CBSE 2022 Maths Standard (Term 2) — Set 1 — 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.

Q.1(a) [1 mark]

Find the sum of first 30 terms of an A.P.: -30, -24, -18, ...

Answer: 1710

Explanation:

Step 1: Identify a = -30, d = -24 - (-30) = 6, n = 30.

Step 2: Use S_n = n/2 * [2a + (n-1)d].

Step 3: S_30 = 30/2 * [2(-30) + 29(6)] = 15 * [-60 + 174] = 15 * 114 = 1710.

OR

Q.1 [1 mark]

In an A.P., if S_n = n(4n + 1), then find the A.P.

Answer: 5, 13, 21, 29, ...

Explanation:

Step 1: First term a_1 = S_1 = 1(4 + 1) = 5.

Step 2: S_2 = 2(8 + 1) = 18. So a_2 = S_2 - S_1 = 18 - 5 = 13.

Step 3: Common difference d = 13 - 5 = 8.

Step 4: The A.P. is 5, 13, 21, 29, ...

Section A

Multiple Choice Questions (1 mark each)

Q.2 [1 mark]

A solid metallic sphere of radius 10.5 cm is melted and recast into a number of smaller cones, each of radius 3.5 cm and height 3 cm. Find the number of cones so formed.

Answer: 126

Explanation:

Step 1: Volume of sphere = (4/3) * pi * R^3 = (4/3) * pi * (10.5)^3 = (4/3) * pi * 1157.625 = 1543.5 * pi cm^3.

Step 2: Volume of each cone = (1/3) * pi * r^2 * h = (1/3) * pi * (3.5)^2 * 3 = (1/3) * pi * 36.75 = 12.25 * pi cm^3.

Step 3: Number of cones = 1543.5 * pi / 12.25 * pi = 126.

Q.3(a) [1 mark]

Find the value of m for which the quadratic equation (m - 1)x^2 + 2(m - 1)x + 1 = 0 has two real and equal roots.

Answer: 2

Explanation:

Step 1: For real and equal roots, discriminant D = 0.

Step 2: Here a = (m-1), b = 2(m-1), c = 1.

Step 3: D = b^2 - 4ac = 4(m-1)^2 - 4(m-1) = 0.

Step 4: Factor out 4(m-1): 4(m-1)[(m-1) - 1] = 4(m-1)(m-2) = 0.

Step 5: m = 1 or m = 2. Since m = 1 makes it non-quadratic, m = 2.

OR

Q.3 [1 mark]

Solve the following quadratic equation for x: sqrt(3) * x^2 + 10x + 7 * sqrt(3) = 0

Answer: x = -sqrt(3) or x = -7*sqrt(3)/3

Explanation:

Step 1: a = sqrt(3), b = 10, c = 7*sqrt(3). Product a*c = 21.

Step 2: Split middle term: 3 + 7 = 10 and 3 * 7 = 21.

Step 3: sqrt(3)*x^2 + 3x + 7x + 7*sqrt(3) = 0.

Step 4: sqrt(3)*x(x + sqrt(3)) + 7(x + sqrt(3)) = 0.

Step 5: (sqrt(3)*x + 7)(x + sqrt(3)) = 0.

Step 6: x = -sqrt(3) or x = -7/sqrt(3) = -7*sqrt(3)/3.

Q.4 [1 mark]

Find the mode of the following frequency distribution:

Class: 10-20, 20-30, 30-40, 40-50, 50-60

Frequency: 15, 10, 12, 17, 4

Answer: 42.78 (approx)

Explanation:

Step 1: Highest frequency = 17, so modal class = 40-50.

Step 2: l = 40, h = 10, f_1 = 17, f_0 = 12 (preceding class), f_2 = 4 (succeeding class).

Step 3: Mode = l + [(f_1 - f_0) / (2*f_1 - f_0 - f_2)] * h.

Step 4: Mode = 40 + [(17 - 12) / (34 - 12 - 4)] * 10 = 40 + (5/18) * 10 = 40 + 2.78 = 42.78.

Q.5 [1 mark]

The product of Rehan's age (in years) 5 years ago and his age 7 years from now, is one more than twice his present age. Find his present age.

Answer: 6

Explanation:

Step 1: Let present age = x years.

Step 2: (x - 5)(x + 7) = 2x + 1.

Step 3: x^2 + 2x - 35 = 2x + 1.

Step 4: x^2 = 36, so x = 6 (rejecting negative value).

Step 5: Verify: (6-5)(6+7) = 1 * 13 = 13 = 2(6) + 1. Correct.

Q.6 [1 mark]

Two concentric circles are of radii 4 cm and 3 cm. Find the length of the chord of the larger circle which touches the smaller circle.

Answer: 2*sqrt(7) cm

Explanation:

Step 1: The chord of the larger circle is tangent to the smaller circle, so the perpendicular distance from the centre to the chord = radius of smaller circle = 3 cm.

Step 2: Half-chord = sqrt(R^2 - r^2) = sqrt(16 - 9) = sqrt(7) cm.

Step 3: Full chord = 2*sqrt(7) cm (approx 5.29 cm).

Q.7 [1 mark]

For what value of x is the median of the following frequency distribution

34.5?

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

Frequency: 3, 5, 11, 10, x, 3, 2

Answer: 13

Explanation:

Step 1: Median = 34.5 falls in class 30-40. Here l = 30, h = 10, f = 10.

Step 2: Total N = 34 + x.

Cumulative frequency before median class cf = 3 + 5 + 11 = 19.

Step 3: Median = l + [(N/2 - cf)/f] * h.

Step 4: 34.5 = 30 + [((34+x)/2 - 19)/10] * 10 = 30 + (34+x)/2 - 19.

Step 5: 4.5 = (34+x)/2 - 19, so (34+x)/2 = 23.5, giving 34+x = 47, x = 13.

Step 6: Verify: N=47, N/2=23.5. Median = 30 + (23.5-19)/10 * 10 = 30 + 4.5 = 34.5. Correct.

Q.9(a) [1 mark]

The angle of elevation of the top of a building from the foot of a tower is 30 degrees and the angle of elevation of the top of the tower from the foot of the building is 60 degrees. If the tower is 50 m high, find the height of the building.

Answer: 50/3 m

Explanation:

Step 1: Let height of building = h m, horizontal distance between them = d m.

Step 2: From foot of tower: tan(30) = h/d => d = h*sqrt(3).

Step 3: From foot of building: tan(60) = 50/d => d = 50/sqrt(3).

Step 4: Equating: h*sqrt(3) = 50/sqrt(3) => h = 50/3 m (approx 16.67 m).

OR

Q.9 [1 mark]

From a point on a bridge across a river, the angles of depression of the banks on opposite sides of the river are 30 degrees and 45 degrees

respectively. If the bridge is at a height of 3 m from the banks, find the width of the river.

Answer: 3(sqrt(3) + 1) m

Explanation:

Step 1: Height of bridge = 3 m.

Step 2: Distance to one bank: tan(30) = 3/d_1, so d_1 = 3*sqrt(3) m.

Step 3: Distance to other bank: tan(45) = 3/d_2, so d_2 = 3 m.

Step 4: Width = d_1 + d_2 = 3*sqrt(3) + 3 = 3(sqrt(3) + 1) m (approx 8.20 m).

Q.10 [1 mark]

Following is the daily expenditure on lunch by 30 employees of a company:

Daily Expenditure (in Rupees): 100-120, 120-140, 140-160, 160-180, 180-200

Number of Employees: 8, 3, 8, 6, 5

Find the mean daily expenditure of the employees.

Answer: Rs 148

Explanation:

Step 1: Class marks (x_i): 110, 130, 150, 170, 190.

Step 2: f_i * x_i: 8*110=880, 3*130=390, 8*150=1200, 6*170=1020, 5*190=950.

Step 3: Sum of f_i = 30. Sum of f_i*x_i = 880 + 390 + 1200 + 1020 + 950 = 4440.

Step 4: Mean = 4440 / 30 = Rs 148.

Q.11(a) [1 mark]

From a solid cylinder of height 30 cm and radius 7 cm, a conical cavity of height 24 cm and same radius is hollowed out. Find the total surface area of the remaining solid.

Answer: 2024 cm^2

Explanation:

Step 1: r = 7 cm, cylinder height H = 30 cm, cone height h = 24 cm.

Step 2: Slant height of cone l = sqrt(7^2 + 24^2) = sqrt(49 + 576) = sqrt(625) = 25 cm.

Step 3: CSA of cylinder = 2 * (22/7) * 7 * 30 = 1320 cm^2.

Step 4: Top circular face = (22/7) * 7^2 = 154 cm^2.

Step 5: CSA of cone (inner surface) = (22/7) * 7 * 25 = 550 cm^2.

Step 6: TSA = 1320 + 154 + 550 = 2024 cm^2.

OR

Q.11 [1 mark]

Water in a canal, 8 m wide and 6 m deep, is flowing with a speed of 12 km/hour. How much area will it irrigate in one hour, if 0.05 m of standing water is required?

Answer: 11520000 m^2

Explanation:

Step 1: Speed = 12 km/h = 12000 m/h.

Step 2: Volume of water per hour = 8 * 6 * 12000 = 576000 m^3.

Step 3: Area irrigated = Volume / standing water depth = 576000 / 0.05 = 11520000 m^2.

Step 4: This equals 1152 hectares.

Q.13(a) [1 mark]

(Case Study) Matchstick patterns are based on linear relations. In a pattern: Figure 1 has 4 triangles, Figure 2 has 6 triangles, Figure 3 has 8 triangles, and so on. Write the A.P. for the number of triangles used in the figures and find the nth term of this A.P.

Answer: AP: 4, 6, 8, 10, ... and nth term = 2n + 2

Explanation:

Step 1: Number of triangles: Figure 1 = 4, Figure 2 = 6, Figure 3 = 8.

Step 2: This is an A.P. with a = 4 and d = 2.

Step 3: nth term a_n = a + (n-1)d = 4 + 2(n-1) = 2n + 2.

Q.13(b) [1 mark]

(Case Study) Matchstick patterns are based on linear relations. In a pattern: Figure 1 uses 5 matchsticks, Figure 2 uses 9 matchsticks, Figure 3 uses 13 matchsticks (each figure uses 4 more matchsticks than the previous). Which figure has 61 matchsticks?

Answer: 15

Explanation:

Step 1: Matchsticks form an A.P.: 5, 9, 13, ... with a = 5 and d = 4.

Step 2: nth term a_n = 5 + (n-1)*4 = 4n + 1.

Step 3: Set 4n + 1 = 61 => 4n = 60 => n = 15.

Step 4: Figure 15 has 61 matchsticks.

Q.14(b) [1 mark]

(Case Study) Gadisar Lake is in Jaisalmer, Rajasthan. From a point A above the water level, the angle of elevation of the top of a Chhatri (point B) is 45 degrees and the angle of depression of its reflection in water (point C) is 60 degrees. If the height of the Chhatri above water level is approximately 10 m, find the height (h) of point A above the water level. (Use sqrt(3) = 1.73)

Answer: 2.67 m (approx)

Explanation:

Step 1: Let height of A above water = h. Chhatri height above water = 10 m.

Step 2: B is (10 - h) m above A. Reflection C is (10 + h) m below A.

Step 3: Let horizontal distance = d.

Step 4: tan(45) = (10 - h)/d => d = 10 - h.

Step 5: tan(60) = (10 + h)/d => sqrt(3) = (10 + h)/d => d = (10 + h)/sqrt(3).

Step 6: 10 - h = (10 + h)/sqrt(3) => sqrt(3)(10 - h) = 10 + h.

Step 7: 10*sqrt(3) - 10 = h(1 + sqrt(3)).

Step 8: h = 10(sqrt(3) - 1)/(sqrt(3) + 1).

Step 9: h = 10(1.73 - 1)/(1.73 + 1) = 10(0.73)/2.73 = 7.3/2.73 = 2.67 m (approx).