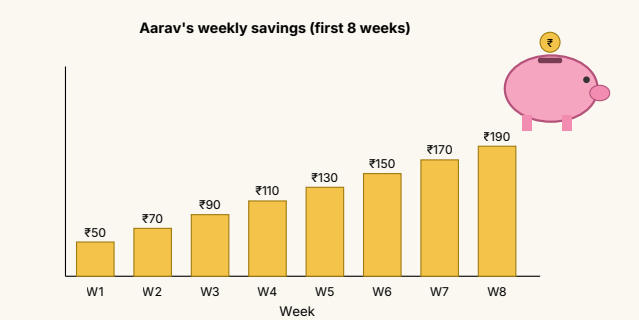
$h = 10\sqrt{3} = 17.3$ m.

Answer: Height $10\sqrt{3} \approx 17.3$ m; distance 10 m

> **Marking scheme:**
> Correct figure: 1 mark
> Both equations: 2 marks
> $x = 10$ m: 1 mark
> $h \approx 17.3$ m: 1 mark

SECTION – E (3 × 4 = 12)

Q36. Aarav's savings (AP) [4 marks]



Weekly savings 50, 70, 90, … form an AP with $a = 50$, $d = 20$.

(i) $a_{10} = 50 + 9 \times 20 =$ **₹ 230**.

(ii) $50 + (n-1)20 = 450 \Rightarrow n - 1 = 20 \Rightarrow$ **21st week**.

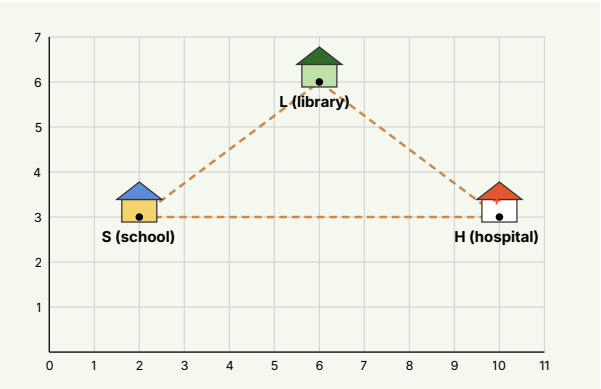
(iii)(A) $S_{20} = \frac{20}{2}[100 + 19 \times 20] = 10 \times 480 =$ **₹ 4800**.

(iii)(B) $\frac{n}{2}[100 + (n-1)20] = 2850 \Rightarrow n(10n + 40) = 2850 \Rightarrow n^2 + 4n - 285 = 0 \Rightarrow (n + 19)(n - 15) = 0 \Rightarrow$ ***n* = 15 weeks**.

Answer: (i) ₹ 230 (ii) 21st week (iii)(A) ₹ 4800 OR (B) 15 weeks

> **Marking scheme:**
> (i) ₹ 230: 1 mark
> (ii) 21st week: 1 mark
> (iii)(A) formula 1 mark + ₹ 4800 1 mark; OR (iii)(B) equation 1 mark + 15 weeks 1 mark

Q37. Town map [4 marks]



(i) SL $= \sqrt{(6-2)^2 + (6-3)^2} = \sqrt{25} =$ **5 km**.

(ii) B $= ((2 + 10)/2, (3 + 3)/2) =$ **(6, 3)**.

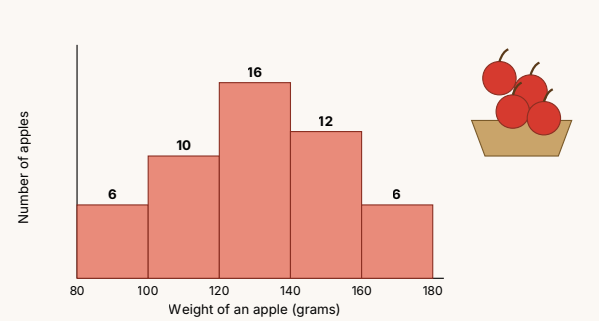
(iii)(A) LH $= \sqrt{(10-6)^2 + (3-6)^2} = 5$ km = SL, so L is equidistant from S and H. LB $= \sqrt{0 + 3^2} =$ **3 km**.

(iii)(B) P $= (\frac{3 \times 10 + 1 \times 2}{4}, \frac{3 \times 3 + 1 \times 3}{4}) =$ **(8, 3)**. LP $= \sqrt{(8-6)^2 + (3-6)^2}$ $= \sqrt{\mathbf{13}}$ **km** ≈ 3.6 km.

Answer: (i) 5 km (ii) (6, 3) (iii)(A) LS = LH = 5 km; LB = 3 km OR (B) P(8, 3); $\sqrt{\mathbf{13}}$ km

> **Marking scheme:**
> (i) 5 km: 1 mark
> (ii) (6, 3): 1 mark
> (iii)(A) LH = 5 1 mark + LB = 3 km 1 mark; OR (iii)(B) P(8, 3) 1 mark + LP = √13 km 1 mark

Q38. Weights of apples [4 marks]



(i) Highest frequency 16 ⇒ modal class **120 – 140 g**.

(ii) $n/2 = 25$; cumulative frequencies 6, 16, 32, 44, 50 ⇒ median class **120 – 140 g**.

(iii)(A) Class marks 90, 110, 130, 150, 170. $\Sigma fx = 540 + 1100 + 2080 + 1800 + 1020 = 6540$. Mean = 6540 ÷ 50 = **130.8 g**.

(iii)(B) Mode = $120 + \frac{16 - 10}{32 - 10 - 12} \times 20 = 120 + 12 =$ **132 g**.

Answer: (i) 120 – 140 g (ii) 120 – 140 g (iii)(A) 130.8 g OR (B) 132 g

> **Marking scheme:**
> (i) 120 – 140: 1 mark
> (ii) 120 – 140: 1 mark
> (iii)(A) Σfx = 6540 1 mark + mean 130.8 g 1 mark; OR (iii)(B) formula 1 mark + 132 g 1 mark

Final Answer Summary

Q	Ans	Q	Ans	Q	Ans	Q	Ans
Q1	(B)	**Q6**	(B)	**Q11**	(A)	**Q16**	(C)
Q2	(A)	**Q7**	(B)	**Q12**	(C)	**Q17**	(B)
Q3	(C)	**Q8**	(D)	**Q13**	(D)	**Q18**	(C)
Q4	(C)	**Q9**	(A)	**Q14**	(A)	**Q19**	(A)
Q5	(D)	**Q10**	(C)	**Q15**	(D)	**Q20**	(C)

Q	Final answer
Q21	(A) 13 / (B) No
Q22	(A) Yes / (B) 12 cm
Q23	$\frac{225}{64}$
Q24	42 cm; 924 cm²
Q25	$\frac{25}{36}$; $\frac{11}{36}$
Q26	Proof
Q27	$\frac{5}{2}$, $-\frac{3}{2}$
Q28	(A) $\frac{7}{15}$ / (B) 57
Q29	Proof
Q30	$(-7, 0)$; $\sqrt{106}$
Q31	Proofs
Q32	25 h and 15 h
Q33	Proof; x = 4
Q34	(A) 418 cm², 282.33 cm³ / (B) 4752 cm², 40.194 L
Q35	(A) 40 m, 34.6 m / (B) 17.3 m, 10 m
Q36	₹ 230; 21st; ₹ 4800 / 15 weeks
Q37	5 km; (6, 3); 3 km / (8, 3), $\sqrt{13}$ km
Q38	120–140; 120–140; 130.8 g / 132 g

Chapter-wise Distribution of Marks

Chapter	Questions	Marks
Real Numbers	1, 19, 21, 26	7
Polynomials	2, 27	4

Pair of Linear Equations	3, 28	4
Quadratic Equations	4, 20, 32	7
Arithmetic Progressions	5, 36	5
Triangles	6, 22, 33	8
Circles	7, 9, 29	5
Coordinate Geometry	14, 30, 37	8
Introduction to Trigonometry	8, 15, 23, 31	7
Some Applications of Trigonometry	16, 35	6
Areas Related to Circles	10, 17, 24	4
Surface Areas and Volumes	11, 34	6
Statistics	12, 18, 38	6
Probability	13, 25	3
Total		**80**

Section totals: A 20 + B 10 + C 18 + D 20 + E 12 = **80**. Marks for questions with internal choice are counted once.

— End of Solutions —