CBSE 2020 Maths Standard — Set 3 — 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]

The HCF of 135 and 225 is

(a) 15

(b) 75

(c) 45 <<

(d) 5

Explanation:

Using Euclid's division algorithm: 225 = 1 × 135 + 90; 135 = 1 × 90 + 45; 90 = 2 × 45 + 0.

So HCF = 45.

Q.2 [1 mark]

The exponent of 2 in the prime factorization of 144 is

(a) 2

(b) 4 <<

(c) 1

(d) 6

Explanation:

144 = $2^4 \times 3^2$. So the exponent (power) of 2 is 4.

Q.3 [1 mark]

The common difference of an AP, whose nth term is a_n = (3n + 7), is

(a) 3 <<

(b) 7

(c) 10

(d) 6

Explanation:

$a_n = 3n + 7$.

Common difference $d = a_n - a_{(n-1)} = (3n + 7) - (3(n-1) + 7) = 3n + 7 - 3n + 3 - 7 = 3$.

Q.4 [1 mark]

The value of λ for which $(x^2 + 4x + \lambda)$ is a perfect square, is

(a) 16

(b) 9

(c) 1

(d) 4 <<

Explanation:

For $x^2 + 4x + \lambda$ to be a perfect square, it must equal $(x + 2)^2 = x^2 + 4x + 4$.

So $\lambda = 4$.

Q.5 [1 mark]

The value of k, for which the pair of linear equations $kx + y = k^2$ and $x + ky = 1$ have infinitely many solutions, is

(a) ±1

(b) 1 <<

(c) −1

(d) 2

Explanation:

For infinitely many solutions: $a_1/a_2 = b_1/b_2 = c_1/c_2$.

Here $k/1 = 1/k = k^2/1$.

From $k/1 = 1/k$: $k^2 = 1$, so $k = \pm 1$.

Check $k = 1$: $1/1 = 1/1 = 1/1$ (consistent).

Check $k = -1$: $-1/1 = 1/(-1) = 1/1$ gives $-1 = -1 \neq 1$ (inconsistent).

So $k = 1$.

Q.6 [1 mark]

The value of p for which (2p + 1), 10 and (5p + 5) are three consecutive

terms of an AP is

(a) −1

(b) −2

(c) 1

(d) 2 <<

Explanation:

For three consecutive AP terms, 2 × middle = first + last.

2(10) = (2p + 1) + (5p + 5).

20 = 7p + 6.

7p = 14.

p = 2.

OR

Q.6 [1 mark]

The number of terms of an AP 5, 9, 13, ..., 185 is

Answer: 46 (none of the printed options — misprint in the paper)

Explanation:

a = 5, d = 4, a_n = 185.

185 = 5 + (n − 1) × 4 → n − 1 = 45 → n = 46.

46 is not among the printed options (31, 51, 41, 40) — a misprint in the paper.

Q.7 [1 mark]

In the given figure, the graph of the polynomial p(x) is shown. The number of zeroes of the polynomial is

(a) 1

(b) 2 <<

(c) 3

(d) 0

Explanation:

The number of zeroes of a polynomial equals the number of times its graph crosses the x-axis.

From the graph, the curve touches/crosses the x-axis at 2 points.

So the number of zeroes is 2.

Q.8 [1 mark]

If (a, b) is the mid-point of the line segment joining the points A(10, −6) and B(k, 4) and a − 2b = 18, the value of k is

(a) 30

(b) 22 <<

(c) 4

(d) 40

Explanation:

Mid-point formula: a = (10 + k)/2, b = (−6 + 4)/2 = −1.

Substituting in a − 2b = 18: a − 2(−1) = 18, a + 2 = 18, a = 16.

From (10 + k)/2 = 16: k = 22.

Q.9 [1 mark]

The value of k for which the points A(0, 1), B(2, k) and C(4, −5) are collinear is

(a) 2

(b) −2 <<

(c) 0

(d) 4

Explanation:

For collinear points, area of triangle = 0.

Using: $x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2) = 0$.

$0(k + 5) + 2(-5 - 1) + 4(1 - k) = 0$.

$-12 + 4 - 4k = 0$.

$-8 - 4k = 0$.

$k = -2$.

Q.10 [1 mark]

If ΔABC ~ ΔDEF such that AB = 1.2 cm and DE = 1.4 cm, the ratio of the

areas of ΔABC and ΔDEF is

(a) 49 : 36

(b) 6 : 7

(c) 7 : 6

(d) 36 : 49 <<

Explanation:

Ratio of areas of similar triangles = (ratio of corresponding sides)².

Area(ΔABC)/Area(ΔDEF) = (AB/DE)² = (1.2/1.4)² = (6/7)² = 36/49 = 36 : 49.

Q.11 [1 mark]

√2 times the distance between (0, 5) and (−5, 0) is _____.

Answer: 10

Explanation:

Distance = √((0−(−5))² + (5−0)²) = √(25 + 25) = √50 = 5√2.

Multiplying by √2: √2 × 5√2 = 5 × 2 = 10.

Q.12 [1 mark]

The distance between two parallel tangents of a circle of radius 4 cm is _____.

Answer: 8 cm

Explanation:

Two parallel tangents to a circle lie on opposite sides, each at a distance equal to the radius from the centre.

Distance = 2 × radius = 2 × 4 = 8 cm.

Q.13 [1 mark]

In the figure, PA and PB are tangents to the circle with centre O such that ∠APB = 50°. The measure of ∠OAB is _____.

Answer: 25°

Explanation:

Since PA and PB are tangents, ∠OAP = ∠OBP = 90°.

In quadrilateral OAPB: ∠AOB = 360° − 90° − 90° − 50° = 130°.

Since OA = OB (radii), ΔOAB is isosceles.

∠OAB = ∠OBA = (180° − 130°)/2 = 25°.

OR

Q.13 [1 mark]

In the figure, PQ is a chord of a circle and PT is tangent at P such that ∠QPT = 60°. The measure of ∠PRQ is _____.

Answer: 120°

Explanation:

By the alternate segment theorem, ∠QPT equals the angle subtended by chord PQ in the alternate segment.

∠QPT = 60° = angle in the major arc.

The angle in the minor arc ∠PRQ = 180° − 60° = 120° (since angles in the same segment are supplementary to opposite segment angles).

Q.14 [1 mark]

(3 cot 40°)/(tan 50°) − (1/2)(cos 35°/sin 55°) = _____.

Answer: 5/2

Explanation:

cot 40° = tan(90° − 40°) = tan 50°.

So 3 cot 40° / tan 50° = 3.

Also cos 35° = sin(90° − 35°) = sin 55°.

So cos 35°/sin 55° = 1.

Result = 3 − (1/2)(1) = 3 − 1/2 = 5/2.

Q.15 [1 mark]

If cot θ = 7/8, then the value of ((1 + sin θ)(1 − sin θ)) / ((1 + cos θ)(1 − cos θ)) is _____.

Answer: 49/64

Explanation:

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

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

Expression $= \cos^2\theta/\sin^2\theta = \cot^2\theta = (7/8)^2 = 49/64$.

Q.16 [1 mark]

What is the value of $(1/(1 + \cot^2\theta) + 1/(1 + \tan^2\theta))$?

Answer: 1

Explanation:

$1/(1 + \cot^2\theta) = 1/\text{cosec}^2\theta = \sin^2\theta$.

$1/(1 + \tan^2\theta) = 1/\sec^2\theta = \cos^2\theta$.

Sum $= \sin^2\theta + \cos^2\theta = 1$.

Q.17 [1 mark]

Two right circular cones have their heights in the ratio 1 : 3 and radii in the ratio 3 : 1. What is the ratio of their volumes?

Answer: 3 : 1

Explanation:

Volume of cone $= (1/3)\pi r^2 h$.

Ratio $= (r_1^2 \times h_1)/(r_2^2 \times h_2) = (3^2 \times 1)/(1^2 \times 3) = 9/3 = 3 : 1$.

Q.18 [1 mark]

Using the empirical formula, find the mode of a distribution whose mean is 8.32 and the median is 8.05.

Answer: 7.51

Explanation:

Empirical formula: Mode $= 3 \times$ Median $- 2 \times$ Mean $= 3(8.05) - 2(8.32) = 24.15 - 16.64 = 7.51$.

Q.19 [1 mark]

The probability that it will rain tomorrow is 0.85. What is the probability that it

will not rain tomorrow?

Answer: 0.15

Explanation:

P(not rain) = 1 − P(rain) = 1 − 0.85 = 0.15.

Q.20 [1 mark]

What is the arithmetic mean of first n natural numbers?

Answer: (n + 1)/2

Explanation:

Sum of first n natural numbers = n(n + 1)/2.

Arithmetic mean = Sum / n = n(n + 1)/(2n) = (n + 1)/2.

Section B

Very Short Answer Questions (2 marks each)

Q.21 [2 marks]

Find the 11th term from the last term (towards the first term) of the AP 12, 8, 4, ..., −84.

Answer: −44

Explanation:

From the last term towards the first, the AP reverses: first term = −84, common difference = +4.

The 11th term = −84 + (11 − 1)(4) = −84 + 40 = −44.

OR

Q.21 [2 marks]

Solve the equation: 1 + 5 + 9 + 13 + ... + x = 1326.

Answer: x = 101

Explanation:

AP with a = 1, d = 4.

S_n = n/2[2a + (n−1)d] = n/2[2 + 4(n−1)] = n(2n − 1).

Setting n(2n − 1) = 1326: $2n^2 - n - 1326 = 0$.

n = (1 + √(1 + 10608))/4 = (1 + 103)/4 = 26.

x = a + (n−1)d = 1 + 25(4) = 101.

Q.22 [2 marks]

In the figure, AB is a chord of a circle with centre O, AOC is a diameter and AT is tangent at A. Prove that ∠BAT = ∠ACB.

Answer: Proof

Explanation:

Since AT is tangent at A and OA is radius, ∠OAT = 90°.

So ∠BAT = 90° − ∠OAB.

In ΔOAB, OA = OB (radii), so ∠OAB = ∠OBA.

∠AOB = 180° − 2∠OAB.

∠ACB is the angle subtended by arc AB at point C on the circle = ∠AOB/2 = (180° − 2∠OAB)/2 = 90° − ∠OAB = ∠BAT.

Hence proved.

Q.23 [2 marks]

If tan θ = 3/4, find the value of $(1 - \cos^2\theta)/(1 + \cos^2\theta)$.

Answer: 9/41

Explanation:

tan θ = 3/4 → sin θ = 3/5, cos θ = 4/5.

$\cos^2\theta = 16/25$.

(1 − 16/25)/(1 + 16/25) = (9/25)/(41/25) = 9/41.

OR

Q.23 [2 marks]

If tan θ = √3, find the value of $(2 \sec\theta)/(1 + \tan^2\theta)$.

Answer: 1

Explanation:

tan θ = √3, so θ = 60°. sec 60° = 2, tan²60° = 3. (2 × 2)/(1 + 3) = 4/4 = 1.

Q.24 [2 marks]

Students of Class XII presented a gift to their school in the form of an electric lamp — a glass hemispherical base surmounted by a metallic cylindrical top of same radius 21 cm and height 3.5 cm. The top was silver coated and the glass surface was painted red.

(i) What is the cost of silver coating the top at the rate of Rs.5 per 100 cm²?

(ii) What is the surface area of the glass part to be painted red?

Answer: (i) Rs.92.40; (ii) 2772 cm²

Explanation:

(i) Silver coating area = CSA of cylinder + top circular face = 2πrh + πr² = 2(22/7)(21)(3.5) + (22/7)(21)² = 462 + 1386 = 1848 cm².

Cost = 1848 × 5/100 = Rs.92.40.

(ii) Glass part = CSA of hemisphere = 2πr² = 2(22/7)(21)² = 2772 cm².

Q.25 [2 marks]

A leap year is randomly chosen. Find the probability that it will contain 53 Sundays and 53 Mondays.

Answer: 1/7

Explanation:

A leap year has 366 days = 52 complete weeks + 2 extra days.

The 2 extra days can be: (Sun,Mon), (Mon,Tue), (Tue,Wed), (Wed,Thu), (Thu,Fri), (Fri,Sat), (Sat,Sun).

For both 53 Sundays AND 53 Mondays, the extra days must be Sunday and Monday.

Favorable outcomes = 1.

Probability = 1/7.

Q.26 [2 marks]

Find the value of p if the mean of the following distribution is 7.5.

Classes: 2–4, 4–6, 6–8, 8–10, 10–12, 12–14

Frequency: 6, 8, 15, p, 8, 4

Answer: p = 3

Explanation:

Mid-values: 3, 5, 7, 9, 11, 13.

$\Sigma f_i = 6+8+15+p+8+4 = 41+p$.

$\Sigma f_i x_i = 18+40+105+9p+88+52 = 303+9p$.

Mean = $(303+9p)/(41+p) = 7.5$.

Solving: $303+9p = 307.5+7.5p$.

$1.5p = 4.5$.

$p = 3$.

Section C

Short Answer Questions (3 marks each)

Q.27 [3 marks]

Find a, b and c if it is given that the numbers a, 7, b, 23, c are in AP.

Answer: $a = -1$, $b = 15$, $c = 31$

Explanation:

In AP: a, 7, b, 23, c.

Since 7 and 23 are separated by 2 terms, $23 - 7 = 2d$, so $d = 8$.

Then $b = 7 + 8 = 15$, $a = 7 - 8 = -1$, $c = 23 + 8 = 31$.

OR

Q.27 [3 marks]

If m times the mth term of an AP is equal to n times its nth term, show that the (m + n)th term of the AP is zero.

Answer: Proof

Explanation:

Let first term = a, common difference = d.

Given: m[a + (m−1)d] = n[a + (n−1)d].

Expanding: ma + m(m−1)d = na + n(n−1)d.

Rearranging: a(m−n) + d[m²−m−n²+n] = 0.

a(m−n) + d[(m²−n²)−(m−n)] = 0.

(m−n)[a + (m+n−1)d] = 0.

Since m ≠ n, a + (m+n−1)d = 0, which is the (m+n)th term.

Hence proved.

Q.28 [3 marks]

Find the values of k for which the quadratic equation $(k + 4)x^2 + (k + 1)x + 1 = 0$ has equal roots.

Answer: k = 5 or k = −3

Explanation:

For equal roots, discriminant = 0.

$D = (k+1)^2 - 4(k+4)(1) = 0$.

$k^2 + 2k + 1 - 4k - 16 = 0$.

$k^2 - 2k - 15 = 0$.

$(k - 5)(k + 3) = 0$.

k = 5 or k = −3.

Q.29 [3 marks]

On dividing $x^3 - 3x^2 + x + 2$ by a polynomial g(x), the quotient and remainder were x − 2 and −2x + 4 respectively. Find g(x).

Answer: $g(x) = x^2 - x + 1$

Explanation:

By division algorithm: Dividend = Divisor × Quotient + Remainder.

$x^3 - 3x^2 + x + 2 = g(x)(x - 2) + (-2x + 4)$.

$g(x)(x - 2) = x^3 - 3x^2 + x + 2 + 2x - 4 = x^3 - 3x^2 + 3x - 2$.

Dividing by (x − 2): $x^3 - 3x^2 + 3x - 2 = (x - 2)(x^2 - x + 1)$.

So $g(x) = x^2 - x + 1$.

OR

Q.29 [3 marks]

If the sum of the squares of zeroes of the quadratic polynomial $f(x) = x^2 - 8x + k$ is 40, find the value of k.

Answer: k = 12

Explanation:

Let zeroes be α and β.

By Vieta's: $\alpha + \beta = 8$, $\alpha\beta = k$.

$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta = 64 - 2k = 40$.

So $2k = 24$, $k = 12$.

Q.30 [3 marks]

In what ratio does the point P(−4, y) divide the line segment joining the points A(−6, 10) and B(3, −8)? If it lies on AB, hence find the value of y.

Answer: Ratio = 2 : 7, y = 6

Explanation:

Let P divide AB in ratio k : 1.

x-coordinate: $(3k + (-6))/(k + 1) = -4$.

$3k - 6 = -4k - 4$.

$7k = 2$.

$k = 2/7$.

Ratio = 2 : 7.

$y = (-8 \times 2/7 + 10 \times 1)/(2/7 + 1) = (-16/7 + 70/7)/(9/7) = (54/7)/(9/7) = 6$.

Q.31 [3 marks]

Prove that a tangent to a circle is perpendicular to the radius through the point of contact.

Answer: Proof

Explanation:

Let O be the centre and P the point of tangency on line AB.

Assume OP is not perpendicular to AB.
Draw OM ⊥ AB where M ≠ P.
Then OM < OP (perpendicular is shortest distance from a point to a line).
But M lies on the tangent, hence outside or on the circle.
Since P is on the circle, OM ≥ OP (radius).
This contradicts OM < OP.
Hence OP ⊥ AB.

OR

Q.31 [3 marks]

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: Proof

Explanation:
Let PA and PB be tangents from external point P to a circle with centre O, touching at A and B.
∠OAP = ∠OBP = 90° (radius ⊥ tangent).
In quadrilateral OAPB: sum of angles = 360°.
∠OAP + ∠APB + ∠OBP + ∠AOB = 360°.
90° + ∠APB + 90° + ∠AOB = 360°.
∠APB + ∠AOB = 180°.
Hence supplementary.

Q.32 [3 marks]

In a right triangle, prove that the square of the hypotenuse is equal to the sum of squares of the other two sides (Pythagoras Theorem).

Answer: Proof

Explanation:
In right ΔABC with ∠B = 90°, draw BD ⊥ AC.
In ΔADB and ΔABC: ∠A is common, ∠ADB = ∠ABC = 90°, so ΔADB ~ ΔABC (AA).
Thus AD/AB = AB/AC, giving $AB^2 = AD \times AC$ ...(1).

Similarly ΔBDC ~ ΔABC: DC/BC = BC/AC, giving $BC^2 = DC \times AC$ ...(2).

Adding (1) and (2): $AB^2 + BC^2 = AC(AD + DC) = AC^2$.

Section D

Long Answer Questions (5 marks each)

Q.33 [5 marks]

If $\sin\theta + \cos\theta = p$ and $\sec\theta + \operatorname{cosec}\theta = q$, show that $q(p^2 - 1) = 2p$.

Answer: Proof

Explanation:

$p^2 = (\sin\theta + \cos\theta)^2 = 1 + 2\sin\theta\cos\theta$.

So $p^2 - 1 = 2\sin\theta\cos\theta$.

$q = \sec\theta + \operatorname{cosec}\theta = (\sin\theta + \cos\theta)/(\sin\theta\cos\theta) = p/(\sin\theta\cos\theta)$.

Therefore $q(p^2 - 1) = [p/(\sin\theta\cos\theta)] \times 2\sin\theta\cos\theta = 2p$.

Hence proved.

Q.34 [5 marks]

500 persons are taking dip into a cuboidal pond which is 80 m long and 50 m broad. What is the rise of water level in the pond, if the average displacement of water by a person is 0.04 m^3?

Answer: 0.005 m (or 5 mm)

Explanation:

Total volume displaced = $500 \times 0.04 = 20\ m^3$.

Rise in water level = Volume/(length × breadth) = $20/(80 \times 50) = 20/4000 = 0.005$ m = 5 mm.

Q.35 [5 marks]

Show that (12)^n cannot end with digit 0 or 5 for any natural number n.

Answer: Proof

Explanation:

12 = 2² × 3.

So 12^n = 2^(2n) × 3^n.

The prime factorization contains no factor of 5.

A number ending in 0 must have both 2 and 5 as factors, and a number ending in 5 must have 5 as a factor but not 2.

Since 12^n has no factor of 5, it cannot end in 0 or 5.

OR

Q.35 [5 marks]

Prove that (√2 + √5) is irrational.

Answer: Proof

Explanation:

Assume √2 + √5 is rational, say a/b.

Then √5 = a/b − √2.

Squaring: 5 = a²/b² − 2(a/b)√2 + 2.

So √2 = (a²/b² − 3) × b/(2a) = (a² − 3b²)/(2ab).

The RHS is rational, but √2 is irrational — a contradiction.

Hence √2 + √5 is irrational.

Q.36 [5 marks]

A train covered a certain distance at a uniform speed. If the train would have been 6 km/hr faster, it would have taken 4 hours less than the scheduled time and if the train were slower by 6 km/hr, it would have taken 6 hrs more than the scheduled time. Find the length of the journey.

Answer: 720 km

Explanation:

Let speed = s km/hr, time = t hrs, distance = st.

Case 1: st = (s+6)(t−4) → 4s − 6t = −24 → 2s − 3t = −12 ...(1).

Case 2: st = (s−6)(t+6) → 6s − 6t = 36 → s − t = 6 ...(2).

From (2): s = t + 6.

In (1): 2(t+6) − 3t = −12.

$2t + 12 - 3t = -12$.

$t = 24$.

$s = 30$.

Distance $= 30 \times 24 = 720$ km.

Section E

Case Study Based Questions (4 marks each)

Q.37 [4 marks]

In an equilateral triangle ABC, D is a point on the side BC such that BD = (1/3)BC. Prove that $9\,AD^2 = 7\,AB^2$.

Answer: Proof

Explanation:

Let AB = BC = CA = a.

BD = a/3.

Draw AE $\perp$ BC.

E is midpoint of BC (equilateral triangle), so BE = a/2.

AE = $(\sqrt{3}/2)a$.

DE = BE − BD = a/2 − a/3 = a/6.

In right ΔADE: $AD^2 = AE^2 + DE^2 = 3a^2/4 + a^2/36 = (27a^2 + a^2)/36 = 28a^2/36 = 7a^2/9$.

So $9\,AD^2 = 7a^2 = 7\,AB^2$.

OR

Q.37 [4 marks]

Prove that the sum of squares of the sides of a rhombus is equal to the sum of the squares of its diagonals.

Answer: Proof

Explanation:

Let ABCD be a rhombus with diagonals AC and BD intersecting at O.

Diagonals of a rhombus bisect each other at right angles: AO = CO = AC/2, BO = DO = BD/2.

In right ΔAOB: $AB^2 = AO^2 + BO^2 = (AC/2)^2 + (BD/2)^2$.

Since all sides equal: $4AB^2 = 4(AC^2/4 + BD^2/4) = AC^2 + BD^2$.

That is, $AB^2 + BC^2 + CD^2 + DA^2 = AC^2 + BD^2$.

Q.38 [4 marks]

If the angle of elevation of a cloud from a point 10 metres above a lake is 30° and the angle of depression of its reflection in the lake is 60°, find the height of the cloud from the surface of the lake.

Answer: 20 m

Explanation:

Let cloud height above lake = h.

Observation point is 10 m above lake.

Horizontal distance = d.

$\tan 30° = (h - 10)/d \rightarrow d = (h - 10)\sqrt{3}$.

$\tan 60° = (h + 10)/d \rightarrow d = (h + 10)/\sqrt{3}$.

Equating: $(h - 10)\sqrt{3} = (h + 10)/\sqrt{3}$.

$3(h - 10) = h + 10$.

$3h - 30 = h + 10$.

$2h = 40$.

$h = 20$ m.

OR

Q.38 [4 marks]

A vertical tower of height 20 m stands on a horizontal plane and is surmounted by a vertical flag-staff of height h. At a point on the plane, the angle of elevation of the bottom and top of the flag staff are 45° and 60° respectively. Find the value of h.

Answer: $20(\sqrt{3} - 1)$ m

Explanation:

Let horizontal distance from base = d.

$\tan 45° = 20/d \rightarrow d = 20$ m.

$\tan 60° = (20 + h)/d \rightarrow \sqrt{3} = (20 + h)/20$.

$20\sqrt{3} = 20 + h$.

$h = 20(\sqrt{3} - 1) \approx 14.64$ m.

Q.39 [4 marks]

A solid iron cuboidal block of dimensions 4.4 m × 2.6 m × 1 m is cast into a hollow cylindrical pipe of internal radius 30 cm and thickness 5 cm. Find the length of the pipe.

Answer: 112 m

Explanation:

Volume of cuboid = $4.4 \times 2.6 \times 1 = 11.44$ m³.

Internal radius r = 30 cm = 0.3 m.

External radius R = 35 cm = 0.35 m.

Volume of hollow cylinder = $\pi(R^2 - r^2)L = \pi(0.1225 - 0.09)L = \pi(0.0325)L$.

Setting equal: $11.44 = (22/7)(0.0325)L$.

$L = 11.44 \times 7/(22 \times 0.0325) = 80.08/0.715 = 112$ m.

Q.40 [4 marks]

For the following frequency distribution, draw a cumulative frequency curve of 'more than' type and hence obtain the median value.

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

Frequency: 5, 15, 20, 23, 17, 11, 9

Answer: Median ≈ 34.35

Explanation:

Total N = 100.

N/2 = 50.

Cumulative frequencies: 0–10: 5, 0–20: 20, 0–30: 40, 0–40: 63, 0–50: 80, 0–60: 91, 0–70: 100.

Median class = 30–40 (cf first exceeds 50).

Median = $30 + ((50 - 40)/23) \times 10 = 30 + 100/23 \approx 34.35$.

For 'more than' ogive: plot points (0,100), (10,95), (20,80), (30,60), (40,37), (50,20),

(60,9), (70,0) and draw a smooth curve.

Median is where N/2 = 50 line meets the curve.