CBSE 2025 Maths Standard — Set 2 — Answer Key

English Medium

Time Allowed: 3 Hours | Maximum Marks: 80

General Instructions:

1. This question paper contains 38 questions. All questions are compulsory.
2. Section A has 20 MCQs carrying 1 mark each.
3. Section B has 6 questions carrying 2 marks each.
4. Section C has 6 questions carrying 3 marks each.
5. Section D has 4 questions carrying 5 marks each.
6. Section E has 3 case-study based questions carrying 4 marks each.
7. Draw neat figures wherever required.

Section A

Multiple Choice Questions (1 mark each)

Q.1 [1 mark]

If $7\cos^2\theta + 3\sin^2\theta = 4$, then the value of θ is:

(a) 30°

(b) 45°

(c) 60° <<

(d) 90°

Explanation:

$7\cos^2\theta + 3\sin^2\theta = 4$.

Using $\sin^2\theta = 1 - \cos^2\theta$: $7\cos^2\theta + 3(1 - \cos^2\theta) = 4 \rightarrow$

$4\cos^2\theta + 3 = 4 \rightarrow$

$\cos^2\theta = 1/4 \rightarrow$

$\cos\theta = 1/2 \rightarrow$

$\theta = 60°$.

Answer is (C).

Q.2 [1 mark]

The probability of drawing an even prime number out of numbers from 1 to 30 is:

(a) 1/30 <<

(b) 4/15

(c) 7/30

(d) 0

Explanation:

The only even prime number is 2. So the probability = 1/30. Answer is (A).

Q.3 [1 mark]

The quadratic equation whose roots are 7 and 1/7 is:

(a) $7x^2 - 50x + 7 = 0$ <<

(b) $7x^2 - 50x + 1 = 0$

(c) $7x^2 + 50x - 7 = 0$

(d) $7x^2 + 50x - 1 = 0$

Explanation:

Sum of roots = 7 + 1/7 = 50/7.

Product of roots = 7 × 1/7 = 1.

Equation: $x^2 - (50/7)x + 1 = 0$.

Multiplying by 7: $7x^2 - 50x + 7 = 0$.

Answer is (A).

Q.4 [1 mark]

The least number which is a perfect square and is divisible by each of 16, 20 and 50, is:

(a) 1200

(b) 100

(c) 3600 <<

(d) 2400

Explanation:

LCM(16, 20, 50): $16 = 2^4$, $20 = 2^2 \times 5$, $50 = 2 \times 5^2$.

LCM = $2^4 \times 5^2 = 400$.

$400 = 20^2$ is already a perfect square, but checking options: 400 is not listed.

However, among the given options, $3600 = 60^2$ is a perfect square and divisible by 16, 20, and 50.

Checking 400: 400/16 = 25 (yes), 400/20 = 20 (yes), 400/50 = 8 (yes).

Since 400 is not an option, the answer from the given options is 3600.

Answer is (C).

Q.5 [1 mark]

The coordinates of the end points of a diameter of a circle are (5, −2) and (5, 2). The length of the radius of the circle is:

(a) ± 2

(b) ± 4

(c) 4

(d) 2 <<

Explanation:

Diameter endpoints: (5, −2) and (5, 2).

Length of diameter = √[(5−5)² + (2−(−2))²] = √[0 + 16] = 4.

Radius = 4/2 = 2.

Radius is always positive.

Answer is (D).

Q.6 [1 mark]

The points (−5, 0), (5, 0) and (0, 4) are the vertices of a triangle which is a/an:

(a) right-angled triangle

(b) isosceles triangle <<

(c) equilateral triangle

(d) scalene triangle

Explanation:

Distances: (−5,0) to (5,0) = 10;

(−5,0) to (0,4) = √(25+16) = √41;

(5,0) to (0,4) = √(25+16) = √41.

Two sides are equal (√41 each), so it is an isosceles triangle.

Answer is (B).

Q.7 [1 mark]

In the given figure, RS is the tangent to the circle at the point L and MN is the diameter. If ∠NML = 30°, then ∠RLM is:

(a) 30°

(b) 60° <<

(c) 90°

(d) 120°

Explanation:

MN is diameter, so ∠MLN = 90° (angle in semicircle).

In ΔMLN: ∠NML = 30°, ∠MLN = 90°, so ∠MNL = 60°.

RS is tangent at L.

By alternate segment theorem, ∠NLS = ∠NML = 30°.

Since RS is a line, ∠RLN = 180° − 30° = 150°.

∠RLM = ∠RLN − ∠MLN = 150° − 90° = 60°.

Answer is (B).

Q.8 [1 mark]

In the given figure, PQ ∥ BC. If AP/PB = 4/13 and AC = 20.4 cm, then the length of AQ is:

(a) 2.8 cm

(b) 5.8 cm

(c) 3.8 cm

(d) 4.8 cm <<

Explanation:

By BPT (Basic Proportionality Theorem): AP/PB = AQ/QC = 4/13.

So AQ/AC = AP/(AP+PB) = 4/17.

AQ = (4/17) × 20.4 = 81.6/17 = 4.8 cm.

Answer is (D).

Q.9 [1 mark]

Which of the following statements is incorrect?

(a) Two congruent figures are always similar.

(b) A square and a rhombus of the same area are always similar. <<

(c) Two equilateral triangles are always similar.

(d) Two similar triangles need not be congruent.

Explanation:

A square has all angles 90° but a rhombus does not necessarily have all angles 90°.

So a square and a rhombus of the same area are NOT always similar.

This statement is incorrect.

Answer is (B).

Q.10 [1 mark]

The sum of the exponents of prime factors in the prime factorisation of 4004 is:

(a) 5 <<
(b) 4
(c) 3
(d) 2

Explanation:

4004 = $2^2 \times 7 \times 11 \times 13$. Sum of exponents = 2 + 1 + 1 + 1 = 5. Answer is (A).

Q.11 [1 mark]

In a cricket match, a batsman hits the boundary 7 times out of the 42 balls he plays. The probability of his not hitting a boundary is:

(a) 1/7
(b) 2/7
(c) 5/6 <<
(d) 1/6

Explanation:

P(hitting boundary) = 7/42 = 1/6.

P(not hitting boundary) = 1 − 1/6 = 5/6.

Answer is (C).

Q.12 [1 mark]

If a large circular pizza is divided into 5 equal sectors, then the central angle of each sector will be:

(a) 60°
(b) 90°
(c) 45°
(d) 72° <<

Explanation:

Total angle at centre = 360°. For 5 equal sectors: 360°/5 = 72°. Answer is (D).

Q.13 [1 mark]

If sin 30° tan 45° = sec 60°/k, then the value of k is:

(a) 4 <<

(b) 3

(c) 2

(d) 1

Explanation:

sin 30° = 1/2, tan 45° = 1, sec 60° = 2.

So (1/2)(1) = 2/k → 1/2 = 2/k → k = 4.

Answer is (A).

Q.14 [1 mark]

The line represented by the equation x − y = 0 is:

(a) parallel to x-axis

(b) parallel to y-axis

(c) passing through the origin <<

(d) passing through the point (3, 2)

Explanation:

x − y = 0 means x = y.

When x = 0, y = 0 so it passes through origin.

Check (3,2): 3 − 2 = 1 ≠ 0, so it doesn't pass through (3,2).

Answer is (C).

Q.15 [1 mark]

The 10th term of the AP 5, 19/4, 9/2, 17/4, ... is:

(a) 11/4 <<

(b) 4/11

(c) 13/4

(d) 4/13

Explanation:

First term a = 5 = 20/4.

Common difference d = 19/4 − 20/4 = −1/4.

10th term = a + 9d = 20/4 + 9(−1/4) = 20/4 − 9/4 = 11/4.

Answer is (A).

Q.16 [1 mark]

If −4 is a zero of the polynomial $p(x) = x^2 - x - (2 + 2k)$, then the value of k is:

(a) 3

(b) 9 <<

(c) 6

(d) −9

Explanation:

If −4 is a zero: $p(-4) = (-4)^2 - (-4) - (2 + 2k) = 0 \rightarrow$

$16 + 4 - 2 - 2k = 0 \rightarrow$

$18 - 2k = 0 \rightarrow$

k = 9.

Answer is (B).

Q.17 [1 mark]

The equation of a line parallel to the x-axis and at a distance of 3 units below x-axis is:

(a) x = 3

(b) x = −3

(c) y = −3 <<

(d) y = 3

Explanation:

A line parallel to the x-axis has equation y = constant.

3 units below the x-axis means y = −3.

Answer is (C).

Q.18 [1 mark]

The HCF of 40, 110 and 360 is:

(a) 40
(b) 110
(c) 360
(d) 10 <<

Explanation:

$40 = 2^3 \times 5$, $110 = 2 \times 5 \times 11$, $360 = 2^3 \times 3^2 \times 5$.

HCF $= 2 \times 5 = 10$.

Answer is (D).

Q.19 [1 mark]

Assertion (A): Common difference of the AP: 5, 1, −3, −7, ... is 4.

Reason (R): Common difference of the AP: $a_1, a_2, a_3, ..., a_n$ is obtained by $d = a_n - a_{n-1}$.

Select the correct option:

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

Explanation:

AP: 5, 1, −3, −7, ...

Common difference $d = 1 - 5 = -4$ (not 4).

So Assertion is false.

Reason is true ($d = a_n - a_{n-1}$ is the correct formula for common difference).

Answer is (D).

Q.20 [1 mark]

Assertion (A): The pair of linear equations $px + 3y + 59 = 0$ and $2x + 6y + 118 = 0$ will have infinitely many solutions if $p = 1$.

Reason (R): If the pair of linear equations $px + 3y + 19 = 0$ and $2x + 6y + 157 = 0$ has a unique solution, then $p \neq 1$.

Select the correct option:

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

(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A). <<

(c) Assertion (A) is true, but Reason (R) is false.

(d) Assertion (A) is false, but Reason (R) is true.

Explanation:

Assertion: $px + 3y + 59 = 0$ and $2x + 6y + 118 = 0$.

For infinitely many solutions: $p/2 = 3/6 = 59/118$.

Since $3/6 = 1/2$ and $59/118 = 1/2$, we need $p/2 = 1/2$, so $p = 1$.

Assertion is true.

Reason: $px + 3y + 19 = 0$ and $2x + 6y + 157 = 0$.

For unique solution: $p/2 \neq 3/6$, so $p \neq 1$.

Reason is true.

But the Reason discusses a different pair of equations, so it is not the correct explanation of the Assertion.

Answer is (B).

Section B

Very Short Answer Questions (2 marks each)

Q.21 [2 marks]

If p and q are zeroes of the polynomial $p(y) = 21y^2 - y - 2$, then find the value of $(1 - p) \cdot (1 - q)$.

Answer: 6/7

Explanation:

For $21y^2 - y - 2$: Sum of zeroes $p + q = 1/21$, Product $pq = -2/21$.

$(1 - p)(1 - q) = 1 - (p + q) + pq = 1 - 1/21 + (-2/21) = 1 - 3/21 = 1 - 1/7 = 6/7$.

The value is 6/7.

Q.22 [2 marks]

(a) In the given figure, the shape of the top of a table is that of a sector of a circle with centre O and $\angle AOB = 90°$. If AO = OB = 42 cm, then find the perimeter of the top of the table.

Answer: 150 cm

Explanation:

The top is a sector with radius r = 42 cm and angle $\theta = 90°$.

Arc length = $(\theta/360) \times 2\pi r = (90/360) \times 2 \times (22/7) \times 42 = (1/4) \times 264 = 66$ cm.

Perimeter = arc length + 2 × radius = 66 + 42 + 42 = 150 cm.

OR

Q.22 [2 marks]

(b) In the given figure, three sectors of a circle of radius 5 cm, making angles 35°, 50° and 95° at the centre are shaded. Find the area of the shaded region. [Use $\pi = 22/7$]

Answer: $275/7$ cm² ≈ 39.29 cm²

Explanation:

Total angle of shaded sectors = 35° + 50° + 95° = 180°.

Area = $(\theta/360) \times \pi r^2 = (180/360) \times (22/7) \times 25 = (1/2) \times (550/7) = 275/7$ cm² ≈ 39.29 cm².

Q.23 [2 marks]

If $\tan A = \sqrt{3}$, where A is an acute angle, then find the value of $\sin^2 A / (1 + \cos^2 A)$.

Answer: 3/5

Explanation:

tan A = √3 → A = 60°.

sin 60° = √3/2, cos 60° = 1/2.

sin²A = 3/4, cos²A = 1/4.

sin²A / (1 + cos²A) = (3/4) / (1 + 1/4) = (3/4) / (5/4) = 3/5.

The value is 3/5.

Q.24 [2 marks]

(a) In the given figure, D is a point on the side BC of ΔABC such that ∠ADC = ∠BAC. Show that CA² = CD · CB.

Answer: Proved: ΔADC ~ ΔBAC (AA similarity), so CA² = CD · CB

Explanation:

In ΔADC and ΔBAC: ∠ADC = ∠BAC (given), ∠ACD = ∠BCA (common angle).

By AA similarity, ΔADC ~ ΔBAC.

Therefore CA/CB = CD/CA (corresponding sides of similar triangles).

Cross-multiplying: CA² = CD · CB.

Hence proved.

OR

Q.24 [2 marks]

(b) In the given figure, OA · OB = OC · OD. Show that ∠A = ∠C and ∠B = ∠D.

Answer: Proved: ΔAOD ~ ΔCOB (SAS similarity), so ∠A = ∠C and ∠B = ∠D

Explanation:

Given OA · OB = OC · OD → OA/OC = OD/OB.

In ΔAOD and ΔCOB: OA/OC = OD/OB (proved above), ∠AOD = ∠COB (vertically opposite angles).

By SAS similarity, ΔAOD ~ ΔCOB.

Therefore ∠A = ∠C and ∠D = ∠B (corresponding angles of similar triangles).

Hence proved.

Q.25 [2 marks]

At point A on the diameter AB of a circle of radius 10 cm, tangent XAY is

drawn to the circle. Find the length of the chord CD parallel to XY at a distance of 16 cm from A.

Answer: CD = 16 cm

Explanation:

Let O be the centre.

Radius = 10 cm, so OA = 10 cm.

AB is diameter and A is on the circle.

Let P be the foot of perpendicular from O to CD.

CD is parallel to XY (tangent at A), so OP $\perp$ CD.

Distance from A to CD = 16 cm.

Since OA = 10 cm and CD is on the other side of O from A: OP = 16 − 10 = 6 cm.

In right ΔOPC: $OC^2 = OP^2 + PC^2 \rightarrow 100 = 36 + PC^2 \rightarrow PC = 8$ cm.

CD = 2 × PC = 16 cm.

Q.26 [2 marks]

(a) Prove that the parallelogram circumscribing a circle is a rhombus.

Answer: Proved: AB + CD = BC + DA with AB = CD, BC = DA $\Rightarrow$ all sides equal, so ABCD is a rhombus

Explanation:

Let ABCD be a parallelogram circumscribing a circle.

Since tangents from an external point are equal: AP = AS, BP = BQ, CQ = CR, DR = DS (where P, Q, R, S are points of tangency on AB, BC, CD, DA respectively).

AB = AP + PB and CD = CR + RD, BC = BQ + QC and DA = DS + SA.

AB + CD = (AP + PB) + (CR + RD) = (AS + BQ) + (QC + DS) = DA + BC.

Since ABCD is a parallelogram, AB = CD and BC = DA.

So 2AB = 2BC $\rightarrow$ AB = BC.

Since all sides are equal, ABCD is a rhombus.

Hence proved.

OR

Q.26 [2 marks]

(b) Prove that the angle between the two tangents drawn from an external

point to a circle is supplementary to the angle subtended by the line-segment joining the points of contact at the centre.

Answer: Proved: ∠APB + ∠AOB = 180°

Explanation:

Let PA and PB be tangents from external point P to a circle with centre O, where A and B are points of contact.

OA ⊥ PA and OB ⊥ PB (radius ⊥ tangent).

So ∠OAP = 90° and ∠OBP = 90°.

In quadrilateral OAPB: ∠OAP + ∠APB + ∠PBO + ∠AOB = 360°.

90° + ∠APB + 90° + ∠AOB = 360°.

∠APB + ∠AOB = 180°.

Hence proved.

Section C

Short Answer Questions (3 marks each)

Q.27 [3 marks]

(a) Prove that: $(1 + 1/\tan^2\theta)(1 + 1/\cot^2\theta) = 1/(\sin^2\theta - \sin^4\theta)$.

Answer: Proved: LHS = RHS = $1/(\sin^2\theta \cos^2\theta)$

Explanation:

LHS = $(1 + \cot^2\theta)(1 + \tan^2\theta) = \text{cosec}^2\theta \times \sec^2\theta = (1/\sin^2\theta)(1/\cos^2\theta) = 1/(\sin^2\theta \cdot \cos^2\theta)$.

RHS = $1/(\sin^2\theta - \sin^4\theta) = 1/[\sin^2\theta(1 - \sin^2\theta)] = 1/(\sin^2\theta \cdot \cos^2\theta)$.

LHS = RHS.

Hence proved.

OR

Q.27 [3 marks]

(b) Prove that: $\sqrt{[(\text{cosec}\,\theta - 1)/(\text{cosec}\,\theta + 1)]} + \sqrt{[(\text{cosec}\,\theta + 1)/(\text{cosec}\,\theta - 1)]} = 2 \sec\theta$.

Answer: Proved: LHS = 2 cosec θ / cot θ = 2 sec θ

Explanation:

LHS = $\sqrt{[(\text{cosec}\theta - 1)/(\text{cosec}\theta + 1)]} + \sqrt{[(\text{cosec}\theta + 1)/(\text{cosec}\theta - 1)]}$.

Combining: $= [(\text{cosec}\theta - 1) + (\text{cosec}\theta + 1)] / \sqrt{[(\text{cosec}\theta + 1)(\text{cosec}\theta - 1)]} = 2\text{cosec}\theta / \sqrt{(\text{cosec}^2\theta - 1)} = 2\text{cosec}\theta / \sqrt{(\cot^2\theta)} = 2\text{cosec}\theta / \cot\theta = 2(1/\sin\theta) \times (\sin\theta/\cos\theta) = 2/\cos\theta = 2\sec\theta$ = RHS.

Hence proved.

Q.28 [3 marks]

If the mid-point of the line segment joining the points A(3, 4) and B(k, 6) is P(x, y) and x + y − 10 = 0, then find the value of k.

Answer: k = 7

Explanation:

Mid-point P = $((3 + k)/2, (4 + 6)/2) = ((3 + k)/2, 5)$.

So $x = (3 + k)/2$ and $y = 5$.

Given $x + y - 10 = 0$: $(3 + k)/2 + 5 = 10 \rightarrow (3 + k)/2 = 5 \rightarrow 3 + k = 10 \rightarrow k = 7$.

Q.29 [3 marks]

The length of the hour hand of a clock is 10 cm. Find the area of the minor sector swept by the hour hand of the clock between 5 a.m. to 8 a.m. Also, find the area of the major sector.

Answer: Minor sector = 550/7 cm² ≈ 78.57 cm²; major sector = 1650/7 cm² ≈ 235.71 cm²

Explanation:

From 5 a.m.

to 8 a.m.

= 3 hours.

Angle swept = 3 × 30° = 90°.

Area of minor sector = $(\theta/360) \times \pi r^2 = (90/360) \times (22/7) \times 100 = (1/4) \times 2200/7 = 550/7$ cm² ≈ 78.57 cm².

Area of major sector = $\pi r^2 - 550/7 = 2200/7 - 550/7 = 1650/7$ cm² ≈ 235.71 cm².

Q.30 [3 marks]

Prove that √3 is an irrational number.

Answer: Proved: √3 is irrational (contradiction — 3 divides both p and q)

Explanation:

Assume √3 is rational, so √3 = p/q where p, q are co-prime integers and q ≠ 0.
Squaring: 3 = p²/q² → p² = 3q².
This means 3 divides p², hence 3 divides p (since 3 is prime).
Let p = 3m.
Then 9m² = 3q² → q² = 3m².
So 3 divides q², hence 3 divides q.
But then both p and q are divisible by 3, contradicting that they are co-prime.
Hence √3 is irrational.

Q.31 [3 marks]

A sum of Rs.2,000 is invested at 7% per annum simple interest. Calculate the interests at the end of 1st, 2nd and 3rd year. Do these interests form an AP? If so, find the interest at the end of the 27th year.

Answer: Rs.140, Rs.280, Rs.420 — yes, an AP (d = 140); interest at end of 27th year = Rs.3,780

Explanation:

SI for 1st year = 2000 × 7/100 × 1 = Rs.140.
SI for 2nd year = 2000 × 7/100 × 2 = Rs.280.
SI for 3rd year = 2000 × 7/100 × 3 = Rs.420.
Differences: 280 − 140 = 140, 420 − 280 = 140.
Common difference is constant, so yes, they form an AP with a = 140, d = 140.
Interest at end of 27th year = a + (n−1)d = 140 + 26 × 140 = 140 + 3640 = Rs.3,780.

Q.32 [3 marks]

(a) Two ships are sailing in the sea on either side of a lighthouse. The angles of depression to the two ships as observed from the top of the lighthouse are 60° and 45°, respectively. If the distance between the ships is 100[(1 +

√3)/√3] m, then find the height of the lighthouse.

Answer: Height of the lighthouse = 100 m

Explanation:

Let h be the height of the lighthouse.

Let d_1 and d_2 be distances of ships from the base.

$\tan 60° = h/d_1 \rightarrow d_1 = h/\sqrt{3}$.

$\tan 45° = h/d_2 \rightarrow d_2 = h$.

Distance between ships = $d_1 + d_2 = h/\sqrt{3} + h = h(1 + \sqrt{3})/\sqrt{3}$.

Given: $h(1 + \sqrt{3})/\sqrt{3} = 100(1 + \sqrt{3})/\sqrt{3}$.

Therefore h = 100 m.

The height of the lighthouse is 100 m.

OR

Q.32 [3 marks]

(b) The angles of depression of the top and the bottom of an 8 m tall building from the top of another multistoried building are 30° and 45°, respectively. Find the height of the multistoried building and the distance between the two buildings.

Answer: Height = $(12 + 4\sqrt{3})$ m ≈ 18.93 m; distance = $(12 + 4\sqrt{3})$ m ≈ 18.93 m

Explanation:

Let h be the height of the multistoried building and d be the distance between buildings.

From angle of depression to bottom = 45°: $\tan 45° = h/d \rightarrow d = h$.

From angle of depression to top of 8m building = 30°: $\tan 30° = (h - 8)/d \rightarrow$

$1/\sqrt{3} = (h - 8)/h \rightarrow$

$h = \sqrt{3}(h - 8) \rightarrow$

$h = \sqrt{3}h - 8\sqrt{3} \rightarrow$

$h(\sqrt{3} - 1) = 8\sqrt{3} \rightarrow$

$h = 8\sqrt{3}/(\sqrt{3} - 1)$.

Rationalizing: $h = 8\sqrt{3}(\sqrt{3} + 1)/(\sqrt{3} - 1)(\sqrt{3} + 1) = 8\sqrt{3}(\sqrt{3} + 1)/2 = 4\sqrt{3}(\sqrt{3} + 1) = 4(3 + \sqrt{3}) = (12 + 4\sqrt{3})$ m.

Distance = h = $(12 + 4\sqrt{3})$ m.

Section D

Long Answer Questions (5 marks each)

Q.33 [5 marks]

(a) The sum of the areas of two squares is 52 cm² and the difference of their perimeters is 8 cm. Find the lengths of the sides of the two squares.

Answer: Sides are 6 cm and 4 cm

Explanation:

Let sides be a and b (a > b).

$a^2 + b^2 = 52$ and $4a - 4b = 8 \rightarrow a - b = 2 \rightarrow a = b + 2$.

Substituting: $(b + 2)^2 + b^2 = 52 \rightarrow$

$b^2 + 4b + 4 + b^2 = 52 \rightarrow$

$2b^2 + 4b - 48 = 0 \rightarrow$

$b^2 + 2b - 24 = 0 \rightarrow$

$(b + 6)(b - 4) = 0$.

Since b > 0, b = 4 cm and a = 6 cm.

The sides are 6 cm and 4 cm.

OR

Q.33 [5 marks]

(b) The time taken by a person to travel an upward distance of 150 km was 2½ hours more than the time taken in the downward return journey. If he returned at a speed of 10 km/h more than the speed while going up, find the speeds in each direction.

Answer: Upward speed = 20 km/h, downward speed = 30 km/h

Explanation:

Let speed going up = x km/h.

Speed coming down = (x + 10) km/h.

Time up = 150/x, Time down = 150/(x + 10).

Given: $150/x - 150/(x + 10) = 5/2$.

Simplifying: $150(x + 10 - x)/[x(x + 10)] = 5/2 \rightarrow$

$1500/[x(x + 10)] = 5/2 \rightarrow$

$x(x + 10) = 600 \rightarrow$

$x^2 + 10x - 600 = 0 \rightarrow$

$(x + 30)(x - 20) = 0.$

Since $x > 0$, $x = 20.$

Speed up = 20 km/h, speed down = 30 km/h.

Q.34 [5 marks]

Prove that a line drawn parallel to one side of a triangle to intersect the other two sides in distinct points divides the other two sides in the same ratio. Hence, in the figure given below, prove that AM/MB = AN/ND where LM ∥ CB and LN ∥ CD.

Answer: Proved (BPT): AM/MB = AL/LC = AN/ND

Explanation:

BPT: In ΔABC, let DE ∥ BC meet AB at D and AC at E.

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

ar(ADE)/ar(DBE) = (½·AD·EN)/(½·DB·EN) = AD/DB, and ar(ADE)/ar(DEC) = (½·AE·DM)/(½·EC·DM) = AE/EC.

ΔDBE and ΔDEC lie on the same base DE between the same parallels DE and BC, so ar(DBE) = ar(DEC).

Hence AD/DB = AE/EC.

For the given figure: In ΔABC, LM ∥ CB, so by BPT AM/MB = AL/LC ...(i).

In ΔACD, LN ∥ CD, so by BPT AN/ND = AL/LC ...(ii).

From (i) and (ii): AM/MB = AN/ND.

Hence proved.

Q.35 [5 marks]

Find the Mean and Mode of the following frequency distribution:

Class: 0–10, 10–20, 20–30, 30–40, 40–50, 50–60, 60–70

Frequency: 8, 7, 15, 20, 12, 8, 10

Answer: Mean = 35.625; Mode = 30 + 50/13 ≈ 33.85

Explanation:

Mean: Mid-values (x_i): 5, 15, 25, 35, 45, 55, 65.

$\Sigma f_i = 8+7+15+20+12+8+10 = 80$.

$\Sigma f_i x_i = 40+105+375+700+540+440+650 = 2850$.

Mean = 2850/80 = 35.625.

Mode: Modal class = 30–40 (highest frequency = 20).

$l = 30$, $f_1 = 20$, $f_0 = 15$, $f_2 = 12$, $h = 10$.

Mode = $l + [(f_1 - f_0)/(2f_1 - f_0 - f_2)] \times h = 30 + [(20 - 15)/(40 - 15 - 12)] \times 10 = 30 + (5/13) \times 10 = 30 + 50/13 \approx 33.85$.

Q.36(a) [5 marks]

Case Study 1: A school is organizing a grand cultural event to show the talent of its students. To accommodate the guests, the school plans to rent chairs and tables from a local supplier. It finds that rent for each chair is Rs.50 and for each table is Rs.200. The school spends Rs.30,000 for renting the chairs and tables. Also, the total number of items (chairs and tables) rented are 300.

(i) If the school rents 'x' chairs and 'y' tables, write down the pair of linear equations representing the given information.

Answer: $x + y = 300$ and $50x + 200y = 30,000$ (i.e. $x + 4y = 600$)

Explanation:

From the given information: Equation 1 (total items): $x + y = 300$.

Equation 2 (total cost): $50x + 200y = 30,000$, which simplifies to $x + 4y = 600$.

Q.36(b) [5 marks]

Case Study 1 (contd.): A school rents 'x' chairs at Rs.50 each and 'y' tables at Rs.200 each. Total items = 300, total cost = Rs.30,000.

(ii)(a) Find the number of chairs and number of tables rented by the school.

Answer: 200 chairs and 100 tables

Explanation:

From x + y = 300 ...(1) and x + 4y = 600 ...(2).

Subtracting (1) from (2): 3y = 300 → y = 100.

From (1): x = 200.

The school rented 200 chairs and 100 tables.

OR

Q.36(b) [5 marks]

Case Study 1 (contd.): A school rents 'x' chairs at Rs.50 each and 'y' tables at Rs.200 each. Total items = 300.

(ii)(b) If the school wants to spend a maximum of Rs.27,000 on 300 items (tables and chairs), then find the number of chairs and tables it can rent.

Answer: 220 chairs and 80 tables

Explanation:

x + y = 300 and 50x + 200y = 27,000.

From x = 300 − y: 50(300 − y) + 200y = 27,000 →

15,000 − 50y + 200y = 27,000 →

150y = 12,000 →

y = 80.

So x = 220.

The school can rent 220 chairs and 80 tables.

Q.36(c) [5 marks]

Case Study 1 (contd.): A school rents chairs at Rs.50 each and tables at Rs.200 each. Total budget = Rs.30,000.

(iii) What is the maximum number of tables that can be rented in Rs.30,000 if no chairs are rented?

Answer: 150 tables

Explanation:

If no chairs are rented (x = 0): 200y = 30,000 → y = 150.

Maximum number of tables = 150.

Q.37(a) [4 marks]

Case Study 2: Rahul is a lucky charm for his cricket team. He has a jar of cards with numbers from 10 to 74. Before each match, he draws a card from the jar. If the card bears an even number, the team wins. If the number is even and divisible by 5, they win by a big margin. If the number is an odd number less than 30, they win by a small margin. And if the number is a prime number between 50 and 74, they lose.

(i) What is the probability that Rahul draws a card with an even number?

Answer: 33/65

Explanation:

Numbers from 10 to 74: total = 74 − 10 + 1 = 65 cards.

Even numbers from 10 to 74: 10, 12, 14, ..., 74.

Count = (74 − 10)/2 + 1 = 33.

P(even number) = 33/65.

Q.37(b) [4 marks]

Case Study 2 (contd.): Rahul has cards numbered 10 to 74.

(ii) What is the probability that Rahul draws a card with an odd number less than 30?

Answer: 2/13

Explanation:

Total cards = 65.

Odd numbers less than 30 from 10 to 74: 11, 13, 15, 17, 19, 21, 23, 25, 27, 29.

Count = 10.

P(odd number less than 30) = 10/65 = 2/13.

Q.37(c) [4 marks]

Case Study 2 (contd.): Rahul has cards numbered 10 to 74.

(iii)(a) What is the probability that Rahul draws a card with a prime number between 50 and 74?

Answer: 6/65

Explanation:

Total cards = 65.

Prime numbers between 50 and 74: 53, 59, 61, 67, 71, 73.

Count = 6.

P(prime number between 50 and 74) = 6/65.

OR

Q.37(c) [4 marks]

Case Study 2 (contd.): Rahul has cards numbered 10 to 74.

(iii)(b) What is the probability that Rahul draws a card with an even number divisible by 5?

Answer: 7/65

Explanation:

Total cards = 65.

Even numbers divisible by 5 from 10 to 74 are multiples of 10: 10, 20, 30, 40, 50, 60, 70.

Count = 7.

P(even number divisible by 5) = 7/65.

Q.38(a) [4 marks]

Case Study 3: A skilled carpenter decided to craft a special rolling pin for the local baker. He carefully joined three cylindrical pieces of wood — two small ones on the ends and one larger in the centre to create a perfect tool. The length of the bigger cylindrical part is 12 cm and diameter is 7 cm. The

length of each smaller cylindrical part is 5 cm and diameter is 2.1 cm.

(i) Find the volume of the bigger cylindrical part.

Answer: 462 cm³

Explanation:

Bigger cylinder: length (h) = 12 cm, diameter = 7 cm, radius (r) = 3.5 cm.

Volume = $\pi r^2 h = (22/7) \times (3.5)^2 \times 12 = (22/7) \times 12.25 \times 12 = 22 \times 1.75 \times 12 = 462$ cm³.

Q.38(b) [4 marks]

Case Study 3 (contd.): Rolling pin with bigger cylinder (length 12 cm, diameter 7 cm) and two smaller cylinders (length 5 cm each, diameter 2.1 cm each).

(ii) Find the curved surface area of the bigger cylindrical part.

Answer: 264 cm²

Explanation:

Bigger cylinder: radius = 3.5 cm, length = 12 cm.

CSA = $2\pi rh = 2 \times (22/7) \times 3.5 \times 12 = 2 \times 22 \times 0.5 \times 12 = 264$ cm².

Q.38(c) [4 marks]

Case Study 3 (contd.): Rolling pin with bigger cylinder (length 12 cm, diameter 7 cm) and two identical smaller cylinders (length 5 cm each, diameter 2.1 cm each).

(iii)(a) Find the ratio of the volume of the bigger cylindrical part to the total volume of the two smaller (identical) cylindrical parts.

Answer: 40 : 3

Explanation:

Volume of bigger cylinder = 462 cm³.

Each smaller cylinder: radius = 1.05 cm, length = 5 cm.

Volume of one small cylinder = $\pi r^2 h$ = (22/7) × $(1.05)^2$ × 5 = (22/7) × 1.1025 × 5 = 17.325 cm^3.

Total volume of 2 small cylinders = 34.65 cm^3.

Ratio = 462 / 34.65 = 40/3.

The ratio is 40 : 3.

OR

Q.38(c) [4 marks]

Case Study 3 (contd.): Rolling pin with two identical smaller cylinders (length 5 cm each, diameter 2.1 cm each).

(iii)(b) Find the sum of the curved surface areas of the two identical smaller cylindrical parts.

Answer: 66 cm^2

Explanation:

Each smaller cylinder: radius = 1.05 cm, length = 5 cm.

CSA of one = $2\pi rh$ = 2 × (22/7) × 1.05 × 5 = 2 × 22 × 0.15 × 5 = 33 cm^2.

Sum of CSA of both = 2 × 33 = 66 cm^2.