Board Paper of Class 10 Maths (Basic) Term-II 2022 Delhi(Set 1) - Solutions

Total Time: 120

Total Marks: 40.0

Section A

Solution 1

Given: Quadratic equation $4x^2 - 5x - 1 = 0$
Here, $a = 4$, $b = -5$ and $c = -1$.
Now,
$D = b^2 - 4ac$
$= (-5)^2 - 4(4)(-1)$
$= 25 + 16$
$= 41$

So, $D > 0$.

Hence, the roots are real and distinct.

Solution 2

Given: AP: 3, 8, 13, 18...
First term, $a = 3$
Common difference, $d = 5$

Let the n^{th} term of the AP be 78.
$\therefore a_n = 78$

Now,
$a_n = a + (n-1)d$
$\Rightarrow 78 = 3 + (n-1)5$
$\Rightarrow 75 = (n-1)5$
$\Rightarrow n - 1 = 15$
$\Rightarrow n = 16$

Hence, 78 is the 16^{th} term of the AP.

OR

Common difference is the difference between the successive term and its preceding term.
Now, $a_n = 6n - 5$
So,
$a_2 = 6(2) - 5 = 12 - 5 = 7$
$a_1 = 6(1) - 5 = 6 - 5 = 1$

Common difference, $d = a_2 - a_1 = 7 - 1 = 6$.

Hence, the common difference is 6.

Solution 3

Edge of each cube = 8 cm
After joining each cube, length of the cuboid, l = 8 + 8 + 8 = 24 cm
Breadth of the cuboid, b = 8 cm
Height of the cuboid, h = 8 cm

Now,
Total surface area of a cuboid = $2(lb + bh + lh)$
= 2(24 × 8 + 8 × 8 + 8 × 24)
= 2(192 + 64 + 192)
= 896 cm^2

Solution 4

Given: Perimeter of ΔPQR = 20 cm
⇒ PQ + QR + RP = 20
⇒ PQ + QC + CR + RP = 20
⇒ PQ + QA + RB + RP = 20 (Tangents to the circle from a point outside are equal so QA = QC and CR = RB)
⇒ PA + PB = 20
⇒ PA + PA = 20 (Tangents to the circle from a point outside are equal)
⇒ 2PA = 20
⇒ PA = 10 cm

Hence, PA = 10 cm.

OR

Given: ∠BAD = 55º
Now,
∠ADB = 90º (Angle subtended by a diameter/semicircle on any point of circle is 90º)

So, in ΔABD,
∠BAD + ∠ADB + ∠ABD = 180º (Angle sum property of a triangle)
⇒ 55º + 90º + ∠ABD = 180º

⇒ ∠ABD = 180º − 145º
= 35º

Also, a tangent is perpendicular to the radius at the point of contact,
∠OBC = 90º
⇒ ∠OBD + ∠DBC = 90º
⇒ 35º + ∠DBC = 90º (∠OBD = ∠ABD)
⇒ ∠DBC = 90º − 35º
= 55º

Hence, *m*∠DBC = 55º.

Solution 5

Class :	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70
Frequency :	25	30	45	42	35

From the data given above, it can be observed that the maximum class frequency is 45, belonging to class interval 40 - 50.
Therefore, modal class = 40 - 50
Lower class limit (l) of modal class = 40
Frequency (f_1) of modal class = 45
Frequency (f_0) of class preceding the modal class = 30
Frequency (f_2) of class succeeding the modal class = 42
Class size (h) = 10

Therefore,

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$$= 40 + \left(\frac{45 - 30}{2 \times 45 - 30 - 42}\right) \times 10$$

$$= 40 + \left(\frac{150}{18}\right)$$

$$\approx 40 + 8.33$$

$$\approx 48.33$$

Therefore, the mode of the distribution is 48.33.

Solution 6

The sum of *n* terms of an A.P. is $S_n = \frac{n}{2}\left[2a + (n-1)d\right]$, where *a* = first term for the given A.P., *d* is common difference of the given A.P. and *n* is the number of terms.
The first multiple of 8 is 8 and the 15th multiple of 8 is 120.
Also, all these terms will form an A.P. with the common difference of 8.
So here,
First term (a) = 8

Number of terms (n) = 15
Common difference (d) = 8
Now, using the formula for the sum of n terms, we get

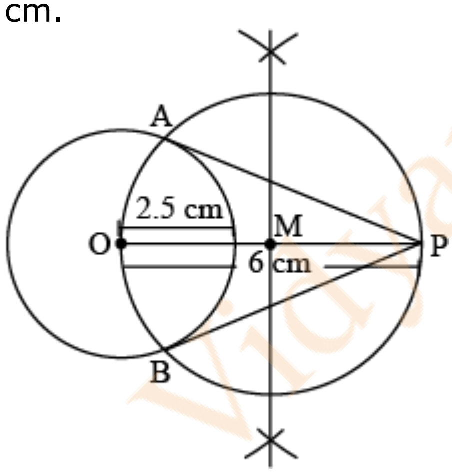
$$S_n = \frac{15}{2}\left[2\left(8\right) + \left(15 - 1\right) \times 8\right]$$
$$= \frac{15}{2}\left[16 + \left(14\right) \times 8\right]$$
$$= \frac{15}{2}\left(16 + 112\right)$$
$$= \frac{15}{2} \times 128$$
$$= 15 \times 64$$
$$= 960$$

Therefore, the sum of the first 15 multiples of 8 is 960.

Section B

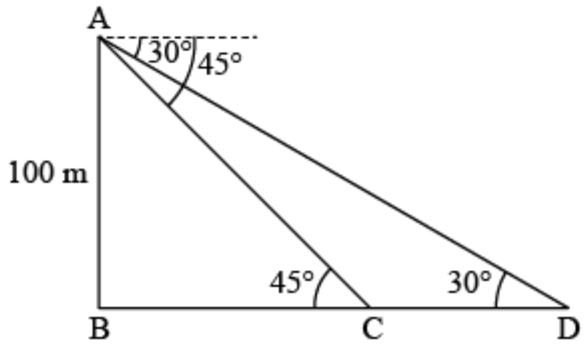
Solution 7

Steps of construction:
Step 1: Draw a circle of 2.5 cm radius with centre O. Locate a point P, 6 cm away from O. Join OP.
Step 2: Bisect OP. Let M be the mid-point of PO.
Step 3: Taking M as centre and MO as radius, draw a circle.
Step 4: Let this circle intersect the previous circle at points A and B.
Step 5: Join PA and PB.
PA and PB are the required tangents to the circle with centre O and radius 2.5 cm.



Solution 8

Since the angle of depression from point A changes from 30° to 45° as the distance CD is covered,
$\angle \mathrm{ADC} = 30^\circ$ and $\angle \mathrm{ACB} = 45^\circ$



In $\triangle$ABD,

$\tan 30^\circ = \frac{AB}{BD}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{100}{BD}$

$\Rightarrow BD = 100\sqrt{3}\ m = 173\ m$

In $\triangle$ABC,

$\tan 45^\circ = \frac{AB}{BC}$

$\Rightarrow 1 = \frac{100}{BC}$

$\Rightarrow BC = 100\ m$

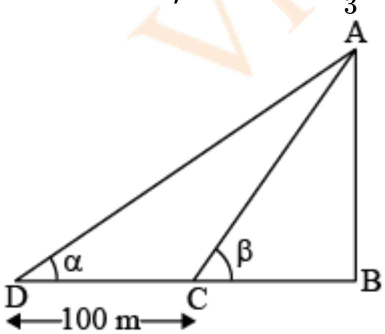
Therefore,

$$\begin{aligned} CD &= BD - BC \\ &= 173 - 100 \\ &= 73\ m \end{aligned}$$

Hence, the distance travelled is 73 m.

OR

Given that, $\tan\alpha = \frac{1}{3}$ and $\tan\beta = \frac{3}{4}$.



In $\triangle$ABD,

$\tan\alpha = \frac{\mathrm{AB}}{\mathrm{BD}}$

$\Rightarrow \frac{1}{3} = \frac{\mathrm{AB}}{\mathrm{BC+100}}$

$\Rightarrow \mathrm{AB} = \frac{\mathrm{BC+100}}{3}$

In $\triangle$ABC,

$\tan\beta = \frac{\mathrm{AB}}{\mathrm{BC}}$

$\Rightarrow \frac{3}{4} = \frac{\frac{\mathrm{BC+100}}{3}}{\mathrm{BC}}$

$\Rightarrow 3\mathrm{BC} = \frac{4(\mathrm{BC+100})}{3}$

$\Rightarrow 9\mathrm{BC} = 4\mathrm{BC} + 400$

$\Rightarrow 5\mathrm{BC} = 400$

$\Rightarrow \mathrm{BC} = 80\ \mathrm{m}$

Therefore,

$\mathrm{AB} = \frac{80+100}{3}$

$= \frac{180}{3}$

$= 60\ \mathrm{m}$

Hence, the height of the tower is 60 m.

Solution 9

Class	Frequency (f_i)	x_i	$f_i x_i$
10 - 15	4	12.5	50
15 - 20	10	17.5	175
20 - 25	5	22.5	112.5
25 - 30	6	27.5	165
30 - 35	5	32.5	162.5
	$\sum f_i = 30$		$\sum f_i x_i = 665$

Now,

$\mathrm{Mean} = \frac{\sum f_i x_i}{\sum f_i}$

$= \frac{665}{30}$

≈ 22.167

Hence, the mean of the given data is 22.167.

Solution 10

Class interval	Frequency	Cumulative frequency
0 − 10	6	6
10 − 20	9	15
20 − 30	10	25
30 − 40	8	33
40 − 50	*x*	33 + *x*
Total (*n*)	33 + *x*	

From the table, it can be observed that $n = 33 + x$
Median of the data is given as 25 which lies in interval 20 − 30.
Therefore, median class = 20 − 30
Lower limit (l) of median class = 20
Cumulative frequency (cf) of class preceding the median class = 15
Frequency (f) of median class = 10
Class size (h) = 10

$$\text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h$$

$$\Rightarrow 25 = 20 + \left(\frac{\frac{33+x}{2} - 15}{10}\right) \times 10$$

$$\Rightarrow 25 = 20 + \frac{33+x-30}{2}$$

$$\Rightarrow \frac{3+x}{2} = 5$$

$$\Rightarrow x + 3 = 10$$

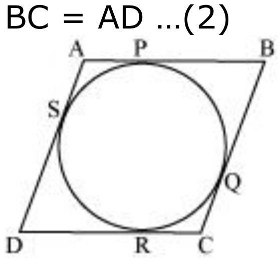
$$\Rightarrow x = 7$$

Thus, the value of *x* is 7.

Section C

Solution 11

Consider ABCD is a parallelogram and a circle is circumscribed in it.
AB = CD ...(1)
BC = AD ...(2)

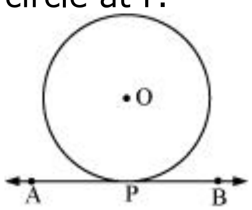


It can be observed that
DR = DS (Tangents on the circle from point D)
CR = CQ (Tangents on the circle from point C)
BP = BQ (Tangents on the circle from point B)

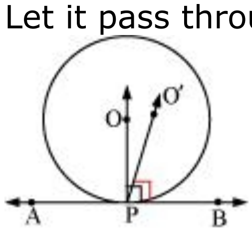
AP = AS (Tangents on the circle from point A)
Adding all these equations, we obtain
DR + CR + BP + AP = DS + CQ + BQ + AS
(DR + CR) + (BP + AP) = (DS + AS) + (CQ + BQ)
CD + AB = AD + BC
On putting the values of equations (1) and (2) in this equation, we obtain
2AB = 2BC
AB = BC ...(3)
Comparing equations (1), (2), and (3), we obtain
AB = BC = CD = DA
Hence, ABCD is a rhombus.

OR

Let us consider a circle with centre O. Let AB be a tangent which touches the circle at P.



We have to prove that the line perpendicular to AB at P passes through centre O.
We shall prove this by contradiction method.
Let us assume that the perpendicular to AB at P does not pass through centre O.
Let it pass through another point O'. Join OP and O'P.



As perpendicular to AB at P passes through O', therefore,
∠O'PB = 90° ... (1)
O is the centre of the circle and P is the point of contact. We know the line joining the centre and the point of contact to the tangent of the circle are perpendicular to each other.
∴ ∠OPB = 90° ... (2)
Comparing equations (1) and (2), we obtain
∠O'PB = ∠OPB ... (3)
From the figure, it can be observed that,
∠O'PB < ∠OPB ... (4)
It is only possible, when the line O'P coincides with OP.
Therefore, the perpendicular to AB through P passes through centre O.

Solution 12

Let the age of boy be x years and that of his sister be y years.
Given that, the sum of the ages of a boy and his sister is 25.

$\Rightarrow x + y = 25$

$\Rightarrow y = 25 - x \qquad .....(1)$

Also, the product of their ages is 150.

$\Rightarrow xy = 150 \qquad .....(2)$

Using (1) and (2),

$x(25 - x) = 150$

$\Rightarrow 25x - x^2 = 150$

$\Rightarrow x^2 - 25x + 150 = 0$

$\Rightarrow x^2 - 15x - 10x + 150 = 0$

$\Rightarrow x(x - 15) - 10(x - 15) = 0$

$\Rightarrow (x - 15)(x - 10) = 0$

$\Rightarrow x = 10 \text{ or } x = 15$

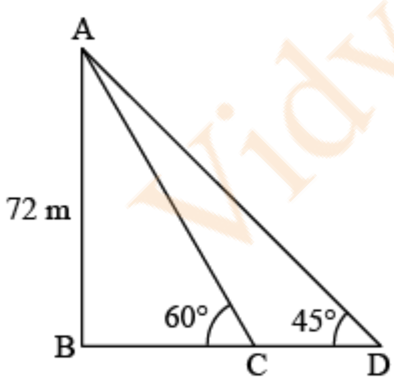
Putting these values in (2),

$\Rightarrow y = 15 \text{ or } y = 10$

Hence, their present ages are 10 and 15.

Solution 13

(1) Consider AB be the Qutub Minar and C and D be the positions of Charu and Daljeet.



(2) In △ABD,

$\tan 45^\circ = \frac{\text{AB}}{\text{BD}}$

$\Rightarrow 1 = \frac{72}{\text{BD}}$

$\Rightarrow \text{BD} = 72 \text{ m}$

In △ABD,

$$\tan 60^\circ = \frac{AB}{BC}$$
$$\Rightarrow \sqrt{3} = \frac{72}{BC}$$
$$\Rightarrow BC = \frac{72}{\sqrt{3}} \text{ m}$$
$$\Rightarrow BC = 24\sqrt{3} \text{ m}$$

Now, CD = BD − BC

$$\Rightarrow CD = 72 - 24\sqrt{3}$$
$$\Rightarrow CD = 24\left(3 - \sqrt{3}\right)$$

Hence, the distances BC, BD and CD are $24\sqrt{3}$ m, 72 m and $24\left(3 - \sqrt{3}\right)$ m respectively.

Solution 14

(1) Let *r* be the radius of conical cavity and *h* be the height of the conical cavity.
$\therefore r = 2.1 \text{ cm}$ and $h = 6 \text{ cm}$

$$\begin{aligned} \text{Volume of the wood carved out to make 5 conical cavities} &= 5 \times \text{volume o} \\ &= 5 \times \frac{1}{3}\pi r^2 h \\ &= 5 \times \frac{1}{3} \times \frac{22}{7} \times \\ &= 138.6 \text{ cm}^3 \end{aligned}$$

(2)

$$\begin{aligned} \text{Volume of the wood in the final product} &= \text{Volume of the cuboidal toy} - \\ &= 10 \times 10 \times 8 - 138.6 \\ &= 800 - 138.6 \\ &= 661.4 \text{ cm}^3 \end{aligned}$$