CBSE 2020 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]

The sum of exponents of prime factors in the prime factorisation of 196 is:

(a) 3

(b) 4 <<

(c) 5

(d) 2

Explanation:

196 = $2^2 \times 7^2$. The exponents are 2 and 2. Their sum = 2 + 2 = 4.

Q.2 [1 mark]

Euclid's division Lemma states that for two positive integers a and b, there exists unique integers q and r satisfying a = bq + r, and:

(a) $0 < r < b$

(b) $0 < r \leq b$

(c) $0 \leq r < b$ <<

(d) $0 \leq r \leq b$

Explanation:

By Euclid's Division Lemma, for two positive integers a and b, there exist unique integers q and r such that a = bq + r, where $0 \leq r < b$.

Q.3 [1 mark]

The zeroes of the polynomial $x^2 - 3x - m(m + 3)$ are:

(a) m, m + 3

(b) −m, m + 3 <<

(c) m, −(m + 3)

(d) −m, −(m + 3)

Explanation:

$x^2 - 3x - m(m + 3) = 0$.

We can factor this as $(x + m)(x - (m + 3)) = 0$.

Checking: $x^2 - (m+3)x + mx - m(m+3) = x^2 - 3x - m(m+3)$.

So the zeroes are $x = -m$ and $x = m + 3$.

Q.4 [1 mark]

The value of k for which the system of linear equations $x + 2y = 3$, $5x + ky + 7 = 0$ is inconsistent is:

(a) $-14/3$

(b) $2/5$

(c) 5

(d) 10 <<

Explanation:

For inconsistent system: $a_1/a_2 = b_1/b_2 \neq c_1/c_2$.

Here $a_1/a_2 = 1/5$, $b_1/b_2 = 2/k$.

For inconsistency: $1/5 = 2/k \rightarrow k = 10$.

Also checking $c_1/c_2 = -3/7 \neq 1/5$.

So $k = 10$.

Q.5 [1 mark]

The roots of the quadratic equation $x^2 - 0.04 = 0$ are:

(a) ± 0.2 <<

(b) ± 0.02

(c) 0.4

(d) 2

Explanation:

$x^2 - 0.04 = 0 \rightarrow x^2 = 0.04 \rightarrow x = \pm\sqrt{0.04} = \pm 0.2$.

Q.6 [1 mark]

The common difference of the A.P. $1/p$, $(1 - p)/p$, $(1 - 2p)/p$, ... is:

(a) 1

(b) 1/p

(c) −1 <<

(d) −1/p

Explanation:

Common difference = $a_2 - a_1 = (1 - p)/p - 1/p = (1 - p - 1)/p = -p/p = -1$.

Q.7 [1 mark]

The n-th term of the A.P. a, 3a, 5a, ... is:

(a) na

(b) (2n − 1)a <<

(c) (2n + 1)a

(d) 2na

Explanation:

First term = a, common difference = 3a − a = 2a.

n-th term = a + (n−1)(2a) = a + 2na − 2a = (2n − 1)a.

Q.8 [1 mark]

The point P on x-axis equidistant from the points A(−1, 0) and B(5, 0) is:

(a) (2, 0) <<

(b) (0, 2)

(c) (3, 0)

(d) (2, 2)

Explanation:

Since both points lie on the x-axis, P is the midpoint.

P = ((−1+5)/2, 0) = (2, 0).

Q.9 [1 mark]

The coordinates of the point which is the reflection of point (−3, 5) in the x-axis are:

(a) (3, 5)

(b) (3, −5)

(c) (−3, −5) <<

(d) (−3, 5)

Explanation:

Reflection of a point (x, y) in the x-axis is (x, −y).

So reflection of (−3, 5) is (−3, −5).

Q.10 [1 mark]

If the point P(6, 2) divides the line segment joining A(6, 5) and B(4, y) in the ratio 3 : 1, then the value of y is:

(a) 4

(b) 3

(c) 2

(d) 1 <<

Explanation:

Using section formula: y-coordinate of P = (3y + 1×5)/(3+1) = 2 →

(3y + 5)/4 = 2 →

3y + 5 = 8 →

3y = 3 →

y = 1.

Q.11 [1 mark]

In Fig. 1, MN ∥ BC and AM : MB = 1 : 2, then ar(△AMN)/ar(△ABC) = _____.

Answer: 1/9

Explanation:

Since MN ∥ BC, △AMN ~ △ABC.

AM : AB = 1 : 3 (since AM : MB = 1 : 2, so AM : AB = 1 : 3).

The ratio of areas of similar triangles = (ratio of corresponding sides)² = (1/3)² = 1/9.

Q.12 [1 mark]

In Fig. 2, two concentric circles have centre O. The outer circle has radius OA = 5 cm and the inner circle has radius OP = 3 cm. Chord AB of the outer

circle touches the inner circle at P. The length PB = _____ cm.

Answer: 4

Explanation:

OP ⊥ AB (radius ⊥ tangent at P), and the perpendicular from the centre bisects chord AB, so PB = PA.

In right △OPA: PA = √(OA² − OP²) = √(5² − 3²) = √16 = 4 cm.

Hence PB = 4 cm.

Q.13 [1 mark]

In △ABC, AB = 6√3 cm, AC = 12 cm and BC = 6 cm, then ∠B = _____.

Answer: 90°

Explanation:

Check if the triangle is right-angled.

AC² = 144, AB² = 108, BC² = 36.

AB² + BC² = 108 + 36 = 144 = AC².

Since AC² = AB² + BC², by converse of Pythagoras theorem, ∠B = 90°.

OR

Q.13 [1 mark]

Two triangles are similar if their corresponding sides are _____.

Answer: proportional

Explanation:

By the SSS similarity criterion, two triangles are similar if their corresponding sides are proportional (i.e., in the same ratio).

Q.14 [1 mark]

The value of (tan 1° tan 2° ..... tan 89°) is equal to _____.

Answer: 1

Explanation:

tan 1° × tan 89° = tan 1° × cot 1° = 1.

Similarly tan 2° × tan 88° = 1, and so on.

tan 45° = 1.

So the product = 1.

Q.15 [1 mark]

In Fig. 3, the angles of depression from the observing positions O_1 and O_2 respectively of the object A are _____, _____.

Answer: 60°, 45°

Explanation:

From Fig.

3: At O_1, the angle between the horizontal and the line O_1A is the angle of depression.

The angle at O_1 is marked as 60° (angle of depression from O_1).

The angle at A is marked as 45° (which relates to the angle of depression from O_2).

Using alternate interior angles with the horizontal at O_2, the angle of depression from O_2 = 45°.

So the angles are 60° and 45°.

Q.16 [1 mark]

If $\sin A + \sin^2 A = 1$, then find the value of the expression $(\cos^2 A + \cos^4 A)$.

Answer: 1

Explanation:

$\sin A = 1 - \sin^2 A = \cos^2 A$.

So $\cos^4 A = (\cos^2 A)^2 = \sin^2 A$.

Hence $\cos^2 A + \cos^4 A = \sin A + \sin^2 A = 1$.

Q.17 [1 mark]

In Fig. 4, a sector of a circle of radius 10.5 cm has angle 60°. Find the perimeter of the sector. (Take $\pi = 22/7$)

Answer: 32 cm

Explanation:

Perimeter of sector = 2r + arc length = 2(10.5) + (60/360) × 2πr = 21 + (1/6) × 2 × (22/7) × 10.5 = 21 + (1/6) × 2 × 22 × 1.5 = 21 + (1/6) × 66 = 21 + 11 = 32 cm.

Q.18 [1 mark]

If a number x is chosen at random from the numbers −3, −2, −1, 0, 1, 2, 3, then find the probability that $x^2 < 4$.

Answer: 3/7

Explanation:

Total outcomes = 7 (numbers: −3, −2, −1, 0, 1, 2, 3).

$x^2 < 4$ means $-2 < x < 2$, so x can be −1, 0, 1.

Favourable outcomes = 3.

Probability = 3/7.

OR

Q.18 [1 mark]

What is the probability that a randomly taken leap year has 52 Sundays?

Answer: 5/7

Explanation:

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

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

Total = 7 cases.

For exactly 52 Sundays, neither extra day should be Sunday.

Cases with Sunday: (Sat,Sun) and (Sun,Mon) = 2 cases.

So cases without Sunday = 5.

P(52 Sundays) = 5/7.

Q.19 [1 mark]

Find the class marks of the classes 10–25 and 35–55.

Answer: 17.5 and 45

Explanation:

Class mark = (lower limit + upper limit)/2.

For 10–25: (10+25)/2 = 17.5.

For 35–55: (35+55)/2 = 45.

Q.20 [1 mark]

A die is thrown once. What is the probability of getting a prime number?

Answer: 1/2

Explanation:

Prime numbers on a die: 2, 3, 5. Total outcomes = 6. Probability = 3/6 = 1/2.

Section B

Very Short Answer Questions (2 marks each)

Q.21 [2 marks]

A teacher asked 10 of his students to write a polynomial in one variable on a paper and then to handover the paper. The following were the answers given by the students: $2x + 3$, $3x^2 + 7x + 2$, $4x^3 + 3x^2 + 2$, $x^3 + \sqrt{x} + 7$, $7x + \sqrt{7}$, $5x^3 - 7x + 2$, $2x^2 + 3 - (5/x)$, $5x - 1/2$, $ax^3 + bx^2 + cx + d$ $(a \neq 0)$, $x + 1/x$. Answer the following: (i) How many of the above ten are not polynomials? (ii) How many of the above are quadratic polynomials?

Answer: (i) 3, (ii) 1

Explanation:

Not polynomials: $x^3 + \sqrt{x} + 7$ (fractional power of x), $2x^2 + 3 - 5/x$ (negative power of x), $x + 1/x$ (negative power of x).

So 3 are not polynomials.

Quadratic polynomials (degree 2): $3x^2 + 7x + 2$.

So 1 is quadratic.

Q.22 [2 marks]

In Fig. 5, ABC and DBC are two triangles on the same base BC. If AD

intersects BC at O, show that ar(△ABC)/ar(△DBC) = AO/DO.

Answer: Proved using heights from A and D

Explanation:

Draw perpendiculars AM and DN from A and D to BC respectively.

ar(△ABC)/ar(△DBC) = (½ × BC × AM)/(½ × BC × DN) = AM/DN.

In △AOM and △DON: ∠AOM = ∠DON (vertically opposite), ∠AMO = ∠DNO = 90°.

So △AOM ~ △DON (AA similarity).

Therefore AM/DN = AO/DO.

Hence ar(△ABC)/ar(△DBC) = AO/DO.

OR

Q.22 [2 marks]

In Fig. 6, if AD ⊥ BC, then prove that $AB^2 + CD^2 = BD^2 + AC^2$.

Answer: Proved using Pythagoras theorem

Explanation:

Since AD ⊥ BC, in right △ADB: $AB^2 = AD^2 + BD^2$ ...

(i).

In right △ADC: $AC^2 = AD^2 + CD^2$ ...

(ii).

From (i): $AD^2 = AB^2 - BD^2$.

Substituting in (ii): $AC^2 = AB^2 - BD^2 + CD^2$.

Rearranging: $AB^2 + CD^2 = BD^2 + AC^2$.

Hence proved.

Q.23 [2 marks]

Prove that: $1 + \cot^2\alpha/(1 + \text{cosec } \alpha) = \text{cosec } \alpha$.

Answer: Proved

Explanation:

LHS = $1 + \cot^2\alpha/(1 + \text{cosec } \alpha) = 1 + (\text{cosec}^2\alpha - 1)/(1 + \text{cosec } \alpha)$ [using $\cot^2\alpha = \text{cosec}^2\alpha - 1$] = $1 + (\text{cosec } \alpha - 1)(\text{cosec } \alpha + 1)/(1 + \text{cosec } \alpha) = 1 + (\text{cosec } \alpha - 1) = \text{cosec } \alpha$ = RHS.

OR

Q.23 [2 marks]

Show that $\tan^4\theta + \tan^2\theta = \sec^4\theta - \sec^2\theta$.

Answer: Proved

Explanation:

LHS = $\tan^2\theta(\tan^2\theta + 1) = \tan^2\theta \times \sec^2\theta = (\sec^2\theta - 1) \times \sec^2\theta = \sec^4\theta - \sec^2\theta$ = RHS.

Hence proved.

Q.24 [2 marks]

The volume of a right circular cylinder with its height equal to the radius is 25 1/7 cm^3. Find the height of the cylinder. (Use $\pi = 22/7$)

Answer: 2 cm

Explanation:

Volume = $\pi r^2 h$.

Given h = r, so $V = \pi r^3$.

25 1/7 = 176/7.

$\pi r^3 = 176/7 \rightarrow (22/7)r^3 = 176/7 \rightarrow 22r^3 = 176 \rightarrow r^3 = 8 \rightarrow r = 2$.

Height = r = 2 cm.

Q.25 [2 marks]

A child has a die whose six faces show the letters A, B, C, D, E, A as shown. The die is thrown once. What is the probability of getting (i) A, (ii) D?

Answer: (i) 1/3, (ii) 1/6

Explanation:

Total outcomes = 6 (A, B, C, D, E, A).

(i) A appears 2 times.

P(A) = 2/6 = 1/3.

(ii) D appears 1 time.

P(D) = 1/6.

Q.26 [2 marks]

Compute the mode for the following frequency distribution:

Size of items (in cm): 0–4, 4–8, 8–12, 12–16, 16–20, 20–24, 24–28
Frequency: 5, 7, 9, 17, 12, 10, 6

Answer: 14.46 cm (approx)

Explanation:
Modal class = 12–16 (highest frequency 17).
l = 12, h = 4, f_1 = 17, f_0 = 9, f_2 = 12.
Mode = l + [(f_1 − f_0)/(2f_1 − f_0 − f_2)] × h = 12 + [8/(34 − 9 − 12)] × 4 = 12 + 32/13 ≈ 12 + 2.46 = 14.46 cm.

Section C

Short Answer Questions (3 marks each)

Q.27 [3 marks]

If 2x + y = 23 and 4x − y = 19, find the value of (5y − 2x) and (y/x − 2).

Answer: (5y − 2x) = 31, (y/x − 2) = 5/7

Explanation:
Adding the equations: 6x = 42 → x = 7.
Substituting: 2(7) + y = 23 → y = 9.
(5y − 2x) = 45 − 14 = 31.
(y/x − 2) = 9/7 − 2 = (9 − 14)/7 = −5/7.
Actually: y/x − 2 = 9/7 − 2 = −5/7.
The question says (y/x − 2), so the answer is −5/7.

OR

Q.27 [3 marks]

Solve for x: 1/(x + 4) − 1/(x − 7) = 11/30, where x ≠ −4, 7.

Answer: x = 1 or x = 2

Explanation:

/[(x + 4)(x − 7)] = 11/30 →

−11/[(x + 4)(x − 7)] = 11/30 →

(x + 4)(x − 7) = −30 →

x² − 3x − 28 = −30 →

x² − 3x + 2 = 0 →

(x − 1)(x − 2) = 0.

So x = 1 or x = 2.

Q.28 [3 marks]

Show that the sum of all terms of an A.P. whose first term is a, the second term is b and the last term is c, is equal to (a + c)(b + c − 2a) / [2(b − a)].

Answer: Proved

Explanation:

Common difference d = b − a.

Last term c = a + (n−1)d →

n − 1 = (c − a)/d = (c − a)/(b − a) →

n = (c − a)/(b − a) + 1 = (c − a + b − a)/(b − a) = (b + c − 2a)/(b − a).

Sum = n/2 × (first + last) = [(b + c − 2a)/(b − a)] × (a + c)/2 = (a + c)(b + c − 2a)/[2(b − a)].

Hence proved.

OR

Q.28 [3 marks]

Solve the equation: 1 + 4 + 7 + 10 + ... + x = 287.

Answer: x = 40

Explanation:

This is an A.P.

with a = 1, d = 3, last term = x.

Sum = n/2 × (1 + x) = 287.

Also x = 1 + (n−1) × 3 = 3n − 2 → n = (x + 2)/3.

Substituting: [(x+2)/3]/2 × (1 + x) = 287 → (x+2)(x+1)/6 = 287 → (x+1)(x+2) = 1722.

Solving: $x^2 + 3x + 2 = 1722 \rightarrow x^2 + 3x - 1720 = 0$.

Discriminant = $9 + 6880 = 6889 = 83^2$.

$x = (-3 + 83)/2 = 40$.

So $x = 40$.

Q.29 [3 marks]

In a flight of 600 km, an aircraft was slowed down due to bad weather. The average speed of the trip was reduced by 200 km/hr and the time of flight increased by 30 minutes. Find the duration of flight.

Answer: 1 hour

Explanation:

Let the scheduled duration be t hours.

Original speed = $600/t$, reduced speed = $600/(t + 1/2)$.

$600/t - 600/(t + 1/2) = 200 \rightarrow$

$3/t - 3/(t + 1/2) = 1 \rightarrow$

$3 \times (1/2) = t(t + 1/2) \rightarrow$

$2t^2 + t - 3 = 0 \rightarrow$

$(t - 1)(2t + 3) = 0 \rightarrow$

$t = 1$ ($t > 0$).

Duration of flight = 1 hour (original speed 600 km/h).

Q.30 [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 $x + y - 10 = 0$, 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 $x + y - 10 = 0$: $(3+k)/2 + 5 = 10 \rightarrow (3+k)/2 = 5 \rightarrow 3+k = 10 \rightarrow k = 7$.

OR

Q.30 [3 marks]

Find the area of triangle ABC with A(1, −4) and the mid-points of sides AB and AC being (2, −1) and (0, −1) respectively.

Answer: 12 sq. units

Explanation:

Let B = (b_1, b_2) and C = (c_1, c_2).

Mid-point of AB = (2, −1): $(1+b_1)/2 = 2 \rightarrow b_1 = 3$; $(-4+b_2)/2 = -1 \rightarrow b_2 = 2$.

So B = (3, 2).

Mid-point of AC = (0, −1): $(1+c_1)/2 = 0 \rightarrow c_1 = -1$; $(-4+c_2)/2 = -1 \rightarrow c_2 = 2$.

So C = (−1, 2).

Area = $\frac{1}{2}|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)| = \frac{1}{2}|1(2-2) + 3(2-(-4)) + (-1)(-4-2)| = \frac{1}{2}|0 + 18 + 6| = 12$ sq.

units.

Q.31 [3 marks]

In Fig. 7, $\triangle ABC \sim \triangle DEF$ with AB = 2x − 1, BC = 2x + 2, CA = 3x and DE = 18, EF = 3x + 9, FD = 6x (in cm). Find the lengths of the sides of each triangle.

Answer: AB = 9 cm, BC = 12 cm, CA = 15 cm; DE = 18 cm, EF = 24 cm, FD = 30 cm

Explanation:

$\triangle ABC \sim \triangle DEF \rightarrow AB/DE = BC/EF = CA/FD$.

$CA/FD = 3x/6x = 1/2$.

So $(2x - 1)/18 = 1/2 \rightarrow 2x - 1 = 9 \rightarrow x = 5$.

Check: $BC/EF = 12/24 = 1/2$ ✓.

Sides: AB = 9, BC = 12, CA = 15; DE = 18, EF = 24, FD = 30 (cm).

Q.32 [3 marks]

If a circle touches the side BC of a triangle ABC at P and extended sides AB and AC at Q and R respectively, prove that AQ = 1/2 (BC + CA + AB).

Answer: Proved

Explanation:

Since tangents from an external point are equal: BQ = BP (tangents from B), CP = CR (tangents from C), AQ = AR (tangents from A).

AQ = AB + BQ = AB + BP ...

(i).

AR = AC + CR = AC + CP ...

(ii).

Adding (i) and (ii): AQ + AR = AB + BP + AC + CP = AB + AC + BC.

Since AQ = AR: 2AQ = AB + AC + BC.

Therefore AQ = (AB + BC + CA)/2.

Section D

Long Answer Questions (5 marks each)

Q.33 [5 marks]

If $\sin\theta + \cos\theta = \sqrt{2}$, prove that $\tan\theta + \cot\theta = 2$.

Answer: Proved

Explanation:

Given $\sin\theta + \cos\theta = \sqrt{2}$.

Squaring both sides: $\sin^2\theta + \cos^2\theta + 2\sin\theta\cos\theta = 2$.

$1 + 2\sin\theta\cos\theta = 2 \rightarrow 2\sin\theta\cos\theta = 1 \rightarrow \sin\theta\cos\theta = 1/2$.

Now $\tan\theta + \cot\theta = \sin\theta/\cos\theta + \cos\theta/\sin\theta = (\sin^2\theta + \cos^2\theta)/(\sin\theta\cos\theta) = 1/(1/2) = 2$.

Hence proved.

Q.34 [5 marks]

The area of a circular play ground is 22176 cm². Find the cost of fencing this ground at the rate of Rs.50 per metre.

Answer: Rs.264

Explanation:

$\pi r^2 = 22176 \rightarrow r^2 = 22176 \times 7/22 = 7056 \rightarrow r = 84$ cm.

Circumference = $2 \times (22/7) \times 84 = 528$ cm = 5.28 m.

Cost = 5.28×50 = Rs.264.

(If the area is read as 22176 m², the intended reading in most solutions, r = 84 m and the cost is Rs.26,400.)

Q.35 [5 marks]

Prove that √5 is an irrational number.

Answer: Proved by contradiction

Explanation:

Assume √5 is rational, so √5 = p/q where p, q are co-prime integers and q ≠ 0.

Squaring: 5 = p²/q² → p² = 5q².

This means 5 divides p², so 5 divides p.

Let p = 5m.

Then 25m² = 5q² → q² = 5m².

So 5 divides q², hence 5 divides q.

But then both p and q are divisible by 5, contradicting that they are co-prime.

Therefore √5 is irrational.

Q.36 [5 marks]

It can take 12 hours to fill a swimming pool using two pipes. If the pipe of larger diameter is used for four hours and the pipe of smaller diameter for 9 hours, only half of the pool can be filled. How long would it take for each pipe to fill the pool separately?

Answer: Larger pipe: 20 hours, Smaller pipe: 30 hours

Explanation:

Let the larger pipe fill the pool in x hours and smaller pipe in y hours.

In 1 hour: larger fills 1/x, smaller fills 1/y.

Together: 1/x + 1/y = 1/12 ...

(i).

Also: 4/x + 9/y = 1/2 ...

(ii).

Let 1/x = a, 1/y = b.

From (i): a + b = 1/12.

From (ii): 4a + 9b = 1/2.

From (i): a = 1/12 − b.

Substituting: 4(1/12 − b) + 9b = 1/2 →

1/3 − 4b + 9b = 1/2 →

5b = 1/2 − 1/3 = 1/6 →

b = 1/30.

So y = 30 hours.

a = 1/12 − 1/30 = (5−2)/60 = 3/60 = 1/20.

So x = 20 hours.

Section E

Case Study Based Questions (4 marks each)

Q.37 [4 marks]

Draw a circle of radius 2 cm with centre O and take a point P outside the circle such that OP = 6.5 cm. From P, draw two tangents to the circle.

Answer: Construction problem

Explanation:

Steps of construction: (1) Draw a circle with centre O and radius 2 cm.

(2) Mark a point P such that OP = 6.5 cm.

(3) Join OP.

(4) Find the midpoint M of OP by drawing the perpendicular bisector.

(5) With M as centre and MO as radius, draw a circle.

(6) This circle intersects the given circle at points A and B.

(7) Join PA and PB.

These are the required tangents.

Verification: PA = PB = $\sqrt{(OP^2 - r^2)} = \sqrt{(42.25 - 4)} = \sqrt{38.25} \approx 6.18$ cm.

OR

Q.37 [4 marks]

Construct a triangle with sides 5 cm, 6 cm and 7 cm and then construct another triangle whose sides are 3/4 times the corresponding sides of the first triangle.

Answer: Construction problem

Explanation:

Steps: (1) Draw BC = 7 cm.

(2) With B as centre and radius 5 cm, draw an arc.

With C as centre and radius 6 cm, draw another arc.

The arcs intersect at A.

(3) Join AB and AC to get △ABC.

(4) Draw ray BX making an acute angle with BC below BC.

(5) Mark 4 points B_1, B_2, B_3, B_4 on BX at equal distances.

(6) Join B_4C.

(7) Draw B_3C' parallel to B_4C meeting BC at C'.

(8) Draw C'A' parallel to CA meeting BA at A'.

(9) △A'BC' is the required triangle with sides 3/4 times the original.

Q.38 [4 marks]

From a point on the ground, the angles of elevation of the bottom and the top of a tower fixed at the top of a 20 m high building are 45° and 60° respectively. Find the height of the tower.

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

Explanation:

Let the height of the tower be h m.

The building is 20 m high.

Let the distance from the point on the ground to the base of the building be d.

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

$\tan 60° = (20 + h)/d \rightarrow$

$\sqrt{3} = (20 + h)/20 \rightarrow$

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

$h = 20\sqrt{3} - 20 = 20(\sqrt{3} - 1)$ m $\approx 20(1.732 - 1) = 20 \times 0.732 = 14.64$ m.

Q.39 [4 marks]

Find the area of the shaded region in Fig. 8, if PQ = 24 cm, PR = 7 cm and O is the centre of the circle.

Answer: 161.54 cm² (approx)

Explanation:

Since PQ and PR are drawn from a point on the circle and the angle in a semicircle is 90°, ∠QPR = 90° (angle in a semicircle with QR as diameter).

$QR^2 = PQ^2 + PR^2 = 576 + 49 = 625$.

QR = 25 cm.

Radius = QR/2 = 12.5 cm.

Area of semicircle = $\frac{1}{2}\pi r^2 = \frac{1}{2} \times \frac{22}{7} \times (12.5)^2 = \frac{1}{2} \times \frac{22}{7} \times 156.25 = 245.54$ cm².

Area of $\triangle PQR = \frac{1}{2} \times PQ \times PR = \frac{1}{2} \times 24 \times 7 = 84$ cm².

Shaded area = Area of semicircle − Area of triangle = 245.54 − 84 = 161.54 cm².

OR

Q.39 [4 marks]

Find the curved surface area of the frustum of a cone, the diameters of whose circular ends are 20 m and 6 m and its height is 24 m.

Answer: 1021.43 m² (approx)

Explanation:

R = 10 m, r = 3 m, h = 24 m.

Slant height $l = \sqrt{[h^2 + (R - r)^2]} = \sqrt{(576 + 49)} = \sqrt{625} = 25$ m.

CSA = $\pi(R + r)l = (22/7) \times 13 \times 25 = 7150/7 \approx 1021.43$ m².

Q.40 [4 marks]

The mean of the following frequency distribution is 18. The frequency f in the class interval 19–21 is missing. Determine f.

Class interval: 11–13, 13–15, 15–17, 17–19, 19–21, 21–23, 23–25

Frequency: 3, 6, 9, 13, f, 5, 4

Answer: f = 8

Explanation:

Class marks: 12, 14, 16, 18, 20, 22, 24.

$\Sigma f_i x_i = 3(12) + 6(14) + 9(16) + 13(18) + f(20) + 5(22) + 4(24) = 36 + 84 + 144 + 234 + 20f + 110 + 96 = 704 + 20f$.

$\Sigma f_i = 3 + 6 + 9 + 13 + f + 5 + 4 = 40 + f.$

$\text{Mean} = \Sigma f_i x_i / \Sigma f_i = 18.$

$(704 + 20f)/(40 + f) = 18.$

$704 + 20f = 720 + 18f.$

$2f = 16.$

$f = 8.$

OR

Q.40 [4 marks]

The following table gives production yield per hectare of wheat of 100 farms of a village:

Production yield: 40–45, 45–50, 50–55, 55–60, 60–65, 65–70
No. of farms: 4, 6, 16, 20, 30, 24

Change the distribution to a 'more than' type distribution and draw its ogive.

Answer: More than ogive drawn

Explanation:

More than type cumulative frequency table:

More than 40: 100

More than 45: 96

More than 50: 90

More than 55: 74

More than 60: 54

More than 65: 24

Plot the points (40, 100), (45, 96), (50, 90), (55, 74), (60, 54), (65, 24) on graph paper with production yield on x-axis and cumulative frequency on y-axis.

Join the points with a smooth curve to get the 'more than' type ogive.