MATHEMATICS — STANDARD (Subject Code 041)

Class X (2026-27) · ANSWER KEY & MARKING SCHEME — SET 1

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

General Instructions:

- This key gives a full worked solution for every question, including both options of each internal choice.
- Any other correct method or equivalent working should be given full credit.
- Marks shown in italics indicate the intended step-wise distribution.
- In numerical questions, award marks for the correct formula and substitution even if the final arithmetic slips.

SECTION A

Q1 to Q20 carry 1 mark each. Q1–Q18 are multiple choice questions; Q19–Q20 are assertion–reason questions. — 20 marks

1. Two positive integers are $2^3 \times 3^2 \times 5$ and $2^2 \times 3^3 \times 7$. Their HCF is: **[1]**

(A) $2^2 \times 3^2$
(B) $2^3 \times 3^3$
(C) $2^2 \times 3^2 \times 5$
(D) $2^3 \times 3^3 \times 5 \times 7$

Answer

(A) $2^2 \times 3^2$

For the HCF you take each common prime raised to the **smaller** of the two powers. The prime 2 appears as 2^3 and 2^2, so take 2^2; the prime 3 appears as 3^2 and 3^3, so take 3^2. The primes 5 and 7 are not common to both numbers, so they are left out.

HCF = $2^2 \times 3^2 = 36$.

2. If HCF(a, b) = 12 and a × b = 1728, then LCM(a, b) is: **[1]**

(A) 144
(B) 288
(C) 12
(D) 1728

Answer

(A) 144

For any two positive integers, HCF × LCM = product of the numbers.

LCM = (a × b) ÷ HCF = 1728 ÷ 12 = **144**.

(Such a pair really does exist — for example a = 36 and b = 48 give HCF 12, product 1728 and LCM 144.)

3. Which one of the following rational numbers has a terminating decimal expansion? **[1]**

(A) 7/45
(B) 9/64
(C) 11/30
(D) 13/42

Answer

(B) 9/64

A rational number in lowest terms has a terminating decimal expansion only when its denominator has no prime factor other than 2 and 5.

$64 = 2^6$ — only the prime 2, so 9/64 terminates.

$45 = 3^2 \times 5$, $30 = 2 \times 3 \times 5$ and $42 = 2 \times 3 \times 7$ all contain a prime other than 2 or 5, so those three do not terminate.

4. If 3 is a zero of the polynomial $p(x) = x^2 - 7x + k$, then the value of k is: **[1]**

(A) 10
(B) 12
(C) –12
(D) 21

Answer

(B) 12

If 3 is a zero then $p(3) = 0$.

$p(3) = 3^2 - 7(3) + k = 9 - 21 + k = k - 12$.

Setting $k - 12 = 0$ gives $\mathbf{k = 12}$.

5. The quadratic equation $2x^2 - 4x + 3 = 0$ has: **[1]**

(A) two distinct real roots
(B) two equal real roots
(C) no real roots
(D) more than two real roots

Answer

(C) no real roots

Discriminant $D = b^2 - 4ac = (-4)^2 - 4(2)(3) = 16 - 24 = \mathbf{-8}$.

Since $D < 0$, the equation has no real roots.

6. The pair of linear equations $3x + 2y = 5$ and $6x + 4y = 11$ is: **[1]**

(A) consistent with a unique solution
(B) consistent with infinitely many solutions
(C) inconsistent
(D) consistent with exactly two solutions

Answer

(C) inconsistent

Compare the ratios: $a_1/a_2 = 3/6 = 1/2$, $b_1/b_2 = 2/4 = 1/2$, $c_1/c_2 = 5/11$.

Here $a_1/a_2 = b_1/b_2 \neq c_1/c_2$, so the lines are parallel and never meet — the pair is inconsistent and has no solution.

7. The 15th term of the AP 7, 11, 15, 19, … is: **[1]**

(A) 59
(B) 63
(C) 67
(D) 71

Answer

(B) 63

Here $a = 7$ and $d = 11 - 7 = 4$.

$a_{15} = a + 14d = 7 + 14(4) = 7 + 56 = \mathbf{63}$.

8. If the nth term of an AP is given by $a_n = 5 - 3n$, then its common difference is: **[1]**

(A) 5
(B) 3
(C) –3
(D) 2

Answer

(C) -3

$a_1 = 5 - 3(1) = 2$ and $a_2 = 5 - 3(2) = -1$.

$d = a_2 - a_1 = -1 - 2 = \mathbf{-3}$.

(In general, when a_n is linear in n the coefficient of n is the common difference.)

9. If M(3, –2) is the midpoint of the line segment joining A(1, 4) and B(x, y), then the coordinates of B are: **[1]**

(A) (5, –8)
(B) (2, 1)
(C) (4, 2)
(D) (–1, 10)

Answer

(A) (5, –8)

The midpoint of AB is ((1 + x)/2, (4 + y)/2), and this equals (3, –2).

$(1 + x)/2 = 3 \rightarrow 1 + x = 6 \rightarrow x = 5$

$(4 + y)/2 = -2 \rightarrow 4 + y = -4 \rightarrow y = -8$

So B is **(5, –8)**.

10. In triangles ABC and DEF, ∠A = ∠D and ∠B = ∠E. If AB = 4 cm, DE = 6 cm and BC = 6 cm, then EF is: **[1]**

(A) 4 cm
(B) 8 cm
(C) 9 cm
(D) 12 cm

Answer

(C) 9 cm

Two pairs of angles are equal, so △ABC ~ △DEF by the AA criterion, and corresponding sides are proportional:

AB/DE = BC/EF → 4/6 = 6/EF → 4 × EF = 36 → **EF = 9 cm**.

11. In △ABC and △DEF it is given that AB/DE = BC/EF = CA/FD. The two triangles are similar by the: **[1]**

(A) AA criterion
(B) SAS criterion
(C) SSS criterion
(D) RHS criterion

Answer

(C) SSS criterion

All three pairs of corresponding sides are in the same ratio, and nothing is said about the angles.

That is exactly the **SSS similarity criterion**: if the corresponding sides of two triangles are proportional, then their corresponding angles are equal and the triangles are similar.

AA needs two pairs of equal angles, and SAS needs two pairs of proportional sides *with* the included angles equal.

12. The tangents drawn at the two end points of a diameter of a circle are: **[1]**

(A) perpendicular to each other
(B) parallel to each other
(C) intersecting at the centre
(D) inclined to each other at 60°

Answer

(B) parallel to each other

A tangent is perpendicular to the radius at its point of contact. Both end points of a diameter lie on the same straight line through the centre, so each tangent makes a right angle with that same line.

Two lines that are both perpendicular to the same line are **parallel** to each other.

13. In △ABC, D lies on AB and E lies on AC with DE ∥ BC. If AD = 3 cm, DB = 5 cm and AE = 4.5 cm, then AC is: **[1]**

(A) 7.5 cm
(B) 9 cm
(C) 12 cm
(D) 13.5 cm

Answer

(C) 12 cm

By the Basic Proportionality Theorem, AD/DB = AE/EC.

3/5 = 4.5/EC → 3 × EC = 22.5 → EC = 7.5 cm.

AC = AE + EC = 4.5 + 7.5 = **12 cm**.

14. If sin θ = 3/5, where θ is acute, then tan θ is: **[1]**

(A) 3/4
(B) 4/3
(C) 4/5
(D) 5/3

Answer

(A) 3/4

cos θ = $\sqrt{(1 - \sin^2\theta)}$ = √(1 – 9/25) = √(16/25) = 4/5.

tan θ = sin θ / cos θ = (3/5) ÷ (4/5) = **3/4**.

15. The value of (tan 25°)/(cot 65°) is: **[1]**

(A) 0
(B) 1/2
(C) 1
(D) 2

Answer

(C) 1

Since 65° = 90° – 25°, we have cot 65° = cot(90° – 25°) = tan 25°.

So the expression becomes (tan 25°)/(tan 25°) = **1**.

16. A circular sheet of radius 10.5 cm is cut into 6 identical sectors. The area of each sector is (take π = 22/7): **[1]**

(A) 57.75 cm^2
(B) 115.5 cm^2
(C) 173.25 cm^2
(D) 346.5 cm^2

Answer

(A) 57.75 cm^2

Area of the whole sheet = πr^2 = (22/7) × 10.5 × 10.5 = 346.5 cm^2.

The six sectors are identical, so each one is a sixth of the whole:

346.5 ÷ 6 = **57.75 cm^2**. (Option D is the area of the whole sheet.)

17. A solid is formed by mounting a hemisphere of radius 7 cm on one flat end of a right circular cylinder of the same radius and height 10 cm. The curved surface area of the solid, excluding its flat circular base, is (take $\pi = 22/7$): **[1]**

(A) 440 cm^2
(B) 594 cm^2
(C) 748 cm^2
(D) 902 cm^2

Answer

(C) 748 cm^2

Curved surface of the cylinder = $2\pi rh = 2 \times (22/7) \times 7 \times 10 = 440$ cm^2.

Curved surface of the hemisphere = $2\pi r^2 = 2 \times (22/7) \times 49 = 308$ cm^2.

The circular face where the two solids join is hidden, so the exposed curved surface = 440 + 308 = **748 cm^2**.

18. A bag contains 5 red, 4 green and 6 blue balls. One ball is drawn at random. The probability that it is **not** blue is: **[1]**

(A) 2/5
(B) 3/5
(C) 1/3
(D) 4/15

Answer

(B) 3/5

Total number of balls = 5 + 4 + 6 = 15. The balls that are not blue are the 5 red and 4 green ones, that is 9 balls.

P(not blue) = 9/15 = **3/5**.

19. Assertion (A): If the probability of an event happening is 0.35, then the probability of the event not happening is 0.65. **[1]**

Reason (R): For any event E, P(E) + P(not E) = 1.

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

Answer

(a) Both A and R are true and R is the correct explanation of A.

An event either happens or it does not, so the two probabilities must add to 1. Applying this, P(not E) = 1 – 0.35 = 0.65, which is exactly what the assertion states. The reason is therefore the correct explanation.

20. Assertion (A): If two triangles are similar, then their corresponding sides are always equal in length. **[1]**

Reason (R): In two similar triangles the corresponding angles are equal and the corresponding sides are in the same ratio.

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

Answer

(d) A is false but R is true.

The reason states the correct meaning of similarity — equal angles and sides in the same *ratio*.

The assertion wrongly turns “in the same ratio” into “equal”. Corresponding sides of similar triangles are proportional, not equal; they are equal only in the special case when the two triangles are also congruent (ratio 1 : 1). So A is false while R is true.

SECTION B

Q21 to Q25 are very short answer questions carrying 2 marks each. — 10 marks

21. Find the value of k for which the quadratic equation $kx^2 - 6x + 2 = 0$ has two equal real roots. **[2]**

Answer

For equal roots the discriminant must be zero.

$D = b^2 - 4ac = (-6)^2 - 4(k)(2) = 36 - 8k$

$36 - 8k = 0 \rightarrow 8k = 36 \rightarrow$ **$k = 9/2$**

(Note that $k \neq 0$, otherwise the equation would not be quadratic; $k = 9/2$ satisfies this.)

Marking: 1 mark for using D = 0, 1 mark for the correct value of k.

22. The point P divides the line segment joining A(–2, 3) and B(6, –5) internally in the ratio 3 : 1. Find the coordinates of P. **[2]**

OR

Find the value of a for which the point P(a, 3) is equidistant from A(4, –1) and B(–2, 5).

Answer

By the section formula with m : n = 3 : 1,

$x = (3(6) + 1(-2))/(3 + 1) = (18 - 2)/4 = 4$

$y = (3(-5) + 1(3))/(3 + 1) = (-15 + 3)/4 = -3$

So P is **(4, –3)**.

Marking: 1 mark for the x-coordinate, 1 mark for the y-coordinate.

Answer — OR option

P is equidistant from A and B, so $PA^2 = PB^2$:

$(a - 4)^2 + (3 + 1)^2 = (a + 2)^2 + (3 - 5)^2$

$a^2 - 8a + 16 + 16 = a^2 + 4a + 4 + 4$

$-8a + 32 = 4a + 8 \rightarrow 12a = 24 \rightarrow$ **$a = 2$**

Check: with P(2, 3), $PA = \sqrt{(4 + 16)} = \sqrt{20}$ and $PB = \sqrt{(16 + 4)} = \sqrt{20}$ ✓

Marking: 1 mark for setting $PA^2 = PB^2$, 1 mark for a.

23. In △ABC, the point D lies on AB and the point E lies on AC. Given AD = 3 cm, DB = 4.5 cm, AE = 4 cm and EC = 6 cm, show that DE is parallel to BC. **[2]**

Answer

Compute the two ratios in which D and E divide the sides:

AD/DB = 3/4.5 = 30/45 = **2/3**

AE/EC = 4/6 = **2/3**

The two ratios are equal, so D and E divide AB and AC in the same ratio.

By the **converse of the Basic Proportionality Theorem** — if a line divides two sides of a triangle in the same ratio, then it is parallel to the third side — we conclude that **DE ∥ BC**.

Marking: 1 mark for showing the two ratios are equal, 1 mark for quoting the converse and concluding.

24. If 5 tan θ = 12, find the value of (5 sin θ – 3 cos θ)/(5 sin θ + 3 cos θ). **[2]**

OR

If tan θ + cot θ = 3, find the value of $\tan^2\theta + \cot^2\theta$.

Answer

We are given tan θ = 12/5.

Divide both the numerator and the denominator by cos θ:

(5 tan θ – 3)/(5 tan θ + 3) = (5 × 12/5 – 3)/(5 × 12/5 + 3) = (12 – 3)/(12 + 3) = 9/15 = **3/5**

Marking: 1 mark for dividing through by cos θ, 1 mark for the value 3/5.

Answer — OR option

Square both sides of the given equation:

$(\tan\theta + \cot\theta)^2 = 3^2$

$\tan^2\theta + 2(\tan\theta)(\cot\theta) + \cot^2\theta = 9$

Since tan θ and cot θ are reciprocals, (tan θ)(cot θ) = 1, so the middle term is 2:

$\tan^2\theta + 2 + \cot^2\theta = 9 \rightarrow$ **$\tan^2\theta + \cot^2\theta = 7$**

Marking: 1 mark for squaring and using tan θ · cot θ = 1, 1 mark for the value.

25. In a school quiz, the next question will be answered by exactly one of three students — Aarav, Bela or Chetan. The probability that Aarav answers it is 0.4 and the probability that Bela answers it is 0.35. Find (a) the probability that Chetan answers it, (b) the probability that it is not answered by Aarav. **[2]**

Answer

Exactly one of the three answers the question, so their three probabilities add up to 1.

(a) P(Chetan) = 1 – P(Aarav) – P(Bela) = 1 – 0.4 – 0.35 = **0.25**

(b) “Not Aarav” is the complement of “Aarav”:

P(not Aarav) = 1 – 0.4 = **0.6**

(As a check, P(Bela) + P(Chetan) = 0.35 + 0.25 = 0.6 ✓)

Marking: 1 mark for each part.

SECTION C

Q26 to Q31 are short answer questions carrying 3 marks each. — 18 marks

26. A stationery shop has 168 pencils and 120 erasers. The owner wants to make identical gift packs using all of them, so that every pack has the same number of pencils and the same number of erasers, with nothing left over. **[3]**

(a) Write 168 and 120 as products of their prime factors.

(b) Find the greatest number of such gift packs that can be made.

(c) How many pencils and how many erasers will each of those packs contain?

Answer

(a) $168 = 2^3 \times 3 \times 7$ and $120 = 2^3 \times 3 \times 5$.

(b) Every pack must divide both totals exactly, so the greatest possible number of packs is the **HCF**. Take each common prime to the smaller power:

HCF = $2^3 \times 3$ = **24 packs**.

(c) Pencils per pack = 168 ÷ 24 = **7**; erasers per pack = 120 ÷ 24 = **5**.

Check: 24 × 7 = 168 ✓ and 24 × 5 = 120 ✓

Marking: 1 mark for each part.

27. The points A(–3, 7) and B(5, –1) are the ends of a line segment. **[3]**

(a) Find the coordinates of the midpoint of AB.

(b) Find the length of AB.

(c) Find the coordinates of the point P which divides AB internally in the ratio 3 : 1.

OR

The points A(1, 2), B(4, 6) and C(x, 10) are such that AB = BC. Find the possible values of x, and state the length of AB.

Answer

(a) Midpoint = ((–3 + 5)/2, (7 + (–1))/2) = (2/2, 6/2) = **(1, 3)**

(b) AB = $\sqrt{(5 - (-3))^2 + (-1 - 7)^2} = \sqrt{8^2 + (-8)^2} = \sqrt{128}$ = **$8\sqrt{2}$ units**

(c) By the section formula with m : n = 3 : 1,

x = (3(5) + 1(–3))/(3 + 1) = (15 – 3)/4 = 3

y = (3(–1) + 1(7))/(3 + 1) = (–3 + 7)/4 = 1

So P is **(3, 1)**.

Marking: 1 mark for each part.

Answer — OR option

First find AB using the distance formula:

AB = $\sqrt{(4 - 1)^2 + (6 - 2)^2} = \sqrt{9 + 16} = \sqrt{25}$ = **5 units**

Now BC must also equal 5:

$BC^2 = (x - 4)^2 + (10 - 6)^2 = (x - 4)^2 + 16 = 25$

$(x - 4)^2 = 9 \rightarrow x - 4 = 3$ or $x - 4 = -3$

So **x = 7 or x = 1**, and in both cases AB = BC = 5 units.

Marking: 1 mark for AB, 2 marks for both values of x.

28. A circle with centre O has radius 9 cm. From an external point T, two tangents TA and TB are drawn, touching the circle at A and B. The distance OT is 15 cm. **[3]**

(a) Explain why ∠OAT and ∠OBT are both right angles.
(b) Find the length of each tangent.
(c) Find the perimeter of the quadrilateral OATB.

Answer

(a) The tangent at any point of a circle is **perpendicular to the radius** drawn to the point of contact. OA and OB are the radii to the points of contact A and B, so ∠OAT = ∠OBT = 90°.

(b) By part (a), △OAT is right-angled at A, so

$TA^2 = OT^2 - OA^2 = 15^2 - 9^2 = 225 - 81 = 144$

TA = **12 cm**, and since the two tangents from an external point are equal, TB = 12 cm as well.

(c) Perimeter of OATB = OA + AT + TB + BO

= 9 + 12 + 12 + 9 = **42 cm**

Marking: 1 mark for each part.

29. If sec θ + tan θ = 5/3, find the value of sin θ. **[3]**

Answer

We know the identity $\sec^2\theta - \tan^2\theta = 1$, that is (sec θ + tan θ)(sec θ – tan θ) = 1.

So sec θ – tan θ = 1 ÷ (5/3) = 3/5.

Adding the two equations: 2 sec θ = 5/3 + 3/5 = (25 + 9)/15 = 34/15, so sec θ = 17/15 and cos θ = 15/17.

Subtracting them: 2 tan θ = 5/3 – 3/5 = (25 – 9)/15 = 16/15, so tan θ = 8/15.

sin θ = tan θ × cos θ = (8/15) × (15/17) = **8/17**

Check: $\sin^2\theta + \cos^2\theta$ = 64/289 + 225/289 = 289/289 = 1 ✓

Marking: 1 mark for sec θ – tan θ, 1 mark for sec θ and tan θ, 1 mark for sin θ.

30. A circular flower bed of radius 42 m has a path marked along a sector of central angle 30°. Taking π = 22/7, find (a) the area of this sector and (b) its perimeter. **[3]**

OR

A solid is in the shape of a right circular cone of radius 7 cm and height 24 cm, mounted on a right circular cylinder of the same radius and height 10 cm. Find (a) the slant height of the cone and (b) the total volume of the solid. (Take π = 22/7)

Answer

(a) Area of a sector = $(\theta/360°) \times \pi r^2$

= (30/360) × (22/7) × 42 × 42 = (1/12) × 22 × 6 × 42 = (1/12) × 5544 = **462 m^2**

(b) The sector is bounded by two radii and its arc.

Arc length = $(30/360) \times 2 \times (22/7) \times 42 = (1/12) \times 264 = 22$ m

Perimeter = 2r + arc = 84 + 22 = **106 m**

Marking: 2 marks for the area, 1 mark for the perimeter.

Answer — OR option

(a) $l = \sqrt{(r^2 + h^2)} = \sqrt{(7^2 + 24^2)} = \sqrt{(49 + 576)} = \sqrt{625}$ = **25 cm**

(b) Volume of the cone = $(1/3)\pi r^2 h = (1/3) \times (22/7) \times 49 \times 24 = (1/3) \times 22 \times 7 \times 24 = 1232\ cm^3$

Volume of the cylinder = $\pi r^2 h = (22/7) \times 49 \times 10 = 1540\ cm^3$

Total volume = 1232 + 1540 = **2772 cm^3**

Marking: 1 mark for the slant height, 2 marks for the total volume.

31. A bag contains 8 red, 6 white and 10 black marbles, all of the same size. One marble is drawn at random. Find the probability that the marble drawn is **[3]**

(a) black, (b) not white, (c) either red or white.

Answer

Total number of marbles = 8 + 6 + 10 = **24**.

(a) There are 10 black marbles.

P(black) = 10/24 = **5/12**

(b) The marbles that are not white are the 8 red and 10 black ones, that is 18 marbles.

P(not white) = 18/24 = **3/4**

(c) Red or white = 8 + 6 = 14 marbles.

P(red or white) = 14/24 = **7/12**

Marking: 1 mark for each part.

SECTION D

Q32 to Q35 are long answer questions carrying 5 marks each. — 20 marks

32. A rectangular sheet of card has a perimeter of 44 cm. A square of side 2 cm is cut away from each of its four corners, and the four flaps that remain are folded up to form an open box of height 2 cm. The base of the box has an area of 45 cm^2. Find the length and the breadth of the original sheet of card. **[5]**

Answer

Let the length of the sheet be l cm and the breadth be b cm.

The perimeter is 44 cm, so 2(l + b) = 44, giving **l + b = 22** and hence b = 22 – l.

Cutting a 2 cm square from each corner removes 2 cm from both ends of each side, so the base of the box measures (l – 4) cm by (b – 4) cm.

Base area = 45, so (l – 4)(b – 4) = 45.

Substituting b = 22 – l:

$(l - 4)(22 - l - 4) = 45 \rightarrow (l - 4)(18 - l) = 45$

$18l - l^2 - 72 + 4l = 45$

$-l^2 + 22l - 72 = 45 \rightarrow \mathbf{l^2 - 22l + 117 = 0}$

$D = (-22)^2 - 4(1)(117) = 484 - 468 = 16$, and $\sqrt{16} = 4$.

$l = (22 \pm 4)/2 \rightarrow l = 13$ or $l = 9$.

Taking the length as the larger value, **l = 13 cm** and **b = 22 – 13 = 9 cm**.

Check: perimeter = 2(13 + 9) = 44 cm ✓, and the base measures 9 cm × 5 cm = 45 cm^2 ✓

Marking: 2 marks for forming the quadratic equation, 2 marks for solving it, 1 mark for stating both dimensions with the check.

33. (a) Prove that if a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then the other two sides are divided in the same ratio. **(3)** **[5]**

(b) In △ABC, D lies on AB and E lies on AC with DE ∥ BC. If AD = 4 cm, DB = 6 cm and AC = 15 cm, find AE. **(2)**

OR

(a) Prove that the lengths of the two tangents drawn from an external point to a circle are equal. **(3)**

(b) Two tangents are drawn from an external point P to a circle with centre O and radius 8 cm. If each tangent is 15 cm long, find the distance OP. **(2)**

Answer

(a) Basic Proportionality Theorem.

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

Construction: Join BE and CD. Draw EM ⊥ AB and DN ⊥ AC.

Proof: ar(△ADE) = ½ × AD × EM and ar(△DBE) = ½ × DB × EM, so

ar(△ADE)/ar(△DBE) = AD/DB ...(i)

Similarly, ar(△ADE) = ½ × AE × DN and ar(△DEC) = ½ × EC × DN, so

ar(△ADE)/ar(△DEC) = AE/EC ...(ii)

Now △DBE and △DEC stand on the same base DE and lie between the same parallels DE and BC, so they are equal in area: ar(△DBE) = ar(△DEC) ...(iii)

From (i), (ii) and (iii): **AD/DB = AE/EC** (proved)

(b) Let AE = x cm, so EC = (15 – x) cm.

By the theorem just proved, AD/DB = AE/EC:

4/6 = x/(15 – x) → 4(15 – x) = 6x → 60 – 4x = 6x → 60 = 10x → **x = 6**

So **AE = 6 cm** (and EC = 9 cm).

Check: 4/6 = 6/9 = 2/3 ✓

Marking: 3 marks for the proof (1 for given/to prove/construction, 2 for the argument), 2 marks for part (b).

Answer — OR option

(a) Equal tangents from an external point.

Given: A circle with centre O and an external point P, with PA and PB the tangents touching the circle at A and B. *To prove:* PA = PB.

Construction: Join OA, OB and OP.

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

In the right triangles OAP and OBP:

OA = OB (radii of the same circle), OP = OP (common), and both are right-angled at A and B.

So △OAP ≅ △OBP by the RHS congruence rule.

Hence **PA = PB** by CPCT (proved)

(b) Let the tangent touch the circle at A, so PA = 15 cm and OA = 8 cm.

The tangent is perpendicular to the radius at the point of contact, so △OAP is right-angled at A:

$OP^2 = OA^2 + PA^2 = 8^2 + 15^2 = 64 + 225 = 289$

OP = 17 cm

Marking: 3 marks for the proof, 2 marks for part (b).

34. A lighthouse stands 60 m above sea level. From its top, the angles of depression of two boats floating on the same side of the lighthouse and in line with its foot are 60° and 30°. **[5]**

Find (a) the distance of the nearer boat from the foot of the lighthouse, and (b) the distance between the two boats. (Take √3 = 1.73)

Answer

Let the foot of the lighthouse be F, and let the nearer and farther boats be at distances d_1 and d_2 metres from F.

The angle of depression from the top equals the angle of elevation from the boat, so the larger angle belongs to the nearer boat.

(a) Nearer boat (angle 60°): $\tan 60° = 60/d_1$

$\sqrt{3} = 60/d_1 \rightarrow d_1 = 60/\sqrt{3} = 20\sqrt{3}$

$d_1 = 20 \times 1.73 =$ **34.6 m**

(b) Farther boat (angle 30°): $\tan 30° = 60/d_2$

$1/\sqrt{3} = 60/d_2 \rightarrow d_2 = 60\sqrt{3}$

Distance between the boats = $d_2 - d_1 = 60\sqrt{3} - 20\sqrt{3} = 40\sqrt{3}$

= 40 × 1.73 = **69.2 m**

Marking: 2 marks for the nearer boat, 3 marks for the distance between the boats.

35. A solid is in the form of a right circular cone mounted on a hemisphere of the same radius. The radius is 21 cm and the height of the cone is 72 cm. Taking π = 22/7, find **[5]**

(a) the slant height of the cone, (b) the total surface area of the solid, and (c) the volume of the solid.

OR

A grain silo is in the shape of a right circular cylinder of radius 21 m and height 30 m, closed at the top by a hemispherical dome of the same radius. Taking π = 22/7, find

(a) the total volume of the silo, and (b) the total curved surface area to be painted (the curved wall of the cylinder together with the dome).

Answer

(a) $l = \sqrt{(r^2 + h^2)} = \sqrt{(21^2 + 72^2)} = \sqrt{(441 + 5184)} = \sqrt{5625}$ = **75 cm**

(b) The flat circular face of the hemisphere is joined to the base of the cone, so neither is exposed. The surface consists of the curved surface of the cone plus the curved surface of the hemisphere.

Curved surface of the cone = πrl = (22/7)(21)(75) = 22 × 3 × 75 = 4950 cm^2

Curved surface of the hemisphere = $2\pi r^2$ = 2 × (22/7) × 441 = 2 × 22 × 63 = 2772 cm^2

Total surface area = 4950 + 2772 = **7722 cm^2**

(c) Volume of the cone = $(1/3)\pi r^2h$ = (1/3)(22/7)(441)(72) = (1/3)(22)(63)(72) = 33264 cm^3

Volume of the hemisphere = $(2/3)\pi r^3$ = (2/3)(22/7)(9261) = (2/3)(22)(1323) = 19404 cm^3

Total volume = 33264 + 19404 = **52668 cm^3**

Marking: 1 mark for the slant height, 2 marks for the surface area, 2 marks for the volume.

Answer — OR option

(a) Volume of the cylindrical part = πr^2h = (22/7)(21)(21)(30) = 22 × 3 × 21 × 30 = **41580 m^3**

Volume of the hemispherical dome = $(2/3)\pi r^3$ = (2/3)(22/7)(9261) = (2/3)(22)(1323) = **19404 m^3**

Total volume = 41580 + 19404 = **60984 m^3**

(b) Curved surface of the cylinder = $2\pi rh$ = 2(22/7)(21)(30) = 2 × 22 × 3 × 30 = 3960 m^2

Curved surface of the dome = $2\pi r^2$ = 2(22/7)(441) = 2 × 22 × 63 = 2772 m^2

Total area to be painted = 3960 + 2772 = **6732 m^2**

Marking: 3 marks for the volume, 2 marks for the surface area.

SECTION E

Q36 to Q38 are case-study based questions carrying 4 marks each, with sub-parts of 1, 1 and 2 marks. An internal choice is provided in the 2-mark sub-part. — 12 marks

36. Read the following and answer the questions that follow. **[4]**

A newly built stadium has 20 rows of seats. The first row has 24 seats, the second row has 28 seats, the third row has 32 seats, and so on — each row has 4 more seats than the row immediately in front of it.

(a) Write the common difference of the arithmetic progression formed by the number of seats in the rows. **(1)**

(b) How many seats are there in the 10th row? **(1)**

(c) Find the total number of seats in the stadium. **(2)**

OR

(c) Which row of the stadium has exactly 76 seats? **(2)**

Answer

The number of seats forms an AP with first term a = 24.

(a) Common difference d = 28 – 24 = **4**

(b) a_{10} = a + 9d = 24 + 9(4) = 24 + 36 = **60 seats**

(c) Total seats = S_{20} = (n/2)[2a + (n – 1)d]

= (20/2)[2(24) + 19(4)] = 10[48 + 76] = 10 × 124 = **1240 seats**

Marking: 1 mark for (a), 1 mark for (b), 2 marks for (c).

Answer — OR option

(c) Let the nth row have 76 seats. Then $a_n = 76$:

24 + (n – 1)(4) = 76

(n – 1)(4) = 52 → n – 1 = 13 → **n = 14**

So the **14th row** has 76 seats.

Marking: 1 mark for forming the equation, 1 mark for n.

37. Read the following and answer the questions that follow. **[4]**

At a school fete, a stall sold identical handmade gift boxes. The number of boxes sold that day turned out to be 5 less than the price of one box in rupees, and the stall collected ₹336 in all.

(a) If the price of one box is ₹x, write an expression for the number of boxes sold. **(1)**

(b) Form the quadratic equation that represents this situation. **(1)**

(c) Find the price of one box and the number of boxes sold. **(2)**

OR

(c) The stall had 4 more boxes left unsold. How much more money would it have collected had those been sold at the same price? **(2)**

Answer

(a) Number of boxes sold = **(x – 5)**

(b) Total collected = price × number of boxes = 336, so

x(x – 5) = 336 → $\mathbf{x^2 - 5x - 336 = 0}$

(c) D = $(-5)^2$ – 4(1)(–336) = 25 + 1344 = 1369, and √1369 = 37.

x = (5 ± 37)/2 → x = 21 or x = –16

A price cannot be negative, so x = 21.

Price of one box = ₹21 and the **number sold = 21 – 5 = 16**.

Check: 21 × 16 = ₹336 ✓

Marking: 1 mark for (a), 1 mark for (b), 2 marks for (c).

Answer — OR option

(c) First solve $x^2 - 5x - 336 = 0$. With D = 1369 and √1369 = 37,

x = (5 + 37)/2 = 21 (the negative root –16 is rejected), so each box cost ₹21.

Selling 4 more boxes at ₹21 each would bring in

4 × 21 = **₹84** more.

Marking: 1 mark for the price, 1 mark for the extra amount.

38. Read the following and answer the questions that follow. **[4]**

A class teacher recorded the daily pocket money, in rupees, of the 40 students of her class. The grouped frequency distribution is shown below.

Pocket money (₹)	0–20	20–40	40–60	60–80	80–100
Number of students	6	9	13	8	4

(a) Write the modal class of the distribution. **(1)**

(b) Find the class mark of the class 60–80. **(1)**

(c) Find the mean daily pocket money of the students. **(2)**

OR

(c) Find the median class of the distribution, and state the cumulative frequency of the class just before it. **(2)**

Answer

(a) The modal class is the class with the highest frequency. The greatest frequency is 13, so the modal class is **40–60**.

(b) Class mark = (lower limit + upper limit)/2 = (60 + 80)/2 = **70**

(c) Using the class marks x_i = 10, 30, 50, 70, 90 with frequencies f_i = 6, 9, 13, 8, 4:

$\Sigma f_i x_i$ = 6(10) + 9(30) + 13(50) + 8(70) + 4(90)

= 60 + 270 + 650 + 560 + 360 = 1900

Σf_i = 40

Mean = 1900 ÷ 40 = **₹47.50**

Marking: 1 mark for (a), 1 mark for (b), 2 marks for (c).

Answer — OR option

(c) Build the cumulative frequencies: 6, 15, 28, 36, 40.

Here n = 40, so n/2 = 20.

The first cumulative frequency that is greater than or equal to 20 is 28, which belongs to the class **40–60** — this is the median class.

The cumulative frequency of the class just before it (20–40) is **15**.

Marking: 1 mark for the median class, 1 mark for the preceding cumulative frequency.

— End of paper —

Prepared by principalsaab.com. 100% original practice material, written to the CBSE 2026-27 Mathematics (041) blueprint.