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

Total Time: 120

Total Marks: 40.0

Section A

Solution 1

The solution of a quadratic equation $ax^2+bx+c=0$, where $a\neq 0$ is given by $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$.

For the given quadratic equation, $a=1,\ b=2\sqrt{2}$ and $c=-6$.

$$\begin{aligned}\therefore x&=\frac{-2\sqrt{2}\pm\sqrt{\left(2\sqrt{2}\right)^2-4\times1\times(-6)}}{2\times1}\\&=\frac{-2\sqrt{2}\pm\sqrt{8+24}}{2}\\&=\frac{-2\sqrt{2}\pm\sqrt{32}}{2}\\&=\frac{-2\sqrt{2}\pm4\sqrt{2}}{2}\\&=-\sqrt{2}\pm2\sqrt{2}\end{aligned}$$

$$\Rightarrow x=-\sqrt{2}+2\sqrt{2}\quad\text{or}\quad x=-\sqrt{2}-2\sqrt{2}$$
$$\Rightarrow x=\sqrt{2}\quad\text{or}\quad x=-3\sqrt{2}$$

Thus, the values of *x* are $\sqrt{2}$ and $-3\sqrt{2}$.

Solution 2

Given A.P.: $-\frac{11}{2},\ -3,\ -\frac{1}{2}$

$\therefore$ First term (a_1) = $-\frac{11}{2}$

Common difference (d) = a_2-a_1

$$d = -3 - \left(-\frac{11}{2}\right)$$
$$= -3 + \frac{11}{2}$$
$$= \frac{-6+11}{2}$$
$$= \frac{5}{2}$$

The *n*-th term of an A.P. is given by $a_n = a + (n-1)d$.

$\therefore \frac{49}{2} = -\frac{11}{2} + (n-1)\frac{5}{2}$

$\Rightarrow (n-1)\frac{5}{2} = \frac{49}{2} + \frac{11}{2}$

$\Rightarrow (n-1)\frac{5}{2} = \frac{60}{2}$

$\Rightarrow 5(n-1) = 60$

$\Rightarrow n - 1 = \frac{60}{5}$

$\Rightarrow n = 12 + 1$

$\Rightarrow n = 13$

Thus, $\frac{49}{2}$ is 13^{th} term of the given A.P.

OR

The consecutive terms of A.P. are separated by a common difference *d*.
So, the terms $a,\ 7,\ b,\ 23$ are in A.P. if $7 - a = b - 7 = 23 - b$.

$\therefore b - 7 = 23 - b$

$\Rightarrow 2b = 23 + 7$

$\Rightarrow b = \frac{30}{2}$

$\Rightarrow b = 15$

$\text{Now, } 7 - a = b - 7$

$\Rightarrow a = 7 - b + 7$

$\Rightarrow a = 7 - 15 + 7$

$\Rightarrow a = -1$

Thus, the value of *a* is -1 and the value of *b* is 15.

Solution 3

Dimension of the metallic cuboid is 11 cm × 7 cm × 7 cm.
Volume of the cuboid = 11 cm × 7 cm × 7 cm = 539 cm^3
∴ Volume of the cuboid = *n* × Volume of a solid sphere

$\Rightarrow 539 = n \times \frac{4}{3}\pi r^3$

$\Rightarrow n = \frac{539\times 3}{4\times\pi\times\left(\frac{7}{2}\right)^3}$

$\Rightarrow n = \frac{539\times 3\times 8\times 7}{4\times 22\times 7\times 7\times 7}$

$\Rightarrow n = 3$

Thus, the value of *n* is 3.

Solution 4

Here, OP bisects the chord AD, then AP = PD.
∴ *m*∠APO = 90° (If a radius bisects a chord, then it is perpendicular to the chord)
Also, by Angle Sum Property of triangle, in ΔAOP,
m∠APO + *m*∠AOP + *m*∠OAP = 180°
⇒ *m*∠OAP = $180^\circ -$ *m*∠APO − *m*∠AOP
⇒ *m*∠OAP = $180^\circ - 90^\circ - 60^\circ = 30^\circ$

Since the tangent at any point of a circle is perpendicular to the radius through the point of contact.
Thus, *m*∠B = 90°
Also, by Angle Sum Property of triangle, in ΔABC
⇒ *m*∠C + *m*∠A + *m*∠B = 180°
∴ *m*∠C = $180^\circ - 30^\circ - 90^\circ = 60^\circ$

Hence, *m*∠C is 60°.

OR

AO and OB are the radii of the circle centered at O.
Since angle opposite to equal sides are equal.
Therefore, *m*∠BAO = *m*∠ABO = 40°

By Angle sum property in $\Delta\,\mathrm{AOB}$,
m∠BAO + *m*∠ABO + *m*∠AOB = 180°
⇒ *m*∠AOB = 180° − *m*∠ABO + *m*∠BAO
⇒ *m*∠AOB = $180^\circ - 40^\circ - 40^\circ = 100^\circ$

Now, XY is the tangent of the circle, therefore, XY ⊥ AO.
Thus, *m*∠OAY = 90°
∴ *m*∠BAY = *m*∠OAY − *m*∠BAO
⇒ *m*∠BAY = $90^\circ - 40^\circ = 50^\circ$

Hence, *m* ∠BAY is 50° and *m* ∠AOB is 100°.

Solution 5

Given: Mode of the given data is 55.

$\therefore$ Modal Class = 45 - 60 ($\because$ 55 lies in the interval 45 - 60)

Class	Frequency	
0 - 15	10	
15 - 30	7	
30 - 45	x	f_0
45 - 60	15	f_1
60 - 75	10	f_2
75 - 90	12	

Lower class limit (l) of modal class = 45
Frequency (f_1) of modal class = 15
Frequency (f_0) of class preceding the modal class = x
Frequency (f_2) of class succeeding the modal class = 10
Class size (h) = 15

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

$$\Rightarrow 55 = 45 + \left(\frac{15 - x}{2 \times 15 - x - 10}\right) \times 15$$

$$\Rightarrow 55 - 45 = \left(\frac{15 - x}{20 - x}\right) \times 15$$

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

$$\Rightarrow 10\,(20 - x) = 15\,(15 - x)$$

$$\Rightarrow 200 - 10x = 225 - 15x$$

$$\Rightarrow 5x = 25$$

$$\Rightarrow x = 5$$

Hence, the value of x is 5.

Solution 6

Given: $a_n = 5 - 2n$

$a_1 = 5 - 2 \Rightarrow a_1 = 3$

$l = a_{20} = 5 - 2 \times 20 \Rightarrow l = -35$

$$\because S_n = \frac{n}{2}\,(a_1 + l)$$

$$\Rightarrow S_{20} = \frac{20}{2}\,(3 - 35)$$

$$\Rightarrow S_{20} = 10\,(-32)$$

$$\Rightarrow S_{20} = -320$$

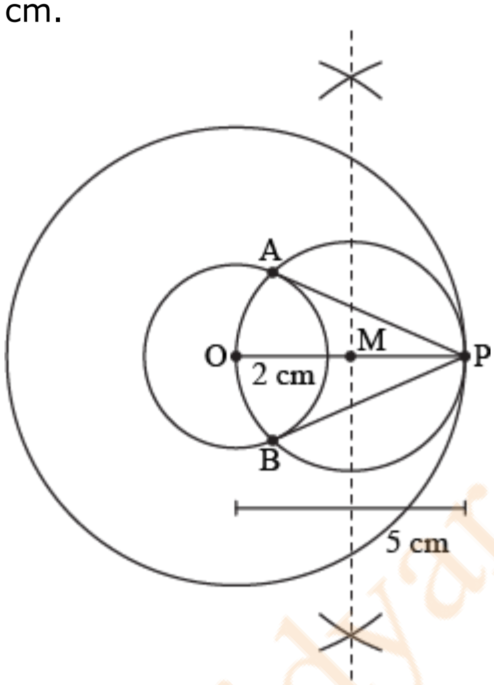
Hence, the sum of the first 20 terms of the given A.P. is −320.

Section B

Solution 7

Steps of construction:
Step 1: Draw a circle of 2 cm radius with centre O.
Step 2: Draw a circle of 5 cm radius taking O as its centre. Locate a point P on this circle and join OP.
Step 3: Bisect OP. Let M be the mid-point of PO.
Step 4: Taking M as its centre and MO as its radius, draw a circle. Let it intersect the given circle at the 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 cm.



Solution 8

We have,
$\angle ACB = 30^\circ \quad (\because \text{ Alternate interior angles})$
$\angle ADB = 45^\circ \quad (\because \text{ Alternate interior angles})$

Now,
In ΔABC,
$\tan 30^\circ = \frac{50}{BC}$
$BC = 50\sqrt{3}$

Also, in ΔABD,

$\tan 45^\circ = \frac{50}{BD}$

$BD = 50 \text{ m}$

Therefore, distance between two cars = CD

= BC + BD

= $50\left(\sqrt{3}+1\right)$ m

Solution 9

To find the class mark (x_i) for each interval, the following relation is used.

$x_i = \frac{\text{Upper class limit} + \text{Lower class limit}}{2}$

Given that, mean frequency distribution, $\bar{x} = 25$

Taking $\frac{20+30}{2} = 25$ as assumed mean (a), d_i and $f_i d_i$ are calculated as follows:

Class	**frequency f_i**	**Classmark x_i**	**$d_i = x_i - 25$**	**$f_i d_i$**
0 −10	5	5	− 20	− 100
10 − 20	18	15	− 10	− 180
20 − 30	15	25	0	0
30 −40	f	35	10	$10f$
40 − 50	6	45	20	120
	$\sum f_i = 44 + f$			$\sum f_i d_i = 10f - 160$

$\bar{x} = a + \frac{\Sigma f_i d_i}{\Sigma f_i}$

$25 = 25 + \frac{10f - 160}{44 + f}$

$0 = \frac{10f - 160}{44 + f}$

$10f - 160 = 0$

$f = 16$

OR

To find the class-mark (x_i) for each interval, the following relation is used.

$x_i = \frac{\text{Upper class limit} + \text{Lower class limit}}{2}$

Here, let A = 12.5

Class	**frequency f_i**	**Class-mark x_i**	**$d_i = x_i - 12.5$**	**$f_i d_i$**
0 −5	8	2.5	− 10	− 80
5 − 10	7	7.5	− 5	− 35
10 − 15	10	12.5	0	0
15 −20	13	17.5	5	65

20 − 25	12	22.5	10	120
	$\Sigma f_i = 50$			$\Sigma f_i d_i = 70$

$$\bar{x} = a + \frac{\Sigma f_i d_i}{\Sigma f_i}$$
$$= 12.5 + \frac{70}{50}$$
$$= 12.5 + 1.4$$
$$= 13.9$$

Solution 10

The cumulative frequencies with their respective class intervals are as follows.

Height (in cm)	Number of students	Cumulative frequency
130 - 135	4	4
135 - 140	11	15
140 - 145	12	27
145 - 150	7	34
150 - 155	10	44
155 - 160	6	50

Since the cumulative frequency just greater than $\frac{n}{2}\left(i.e., \frac{50}{2} = 25\right)$ is 27, belonging to class interval 140 - 145.

Median class = 140 − 145
Lower limit (*l*) of median class = 140
Frequency (*f*) of median class = 12
Cumulative frequency (*cf*) of class preceding median class = 15
Class size (*h*) = 5

$$\text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h$$
$$= 140 + \left(\frac{\frac{50}{2} - 15}{12}\right) \times 5$$
$$= 140 + \frac{50}{12}$$
$$\approx 140 + 4.17$$
$$\approx 144.17$$

Therefore, the median height of the students is 144.17 cm.

Section C

Solution 11

Consider $\Delta\,\text{TOP}$ and $\Delta\,\text{TOQ}$.

From the property of tangents we know that the length of two tangents drawn form an external point will be equal. Therefore we have,

PT = QT
OP = OQ (Radii of the same circle)
TO is the common side
Therefore, from SSS postulate of congruency, we have,
$\Delta \text{TOP} \cong \text{TOQ}$
Hence,
$\angle \text{OTP} = \angle \text{OTQ} \; .....(1)$
Now consider $\Delta \, \text{TRP} \;$ and $\; \Delta \, \text{TRQ}$. We have,
$\angle OTP = \angle OTQ$ (From (1))
TR is the common side.
From the property of tangents we know that the length of two tangents drawn form an external point will be equal. Therefore we have,
PT = PQ
From SAS postulate of congruent triangles, we have,
$\Delta \text{TRP} \cong \text{TRQ}$
Therefore,
PR = QR
It is given that PQ = 8 cm. That is,
$PR + QR = 8$
$\Rightarrow 2PR = 8 \quad (\because PR = QR)$
$\Rightarrow PR = 4$
Also, *PRQ* is a straight line. Therefore,
$\angle \text{PRQ} = 180^{\circ}$
$\Rightarrow \angle \text{PRT} + \angle \text{QRT} = 180^{\circ}$
$\Rightarrow 2\angle \text{PRT} = 180^{\circ}$
$\Rightarrow \angle \text{PRT} = 90^{\circ}$
Therefore,
Now let us consider$\Delta \, \text{POR}$. We have,
$OP^2 = PR^2 + OR^2$
$\Rightarrow 5^2 = 4^2 + OR^2$
$\Rightarrow OR^2 = 25 - 16 = 9$
$\Rightarrow OR = 3$
Consider $\Delta \, \text{POT}$.
Therefore,
$\text{PT}^2 = \text{OT}^2 - \text{OP}^2$
Also, $PT^2 = PR^2 + RT^2 \; .....(2)$
Thus,

$OT^2 - OP^2 = PR^2 + RT^2$
$\Rightarrow (OR + RT)^2 - OP^2 = PR^2 + RT^2$
$\Rightarrow (3 + RT)^2 - 5^2 = 4^2 + RT^2$
$\Rightarrow 9 + RT^2 + 6RT - 25 = 16 + RT^2$
$\Rightarrow 6RT = 32$
$\Rightarrow RT = \frac{16}{3}$

Now, let us substitute the value of *RT* in equation (2). We get,
$PT^2 = PR^2 + RT^2$
$PT^2 = 4^2 + \left(\frac{16}{3}\right)^2$
$PT^2 = 16 + \frac{256}{9}$
$PT^2 = \frac{400}{9}$
$PT = \frac{20}{3}$

Hence, the value of PT is $\frac{20}{3}$ cm.

Solution 12

Let the original number be 10*x* + *y*.
Given that, the product of the two digits is 24.
$\Rightarrow xy = 24 \qquad \ldots\ldots(1)$

Now, when 18 is subtracted from the number, the digits interchange. Therefore, the number becomes 10*y* + *x*.
$\Rightarrow 10x + y - 18 = 10y + x$
$\Rightarrow 9x - 18 = 9y$
$\Rightarrow x - 2 = y$
$\Rightarrow x = y + 2 \qquad \ldots\ldots(2)$

From (1) and (2),

$(y+2)y=24$

$\Rightarrow y^2+2y=24$

$\Rightarrow y^2+2y-24=0$

$\Rightarrow y^2+6y-4y-24=0$

$\Rightarrow y(y+6)-4(y+6)=0$

$\Rightarrow (y+6)(y-4)=0$

$\Rightarrow y=4 \qquad (\because \text{digit of a number cannot be negative})$

Putting the value of *y* in (1),

$x(4)=24$

$\Rightarrow x=6$

Therefore, the original number is:

$10x+y=10(6)+4$

$=64$

Hence, the original number is 64.

OR

Let the two numbers be *x* and *y* such that *x* > *y*.
Given that, the difference between their squares is 180.

$\Rightarrow x^2-y^2=180$ .....(1)

Also, the square of the smaller number is eight times the greater number.

$\Rightarrow y^2=8x$ .....(2)

Putting (2) in (1),

$x^2-8x=180$

$\Rightarrow x^2-8x-180=0$

$\Rightarrow x^2-18x+10x-180=0$

$\Rightarrow x(x-18)+10(x-18)=0$

$\Rightarrow (x-18)(x+10)=0$

$\Rightarrow x=18 \qquad \left(\because x \text{ cannot be negative as } x=\frac{y^2}{8}\right)$

Putting the value of *x* in (2),

$y^2=8\times 18$

$\Rightarrow y^2=144$

$\Rightarrow y=\pm 12$

Hence, the two numbers are 18 and 12 or 18 and −12.

Solution 13

(1) In △ADC,

$\sin 30^\circ = \frac{\text{Perpendicular}}{\text{Hypotenuse}}$

$\Rightarrow \sin 30^\circ = \frac{50}{\text{AC}}$

$\Rightarrow \frac{1}{2} = \frac{50}{\text{AC}}$

$\Rightarrow \text{AC} = 100 \text{ m}$

Hence, the length of string used for kite A is 100 m.

In △BCE,

$\sin 60^\circ = \frac{\text{Perpendicular}}{\text{Hypotenuse}}$

$\Rightarrow \sin 60^\circ = \frac{60}{\text{BC}}$

$\Rightarrow \frac{\sqrt{3}}{2} = \frac{60}{\text{BC}}$

$\Rightarrow \text{BC} = \frac{120}{\sqrt{3}}$

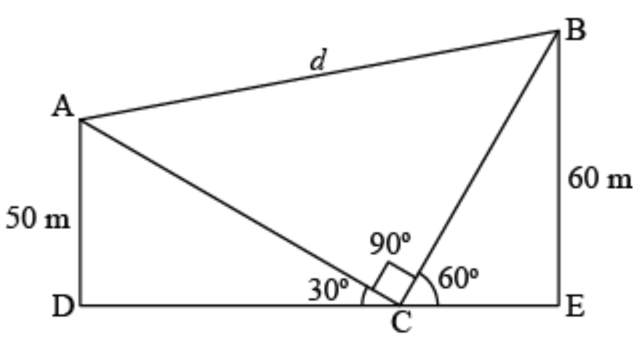
$\Rightarrow \text{BC} = 40\sqrt{3}$

Hence, the length of string used for kite B is $40\sqrt{3}$ m.

(2) We have, ∠ACD = 30°, ∠BCE = 60°

∴ ∠ACD + ∠BCE + ∠ACB = 180° (Angles on straight line)

⇒ ∠ACB = 90°



Thus, △ACB is a right-angled triangle.

Using Pythagoras theorem we get

$(AC)^2 + (BC)^2 = d^2$

$$\Rightarrow (100)^2 + \left(40\sqrt{3}\right)^2 = d^2$$
$$\Rightarrow 10000 + 4800 = d^2$$
$$\Rightarrow d = \sqrt{14800}$$
$$\Rightarrow d = 121.65 \text{ m}$$

Hence, the distance between these two kites i.e., d is 121.65 m.

Solution 14

(1) The canvas used in the making of the tent will be the CSA of the cylindrical and conical parts.

For cylindrical part:

Height(H) = 9 m and Diameter = 30 m ⇒ Radius(r) = 15 m

CSA of the cylinder = $2\pi rH = 2 \times \frac{22}{7} \times 15 \times 9 \text{ m}^2$

For the conical part:

Height(h) = 8 m and Radius(r) = 15 m

$$\therefore \text{Slant height } (l) = \sqrt{r^2 + h^2}$$
$$\Rightarrow l = \sqrt{(15)^2 + (8)^2}$$
$$\Rightarrow l = 17 \text{ m}$$

CSA of the cylinder = $\pi rl = \frac{22}{7} \times 15 \times 17 \text{ m}^2$

$$\therefore \text{Area of canvas used} = 2 \times \frac{22}{7} \times 15 \times 9 + \frac{22}{7} \times 15 \times 17$$
$$= \frac{22}{7} \times 15 \times (18 + 17)$$
$$= \frac{22}{7} \times 15 \times (35)$$
$$= 22 \times 15 \times 5$$
$$= 1650 \text{ m}^2$$

(2) 30 m^2 of canvas was wasted during the making of the tent.

So, the total canvas used = 1650 m^2 + 30 m^2 = 1680 m^2

The cost of the canvas is ₹200 per m^2.

The cost of canvas bought = 1680 × ₹200 = ₹336000

Hence, the cost of canvas bought is ₹3,36,000.