CBSE 2024 Maths Standard — 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.

Section A

Multiple Choice Questions (1 mark each)

Q.1 [1 mark]

If the sum of zeroes of the polynomial p(x) = 2x^2 - k*sqrt(2)*x + 1 is sqrt(2), then the value of k is:

(a) sqrt(2)

(b) 2 <<

(c) 2*sqrt(2)

(d) 1/2

Explanation:

Sum of zeroes = -(-k*sqrt(2))/2 = k*sqrt(2)/2.

Given k*sqrt(2)/2 = sqrt(2), so k = 2.

Q.2 [1 mark]

If the probability of a player winning a game is 0.79, then the probability of his losing the same game is:

(a) 1.79

(b) 0.31

(c) 0.21%

(d) 0.21 <<

Explanation:

P(losing) = 1 - P(winning) = 1 - 0.79 = 0.21.

Q.3 [1 mark]

If the roots of equation ax^2 + bx + c = 0, a != 0 are real and equal, then which of the following relation is true?

(a) a = b^2/c

(b) b^2 = ac

(c) ac = b^2/4 <<

(d) c = b/a

Explanation:

For real and equal roots, discriminant = 0: b^2 - 4ac = 0, so b^2 = 4ac, which gives ac = b^2/4.

Q.4 [1 mark]

In an A.P., if the first term a = 7, nth term a_n = 84 and the sum of first n terms S_n = 2093/2, then n is equal to:

(a) 22

(b) 24

(c) 23 <<

(d) 26

Explanation:

S_n = n/2 * (a + a_n).

2093/2 = n/2 * (7 + 84) = n/2 * 91.

So 2093 = 91n, n = 23.

Q.5 [1 mark]

If two positive integers p and q can be expressed as p = 18a^2*b^4 and q = 20a^3*b^2, where a and b are prime numbers, then LCM(p, q) is:

(a) 2a^2*b^2

(b) 180a^2*b^2

(c) 12a^2*b^2

(d) 180a^3*b^4 <<

Explanation:

LCM takes the highest power of each factor.

18 = 2 * 3^2, 20 = 2^2 * 5.

LCM(18,20) = 2^2 * 3^2 * 5 = 180.

Highest power of a: a^3.

Highest power of b: b^4.

LCM(p,q) = 180a^3*b^4.

Q.6 [1 mark]

AD is a median of triangle ABC with vertices A(5, -6), B(6, 4) and C(0, 0). Length AD is equal to:

(a) sqrt(68) units <<
(b) 2*sqrt(15) units
(c) sqrt(101) units
(d) 10 units

Explanation:
D is the midpoint of BC = ((6+0)/2, (4+0)/2) = (3, 2).
AD = sqrt((5-3)^2 + (-6-2)^2) = sqrt(4 + 64) = sqrt(68).

Q.7 [1 mark]

If sec(theta) - tan(theta) = m, then the value of sec(theta) + tan(theta) is:

(a) 1 - 1/m
(b) m^2 - 1
(c) 1/m <<
(d) -m

Explanation:
We know sec^2(theta) - tan^2(theta) = 1.
So (sec(theta) - tan(theta))(sec(theta) + tan(theta)) = 1.
m * (sec(theta) + tan(theta)) = 1.
Therefore sec(theta) + tan(theta) = 1/m.

Q.8 [1 mark]

From the data 1, 4, 7, 9, 16, 21, 25, if all the even numbers are removed, then the probability of getting a prime number from the remaining is:

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

Explanation:

Removing even numbers (4, 16): remaining = {1, 7, 9, 21, 25}.

Prime numbers in remaining = {7}.

Probability = 1/5.

Q.9 [1 mark]

For some data x_1, x_2, ..., x_n with respective frequencies f_1, f_2, ..., f_n, the value of sum(f_i * (x_i - x_bar)) is equal to:

(a) n * x_bar

(b) 1

(c) sum(f_i)

(d) 0 <<

Explanation:

sum(f_i * (x_i - x_bar)) = sum(f_i * x_i) - x_bar * sum(f_i).

Since x_bar = sum(f_i * x_i) / sum(f_i), we get sum(f_i * x_i) = x_bar * sum(f_i).

So the expression = x_bar * sum(f_i) - x_bar * sum(f_i) = 0.

Q.10 [1 mark]

If the zeroes of a polynomial x^2 + px + q are twice the zeroes of the polynomial 4x^2 - 5x - 6, the value of p is:

(a) -5/2 <<

(b) 5/2

(c) -5

(d) 10

Explanation:

Zeroes of 4x^2 - 5x - 6: sum = 5/4, product = -6/4 = -3/2.

If new zeroes are twice, new sum = 2 * 5/4 = 5/2.

For x^2 + px + q, sum of zeroes = -p.

So -p = 5/2, p = -5/2.

Q.11 [1 mark]

If the distance between the points (3, -5) and (x, -5) is 15 units, then the

values of x are:

(a) 12, -18

(b) -12, 18 <<

(c) 18, 5

(d) -9, -12

Explanation:

Distance = sqrt((x-3)^2 + (-5+5)^2) = |x-3| = 15.

So x - 3 = 15 or x - 3 = -15, giving x = 18 or x = -12.

Q.12 [1 mark]

If cos(alpha + beta) = 0, then the value of cos((alpha + beta)/2) is equal to:

(a) 1/sqrt(2) <<

(b) 1/2

(c) 0

(d) sqrt(2)

Explanation:

cos(alpha + beta) = 0 means alpha + beta = 90 degrees.

So (alpha + beta)/2 = 45 degrees.

cos(45) = 1/sqrt(2).

Q.13 [1 mark]

A solid sphere is cut into two hemispheres. The ratio of the surface areas of sphere to that of two hemispheres taken together is:

(a) 1 : 1

(b) 1 : 4

(c) 2 : 3 <<

(d) 3 : 2

Explanation:

Surface area of sphere = 4*pi*r^2.

Surface area of two hemispheres = 2 * (2*pi*r^2 + pi*r^2) = 2 * 3*pi*r^2 = 6*pi*r^2.

Ratio = 4*pi*r^2 : 6*pi*r^2 = 2 : 3.

Q.14 [1 mark]

The middle most observation of every data arranged in order is called:

(a) mode

(b) median <<

(c) mean

(d) deviation

Explanation:

By definition, the median is the middle most observation when data is arranged in order.

Q.15 [1 mark]

The volume of the largest right circular cone that can be carved out from a solid cube of edge 2 cm is:

(a) 4*pi/3 cu cm

(b) 5*pi/3 cu cm

(c) 8*pi/3 cu cm

(d) 2*pi/3 cu cm <<

Explanation:

For the largest cone from a cube of edge 2 cm: radius = 2/2 = 1 cm, height = 2 cm.
Volume = (1/3)*pi*r^2*h = (1/3)*pi*1*2 = 2*pi/3 cu cm.

Q.16 [1 mark]

Two dice are rolled together. The probability of getting sum of numbers on the two dice as 2, 3 or 5 is:

(a) 7/36 <<

(b) 11/36

(c) 5/36

(d) 4/9

Explanation:

Sum 2: (1,1) = 1 way.

Sum 3: (1,2),(2,1) = 2 ways.
Sum 5: (1,4),(2,3),(3,2),(4,1) = 4 ways.
Total = 7.
Probability = 7/36.

Q.17 [1 mark]

The centre of a circle is at (2, 0). If one end of a diameter is at (6, 0), then the other end is at:

(a) (0, 0)
(b) (4, 0)
(c) (-2, 0) <<
(d) (-6, 0)

Explanation:
If centre is midpoint of diameter: (2,0) = ((6+x)/2, (0+y)/2).
So (6+x)/2 = 2 gives x = -2, and y = 0.
Other end = (-2, 0).

Q.18 [1 mark]

In the given figure, graphs of two linear equations are shown. The pair of these linear equations is:

(a) consistent with unique solution
(b) consistent with infinitely many solutions
(c) inconsistent <<
(d) inconsistent but can be made consistent by extending these lines

Explanation:
From the figure, the two lines are parallel (they do not intersect).
Parallel lines represent an inconsistent system with no solution.

Q.19 [1 mark]

Assertion (A): The tangents drawn at the end points of a diameter of a circle, are parallel. Reason (R): Diameter of a circle is the longest chord.

(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

Explanation:

Assertion is true: tangents at endpoints of a diameter are perpendicular to the radius, hence parallel to each other.

Reason is also true: diameter is the longest chord.

But R does not explain why tangents are parallel, so R is not the correct explanation of A.

Q.20 [1 mark]

Assertion (A): If the graph of a polynomial touches x-axis at only one point, then the polynomial cannot be a quadratic polynomial. Reason (R): A polynomial of degree n (n > 1) can have at most n zeroes.

(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 <<

Explanation:

Assertion is false: a quadratic polynomial can touch the x-axis at exactly one point (e.g., $x^2 = 0$ has a repeated root at $x = 0$).

Reason is true: a polynomial of degree n can have at most n zeroes.

Section B

Very Short Answer Questions (2 marks each)

Q.21 [2 marks]

Solve the following system of linear equations: $7x - 2y = 5$ and $8x + 7y = 15$. Verify your answer.

Answer: $x = 1, y = 1$

Explanation:

From 7x - 2y = 5: y = (7x-5)/2.

Substituting in 8x + 7y = 15: 8x + 7(7x-5)/2 = 15 => 16x + 49x - 35 = 30 => 65x = 65 => x = 1.

Then y = (7-5)/2 = 1.

Verification: 7(1) - 2(1) = 5 (correct), 8(1) + 7(1) = 15 (correct).

Q.22 [2 marks]

In a pack of 52 playing cards one card is lost. From the remaining cards, a card is drawn at random. Find the probability that the drawn card is queen of heart, if the lost card is a black card.

Answer: 1/51

Explanation:

If the lost card is a black card, all 26 red cards remain including the queen of hearts, but total remaining cards = 51.

Probability = 1/51.

Q.23 [2 marks]

Evaluate: 2*sqrt(2)*cos(45)*sin(30) + 2*sqrt(3)*cos(30)

Answer: 4

Explanation:

2*sqrt(2)*cos(45)*sin(30) + 2*sqrt(3)*cos(30) = 2*sqrt(2)*(1/sqrt(2))*(1/2) + 2*sqrt(3)*(sqrt(3)/2) = 2*(1/2) + 2*(3/2) = 1 + 3 = 4.

OR

Q.23 [2 marks]

If A = 60 degrees and B = 30 degrees, verify that sin(A + B) = sin(A)*cos(B) + cos(A)*sin(B).

Answer: Verified: both sides = 1

Explanation:

LHS = sin(60° + 30°) = sin 90° = 1.

RHS = sin 60° cos 30° + cos 60° sin 30° = (√3/2)(√3/2) + (1/2)(1/2) = 3/4 + 1/4 = 1.

LHS = RHS = 1. Verified.

Q.24 [2 marks]

In the given figure, ABCD is a quadrilateral. Diagonal BD bisects angle B and angle D both. Prove that: (i) triangle ABD ~ triangle CBD (ii) AB = BC

Answer: Proved (triangles congruent by ASA, hence similar; AB = BC by CPCT)

Explanation:

In triangle ABD and triangle CBD: angle ABD = angle CBD (BD bisects angle B), angle ADB = angle CDB (BD bisects angle D), and BD = BD (common side).

By ASA, triangle ABD is congruent to triangle CBD, which also makes triangle ABD ~ triangle CBD.

Hence corresponding sides are equal, so AB = CB, i.e.

AB = BC.

Q.25 [2 marks]

Prove that 5 - 2*sqrt(3) is an irrational number. It is given that sqrt(3) is an irrational number.

Answer: Irrational (proof by contradiction)

Explanation:

Assume 5 - 2*sqrt(3) is rational, say p/q.

Then sqrt(3) = (5 - p/q)/2 = (5q - p)/(2q), which is rational.

This contradicts the given that sqrt(3) is irrational.

Hence 5 - 2*sqrt(3) is irrational.

OR

Q.25 [2 marks]

Show that the number 5 * 11 * 17 + 3 * 11 is a composite number.

Answer: 649 is composite (11 * 59)

Explanation:

5*11*17 + 3*11 = 11*(5*17 + 3) = 11*(85 + 3) = 11*88 = 968.

Since 968 = 11 * 88, it has factors other than 1 and itself, so it is composite.

Q.26 [2 marks]

Find the ratio in which the point (8/5, y) divides the line segment joining the points (1, 2) and (2, 3). Also, find the value of y.

Answer: Ratio = 3:2, y = 13/5

Explanation:

Let the ratio be k:1.

x-coordinate: (2k + 1)/(k + 1) = 8/5.

So 10k + 5 = 8k + 8, 2k = 3, k = 3/2.

Ratio = 3:2.

y = (3*3 + 2*2)/(3+2) = (9+4)/5 = 13/5.

OR

Q.26 [2 marks]

ABCD is a rectangle formed by the points A(-1, -1), B(-1, 6), C(3, 6) and D(3, -1). P, Q, R and S are mid-points of sides AB, BC, CD and DA respectively. Show that diagonals of the quadrilateral PQRS bisect each other.

Answer: Midpoints of both diagonals = (1, 5/2)

Explanation:

P = midpoint of AB = (-1, 5/2), Q = midpoint of BC = (1, 6), R = midpoint of CD = (3, 5/2), S = midpoint of DA = (1, -1).

Midpoint of PR = ((-1+3)/2, (5/2+5/2)/2) = (1, 5/2).

Midpoint of QS = ((1+1)/2, (6-1)/2) = (1, 5/2).

Both diagonals have the same midpoint, so they bisect each other.

Section C

Short Answer Questions (3 marks each)

Q.27 [3 marks]

In a teachers' workshop, the number of teachers teaching French, Hindi and English are 48, 80 and 144 respectively. Find the minimum number of rooms required if in each room the same number of teachers are seated and all of them are of the same subject.

Answer: 17

Explanation:

Find HCF(48, 80, 144).

48 = 2^4 * 3, 80 = 2^4 * 5, 144 = 2^4 * 3^2.

HCF = 2^4 = 16.

Rooms for French = 48/16 = 3, Hindi = 80/16 = 5, English = 144/16 = 9.

Total rooms = 3 + 5 + 9 = 17.

Q.28 [3 marks]

Prove that: tan(theta)/(1 - cot(theta)) + cot(theta)/(1 - tan(theta)) = 1 + sec(theta)*cosec(theta)

Answer: Identity proved (both sides equal 1 + sec(theta)*cosec(theta))

Explanation:

Let t = tan(theta), so cot(theta) = 1/t.

LHS = t/(1 - 1/t) + (1/t)/(1 - t) = t^2/(t-1) - 1/(t(t-1)) = (t^3 - 1)/(t(t-1)) = (t-1)(t^2+t+1)/(t(t-1)) = (t^2+t+1)/t = t + 1 + 1/t = tan(theta) + cot(theta) + 1.

Now tan(theta) + cot(theta) = (sin^2+cos^2)/(sin(theta)cos(theta)) = 1/(sin(theta)cos(theta)) = sec(theta)*cosec(theta).

Hence LHS = 1 + sec(theta)*cosec(theta) = RHS.

Q.29 [3 marks]

Three years ago, Rashmi was thrice as old as Nazma. Ten years later, Rashmi will be twice as old as Nazma. How old are Rashmi and Nazma now?

Answer: Rashmi = 42 years, Nazma = 16 years

Explanation:

Let Rashmi's current age = R, Nazma's = N.

Three years ago: R - 3 = 3(N - 3) => R = 3N - 6.

Ten years later: R + 10 = 2(N + 10) => R = 2N + 10.

From both: 3N - 6 = 2N + 10 => N = 16.

R = 2(16) + 10 = 42.

Q.30 [3 marks]

In the given figure, AB is a diameter of the circle with centre O. AQ, BP and PQ are tangents to the circle. Prove that angle POQ = 90 degrees.

Answer: Proved (angle POQ = 90 degrees)

Explanation:

Let PQ touch the circle at T.

Tangents from Q: QA = QT, with OA = OT (radii), so OQ bisects angle AOT.

Tangents from P: PB = PT, with OB = OT, so OP bisects angle BOT.

Since AB is a diameter, A, O, B are collinear, so angle AOT + angle BOT = 180 degrees.

Therefore angle POQ = angle QOT + angle TOP = (1/2)angle AOT + (1/2)angle BOT = (1/2)(180) = 90 degrees.

OR

Q.30 [3 marks]

A circle with centre O and radius 8 cm is inscribed in a quadrilateral ABCD in which P, Q, R, S are the points of contact. If AD is perpendicular to DC, BC = 30 cm and BS = 24 cm, then find the length DC.

Answer: DC = 14 cm

Explanation:

Since tangents from an external point are equal: BS = BQ = 24, so QC = BC - BQ = 30 - 24 = 6.

QC = CR = 6 (tangents from C).

Since AD is perpendicular to DC, angle D = 90.

DR = DS (tangents from D).

Also ODRS is a square (since angle D = 90 and OR, OS are radii perpendicular to tangents).
So DR = DS = 8.
DC = DR + RC = 8 + 6 = 14 cm.

Q.31 [3 marks]

The difference between the outer and inner radii of a hollow right circular cylinder of length 14 cm is 1 cm. If the volume of the metal used in making the cylinder is 176 cm^3, find the outer and inner radii of the cylinder.

Answer: Outer radius = 2.5 cm, Inner radius = 1.5 cm

Explanation:
Let outer radius = R, inner radius = r.
R - r = 1.
Volume = pi*(R^2 - r^2)*h = 176.
(22/7)*(R+r)*(R-r)*14 = 176.
44*(R+r) = 176.
R + r = 4.
With R - r = 1: R = 2.5 cm, r = 1.5 cm.

Q.32 [3 marks]

An arc of a circle of radius 21 cm subtends an angle of 60 degrees at the centre. Find: (i) the length of the arc, (ii) the area of the minor segment of the circle made by the corresponding chord.

Answer: (i) 22 cm, (ii) 40.25 cm^2

Explanation:
(i) Length of arc = (theta/360)*2*pi*r = (60/360)*2*(22/7)*21 = (1/6)*132 = 22 cm.
(ii) Area of sector = (60/360)*pi*r^2 = (1/6)*(22/7)*441 = (1/6)*1386 = 231 cm^2.
Area of triangle = (sqrt(3)/4)*21^2 = (sqrt(3)/4)*441 = 441*sqrt(3)/4 = 441*1.732/4 = 190.75 cm^2 (approx).
Area of segment = 231 - 190.75 = 40.25 cm^2.

Section D

Long Answer Questions (5 marks each)

Q.33 [5 marks]

The sum of first and eighth terms of an A.P. is 32 and their product is 60. Find the first term and common difference of the A.P. Hence, also find the sum of its first 20 terms.

Answer: a = 2, d = 4, S_{20} = 800 (or a = 30, d = -4, S_{20} = -160)

Explanation:

$a_1 + a_8 = 2a + 7d = 32$.

$a_1 * a_8 = a(a + 7d) = 60$.

So $a(32 - a) = 60$, $a^2 - 32a + 60 = 0$.

$a = (32 \pm 28)/2 = 30$ or 2.

If a = 2: $d = (32-4)/7 = 4$, $S_{20} = 10*(4+76) = 800$.

If a = 30: d = -4, $S_{20} = 10*(60-76) = -160$.

OR

Q.33 [5 marks]

In an A.P. of 40 terms, the sum of first 9 terms is 153 and the sum of last 6 terms is 687. Determine the first term and common difference of A.P. Also, find the sum of all the terms of the A.P.

Answer: a = 5, d = 3, S_{40} = 2540

Explanation:

$S_9 = 9/2*(2a + 8d) = 153$, so $2a + 8d = 34$, $a + 4d = 17$.

Sum of last 6 terms: $a_{35} + a_{36} + ...$

$+ a_{40} = S_{40} - S_{34} = 687$.

$S_{40} = 40/2*(2a+39d) = 20(2a+39d)$.

$S_{34} = 34/2*(2a+33d) = 17(2a+33d)$.

$20(2a+39d) - 17(2a+33d) = 687$.

$40a + 780d - 34a - 561d = 687$.

$6a + 219d = 687$.

$2a + 73d = 229$.

From a = 17 - 4d: 2(17-4d) + 73d = 229.

34 - 8d + 73d = 229.

65d = 195.

d = 3.

a = 17 - 12 = 5.

S_40 = 20*(10+117) = 20*127 = 2540.

Q.34 [5 marks]

If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then prove that the other two sides are divided in the same ratio. (Basic Proportionality Theorem)

Answer: Proved (Basic Proportionality / Thales Theorem: AD/DB = AE/EC)

Explanation:

In triangle ABC, let DE be drawn parallel to BC meeting AB at D and AC at E.

Join BE and CD.

area(ADE)/area(BDE) = AD/DB (triangles with the same height from E onto AB).

Similarly area(ADE)/area(CDE) = AE/EC (same height from D onto AC).

Now triangles BDE and CDE are on the same base DE and between the same parallels DE and BC, so area(BDE) = area(CDE).

Therefore AD/DB = AE/EC.

OR

Q.34 [5 marks]

In the given figure PA, QB and RC are each perpendicular to AC. If AP = x, BQ = y and CR = z, then prove that 1/x + 1/z = 1/y.

Answer: Proved using similar triangles

Explanation:

In triangle PAC and triangle QBC: triangles PAC and QBC share angle C and both have a right angle.

By AA similarity in triangle PAC: PA/QR gives proportional sides.

Using similar triangles: In triangle APC and triangle BQC: BQ/AP = BC/AC => y/x = BC/AC.

In triangle CRA and triangle BQA: BQ/CR = AB/AC => y/z = AB/AC.
Adding: y/x + y/z = BC/AC + AB/AC = (AB+BC)/AC = 1.
So 1/x + 1/z = 1/y.

Q.35 [5 marks]

A pole 6 m high is fixed on the top of a tower. The angle of elevation of the top of the pole observed from a point P on the ground is 60 degrees and the angle of depression of the point P from the top of the tower is 45 degrees. Find the height of the tower and the distance of point P from the foot of the tower. (Use sqrt(3) = 1.73)

Answer: Height of tower = 3(sqrt(3) + 3) m = 14.19 m, Distance = 3(sqrt(3) + 3) m = 14.19 m

Explanation:
Let tower height = h, distance from P to foot = d.
From top of tower: tan(45) = h/d, so d = h.
From top of pole: tan(60) = (h+6)/d.
sqrt(3) = (h+6)/h.
sqrt(3)*h = h + 6.
h(sqrt(3)-1) = 6.
h = 6/(sqrt(3)-1) = 6(sqrt(3)+1)/((sqrt(3))^2-1) = 6(sqrt(3)+1)/2 = 3(sqrt(3)+1).
h = 3*1.73 + 3 = 5.19 + 3 = 8.19 m.
d = h = 8.19 m.

Q.36(a) [5 marks]

A rectangular floor area can be completely tiled with 200 square tiles. If the side length of each tile is increased by 1 unit, it would take only 128 tiles to cover the floor. Assuming the original length of each side of a tile be x units, make a quadratic equation from the above information.

Answer: 200x^2 = 128(x+1)^2

Explanation:
Area of floor = 200 * x^2.

With new tile side (x+1): area = 128 * (x+1)^2.

Since the floor area is same: 200x^2 = 128(x+1)^2.

Q.36(b) [5 marks]

A rectangular floor can be tiled with 200 square tiles of side x units or 128 tiles of side (x+1) units. Write the corresponding quadratic equation in standard form.

Answer: 9x^2 - 32x - 16 = 0

Explanation:

From 200x^2 = 128(x+1)^2: 200x^2 = 128x^2 + 256x + 128.

72x^2 - 256x - 128 = 0.

Dividing by 8: 9x^2 - 32x - 16 = 0.

Q.36(c) [5 marks]

Find the value of x, the length of side of a tile, by factorisation of 9x^2 - 32x - 16 = 0.

Answer: x = 4

Explanation:

9x^2 - 32x - 16 = 0.

9x^2 - 36x + 4x - 16 = 0.

9x(x - 4) + 4(x - 4) = 0.

(9x + 4)(x - 4) = 0.

x = 4 or x = -4/9 (rejected as length must be positive).

So x = 4.

OR

Q.36(c) [5 marks]

Solve the quadratic equation 9x^2 - 32x - 16 = 0 for x using quadratic formula.

Answer: x = 4

Explanation:

x = (32 +/- sqrt(1024 + 576))/18 = (32 +/- sqrt(1600))/18 = (32 +/- 40)/18.

x = 72/18 = 4 or x = -8/18 = -4/9 (rejected).

So x = 4.

Q.37(a) [4 marks]

BINGO is a game of chance. The host has 75 balls numbered 1 through 75. A table shows numbers announced and frequency before Tara said BINGO (48 balls used): 0-15: 8, 15-30: 9, 30-45: 10, 45-60: 12, 60-75: 9. Write the median class.

Answer: 30-45

Explanation:

Total frequency = 48.

Median position = 48/2 = 24.

Cumulative frequencies: 0-15: 8, 0-30: 17, 0-45: 27.

The 24th observation falls in the class 30-45.

Q.37(b) [4 marks]

In a BINGO game, 48 balls were used. The frequency distribution is: 0-15: 8, 15-30: 9, 30-45: 10, 45-60: 12, 60-75: 9. When the first ball was picked up, what was the probability of calling out an even number?

Answer: 37/75

Explanation:

Numbers 1 to 75: even numbers = 2,4,6,...,74 = 37 numbers.

Total = 75.

Probability = 37/75.

Q.37(c) [4 marks]

Find the median of the given data: 0-15: 8, 15-30: 9, 30-45: 10, 45-60: 12, 60-75: 9.

Answer: 40.5

Explanation:

N = 48, N/2 = 24.

Median class = 30-45.

l = 30, cf = 17 (cumulative frequency before median class), f = 10, h = 15.

Median = l + ((N/2 - cf)/f)*h = 30 + ((24-17)/10)*15 = 30 + 10.5 = 40.5.

OR

Q.37(c) [4 marks]

Find the mode of the given data: 0-15: 8, 15-30: 9, 30-45: 10, 45-60: 12, 60-75: 9.

Answer: 51

Explanation:

Modal class = 45-60 (highest frequency 12).

l = 45, f1 = 12, f0 = 10, f2 = 9, h = 15.

Mode = l + ((f1-f0)/(2*f1-f0-f2))*h = 45 + ((12-10)/(24-10-9))*15 = 45 + (2/5)*15 = 45 + 6 = 51.

Q.38(a) [4 marks]

A backyard is in the shape of a triangle ABC with right angle at B. AB = 7 m and BC = 15 m. A circular pit was dug inside it such that it touches the walls AC, BC and AB at P, Q and R respectively such that AP = x m. Find the length of AR in terms of x.

Answer: AR = x

Explanation:

Tangents from an external point are equal. From point A: AP = AR = x.

Q.38(b) [4 marks]

A backyard is in the shape of a triangle ABC with right angle at B. AB = 7 m and BC = 15 m. A circular pit touches AB at R, BC at Q and AC at P with AP = x m. Write the type of quadrilateral BQOR where O is the centre of the circle.

Answer: Square

Explanation:

BQOR has angle B = 90 (given right angle), angle BRO = 90 (radius perpendicular to tangent), angle BQO = 90 (radius perpendicular to tangent).

Also OR = OQ (radii).

Since three angles are 90, the fourth must also be 90.

With adjacent sides equal (OR = OQ = r), BQOR is a square.

Q.38(c) [4 marks]

A backyard triangle ABC has right angle at B, AB = 7 m, BC = 15 m. A circle inscribed touches AC at P, BC at Q, AB at R. AP = x. Find the length PC in terms of x and hence find the value of x.

Answer: PC = 8 + x, x = (sqrt(274) - 8)/2

Explanation:

Tangents from external point are equal: AR = AP = x, BR = BQ = 7 - x, CQ = CP = 15 - (7 - x) = 8 + x.

So PC = 8 + x.

AC = AP + PC = x + 8 + x = 2x + 8.

AC = sqrt(7^2 + 15^2) = sqrt(274).

So 2x + 8 = sqrt(274), x = (sqrt(274) - 8)/2.

OR

Q.38(c) [4 marks]

A backyard triangle ABC has right angle at B, AB = 7 m, BC = 15 m. A circle inscribed touches AC at P, BC at Q, AB at R with AP = x. Find x and hence find the radius r of the circle.

Answer: r = (22 - sqrt(274))/2, x = (sqrt(274) - 8)/2

Explanation:

AR = AP = x, BR = BQ = 7 - x = r, CQ = CP = 15 - r = 15 - (7-x) = 8+x.

AC = AP + PC = x + 8 + x = 2x + 8.

AC = sqrt(AB^2+BC^2) = sqrt(49+225) = sqrt(274).

So 2x+8 = sqrt(274), x = (sqrt(274)-8)/2.

r = 7-x = 7-(sqrt(274)-8)/2 = (14-sqrt(274)+8)/2 = (22-sqrt(274))/2.