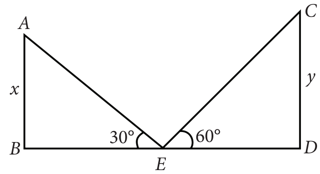
SOLUTIONS

1. Let AB and CD be two towers of height x and y respectively.



$\because$ E is the midpoint of BD. $\therefore$ $BE = ED$

Now, in ΔABE, $\tan 30° = \dfrac{AB}{BE}$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{x}{BE} \Rightarrow x = \frac{BE}{\sqrt{3}}$$

And in ΔEDC, $\tan 60° = \dfrac{CD}{ED}$

$$\Rightarrow \sqrt{3} = \frac{y}{ED} \quad \Rightarrow \quad y = \sqrt{3}BE \quad (\because\ BE = ED)$$

$$\therefore \quad \frac{x}{y} = \frac{BE}{\sqrt{3}} \times \frac{1}{\sqrt{3}BE} = \frac{1}{3}$$

Thus, $x : y = 1 : 3$.

2. Since, angle subtended by an arc at the centre is double the angle subtended by the same arc at the remaining part of the circle.

$\therefore$ $2\angle ABQ = \angle AOQ$

$$\Rightarrow \quad \angle ABT = \frac{58°}{2} \quad \Rightarrow \quad \angle ABT = 29°$$

Also, $\angle BAT = 90°$ ($\because$ Tangent is perpendicular to the radius through the point of contact)

In ΔABT, $\angle ABT + \angle BAT + \angle ATB = 180°$

$\Rightarrow$ $29° + 90° + \angle ATQ = 180°$

$\Rightarrow$ $\angle ATQ = 180° - 119° = 61°$

3. The frequency distribution table from the given data can be drawn as :

Class interval	Frequency
0–20	15
20–40	37 – 15 = 22
40–60	56 – 37 = 19
60–80	87 – 56 = 31
80–100	115 – 87 = 28

The modal class is 60–80 as it has the maximum frequency.

4. We have, first term, $a = 3$,

common difference, $d = 15 - 3 = 12$

n^{th} term of an A.P. is given by $a_n = a + (n - 1)\,d$

$\therefore$ $a_{21} = 3 + (20) \times 12 = 3 + 240 = 243$

Let the r^{th} term of the A.P. be 120 more than the 21^{st} term.

$\Rightarrow$ $a + (r - 1)d = 243 + 120$ $\Rightarrow 3 + (r - 1)\,12 = 363$

$\Rightarrow$ $(r - 1)\,12 = 360$ $\Rightarrow$ $r - 1 = 30$ $\Rightarrow$ $r = 31$

OR

Let the four terms are $a - 3d$, $a - d$, $a + d$ and $a + 3d$.

Sum of four terms = 50 [Given]

$\Rightarrow$ $4a = 50 \Rightarrow a = 25/2$ ...(i)

According to the question, $a + 3d = 4(a - 3d)$

$\Rightarrow$ $a + 3d = 4a - 12d \Rightarrow 15d = 3a$

$\Rightarrow$ $d = a/5 = \dfrac{25}{2 \times 5}$ [Using (i)]

$\Rightarrow$ $d = 5/2$

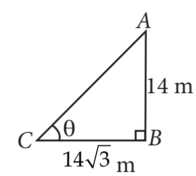
$\therefore$ Numbers are 5, 10, 15 and 20.

5. Let AB be the pole and BC be its shadow.

Then, $AB = 14$ m, $BC = 14\sqrt{3}$ m

Also, let θ be the sun's elevation, *i.e.*, $\angle ACB = \theta$

In right ΔABC,



$$\tan\theta = \frac{AB}{BC} = \frac{14}{14\sqrt{3}}$$

$$\Rightarrow \tan\theta = \frac{1}{\sqrt{3}}$$

But we know that, $\tan 30° = \dfrac{1}{\sqrt{3}}$

$\therefore$ $\theta = 30°$

So, required angle of elevation is 30°.

6. Let radius of hemisphere = r cm

Total surface area of hemisphere = 462 cm^2

$$\Rightarrow 3\pi r^2 = 462 \Rightarrow \quad r^2 = \frac{462 \times 7}{3 \times 22} = 49 \Rightarrow r = 7$$

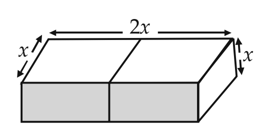
$$\therefore \quad \text{Volume of hemisphere} = \frac{2}{3}\pi r^3$$

$$= \frac{2}{3} \times \frac{22}{7} \times 7 \times 7 \times 7 = 718.67 \text{ cm}^3$$

OR

Let the side of each cube be x.

Given, volume of each cube = 125 cm^3



$\therefore$ $x^3 = 125$ cm^3

$\Rightarrow$ $x = 5$ cm

Now, length of resulting cuboid $(l) = 2x = 10$ cm

Breadth of resulting cuboid $(b) = x = 5$ cm

Height of resulting cuboid $(h) = x = 5$ cm

$\therefore$ Surface area of the cuboid = $2\,(lb + bh + hl)$

$= 2\,(10 \times 5 + 5 \times 5 + 5 \times 10) = 2\,[50 + 25 + 50]$

$= 250$ cm^2

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7. Here, the frequency distribution table is given in inclusive form. So, we first convert it into exclusive form.

$\therefore$ The cumulative frequency distribution table in exclusive form is as follows :

Weekly wages (in ₹)	No. of workers	Cumulative frequency
59.5-69.5	5	5
69.5-79.5	15	20
79.5-89.5	20	40
89.5-99.5	30	70
99.5-109.5	20	90
109.5-119.5	8	98
	$N = \sum f_i = 98$	

We have, $n = 98 \therefore n/2 = 49$

The cumulative frequency just greater than $n/2$ is 70 and the corresponding class is 89.5–99.5. So, 89.5–99.5 is the median class.

$\therefore$ $l = 89.5$, $h = 10$, $f = 30$ and $cf = 40$

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

$$= 89.5 + \left(\frac{49 - 40}{30}\right) \times 10 = 92.5$$

8. Steps of construction :

Step-I : Draw a line segment $AB = 8.4$ cm.

Step-II : Draw any ray AX making an acute angle with AB.

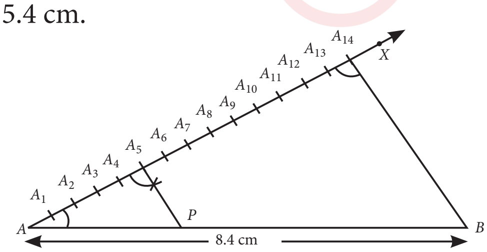
Step-III : On ray AX, mark $5 + 9 = 14$ points $A_1, A_2, A_3, ..., A_{14}$ such that $AA_1 = A_1A_2 = A_2A_3 = ... = A_{13}A_{14}$.

Step-IV : Join $A_{14}B$.

Step -V : From A_5, draw $A_5P \parallel A_{14}B$, meeting AB at P.

Thus, P divides AB in the ratio 5 : 9.

On measuring the two parts, we get $AP = 3$ cm and $PB = 5.4$ cm.

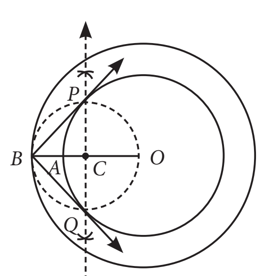


OR

Steps of construction :

Step-I : Draw two concentric circle with centre O and radii 5 cm and 7 cm. Take a point B on the outer circle and then join OB.

Step-II : Draw the perpendicular bisector of OB. Let the bisector intersects OB at C.

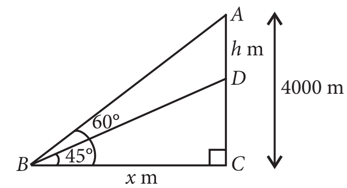


Step-III : With C as centre and OC as radius, draw a circle which intersects the inner circle at P and Q.

Step-IV : Join BP and QB.

Thus, BP and BQ are the required tangents.

9. Let one aeroplane be at A and second be at D such that vertical distance between two planes is h m.



In ΔABC, $\tan 60° = \dfrac{AC}{BC}$

$\Rightarrow \sqrt{3} = \dfrac{4000}{x} \Rightarrow x = \dfrac{4000}{\sqrt{3}}$ ...(i)

In ΔDBC, $\tan 45° = \dfrac{DC}{BC}$

$\Rightarrow 1 = \dfrac{4000 - h}{x} \Rightarrow x = 4000 - h$

$\Rightarrow \dfrac{4000}{\sqrt{3}} = 4000 - h$ [Using (i)]

$\Rightarrow h = 4000 - \dfrac{4000}{\sqrt{3}} = 4000 - \dfrac{4000\sqrt{3}}{3}$

$\Rightarrow h = \dfrac{12000 - 6920}{3} = \dfrac{5080}{3} = 1693.33$

Hence, vertical distance between the aeroplanes at that instant was 1693.33 m.

10. Total number of students = 150

Mean weight = 60 kg

$\therefore$ Total weight of 150 students = $150 \times 60 = 9000$ kg

Let the total number of boys be x.

$\therefore$ Total number of girls = $150 - x$

Mean weight of boys = 70 kg

$\therefore$ Total weight of boys = $70 \times x = 70x$ kg

Mean weight of girls = 55 kg

$\therefore$ Total weight of girls = $(150 - x)55$ kg

Now, Total weight = Weight of boys + Weight of girls

$\Rightarrow 9000 = 70x + (150 - x)55$

$\Rightarrow 9000 = 70x + 150 \times 55 - 55x$

$\Rightarrow 9000 - 8250 = 70x - 55x$

$\Rightarrow 750 = 15x \Rightarrow x = 50$

$\therefore$ Number of boys = 50 and number of girls = 100

11. Let a be the first term and d be the common difference of the A.P.

$\therefore S_1 = \dfrac{n}{2}[2a + (n - 1)d]$ ...(i)

$S_2 = \dfrac{2n}{2}[2a + (2n - 1)d]$ ...(ii)

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and $S_3 = \frac{3n}{2}[2a + (3n - 1)d]$ ...(iii)

R.H.S. $= 3(S_2 - S_1)$

$$= 3\left[\frac{2n}{2}(2a + 2nd - d) - \frac{n}{2}(2a + nd - d)\right]$$

$$= 3 \cdot \frac{n}{2}[2(2a + 2nd - d) - (2a + nd - d)]$$

$$= \frac{3n}{2}[4a + 4nd - 2d - 2a - nd + d]$$

$$= \frac{3n}{2}[2a + 3nd - d]$$

$$= \frac{3n}{2}[2a + (3n - 1)d] = S_3 \quad \text{[From (iii)]}$$

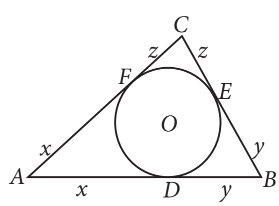
= L.H.S.

12. Since, tangents drawn from an external point to a circle are equal.

$\therefore$ $AD = AF = x$ (say)

$BD = BE = y$ (say)

$CE = CF = z$ (say)



According to the question,

$AB = x + y = 24$ cm ...(i)

$BC = y + z = 16$ cm ...(ii)

$AC = x + z = 20$ cm ...(iii)

Subtracting (iii) from (i), we get

$y - z = 4$ ...(iv)

Adding (ii) and (iv), we get

$2y = 20 \Rightarrow y = 10$ cm

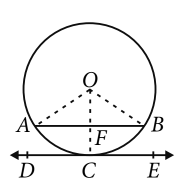
Substituting the value of y in (i) and (ii), we get

$x = 14$ cm, $z = 6$ cm

$\therefore$ $AD = 14$ cm, $BE = 10$ cm and $CF = 6$ cm.

OR

Let us consider a circle with centre O and C is the mid point of arc ACB and DE is a tangent to the circle.



Now, we need to prove that $AB \parallel DE$

Join OA, OB and OC.

Since C is the mid point of arc ACB.

$\therefore$ $\angle AOF = \angle BOF$

[$\because$ OA and OB are equally inclined with OC]

Now, in ΔOAF and ΔOBF,

$OA = OB$ [Radii of the circle]

$\angle AOF = \angle BOF$ [Proved above]

$OF = OF$ [Common]

$\therefore$ $\Delta OAF \cong \Delta OBF$ [By SAS congruence criterion]

$\Rightarrow$ $\angle AFO = \angle BFO$ [By CPCT]

Now, $\angle AFO + \angle BFO = 180°$ [Linear pair]

$\Rightarrow$ $2\angle AFO = 180° \Rightarrow \angle AFO = 90°$

Also, $\angle OCD = 90°$

[$\because$ Tangent is perpendicular to radius through the point of contact.]

$\therefore$ $\angle AFO = \angle OCD$ [Each 90°]

But these are corresponding angles.

$\therefore$ $AB \parallel DE$

13. (i) Let two consecutive integers be x, $x + 1$.

Given, $x^2 + (x + 1)^2 = 650$

$\Rightarrow$ $2x^2 + 2x + 1 - 650 = 0$

$\Rightarrow$ $2x^2 + 2x - 649 = 0$

(ii) Let the number be x.

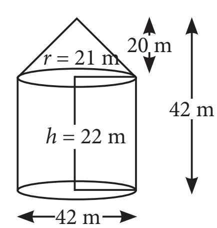
According to question, $x^2 - 84 = 3(x + 8)$

$\Rightarrow$ $x^2 - 84 = 3x + 24 \Rightarrow x^2 - 3x - 108 = 0$

14. (i) Required area of canvas = Curved surface area of cone + Curved surface area of cylinder

$= \pi rl + 2\pi rh = \pi r(l + 2h)$

$$= \frac{22}{7} \times 21\,(29 + 44)$$



$$\left[\because\ l = \sqrt{r^2 + h_1^2} = \sqrt{(21)^2 + (20)^2} = \sqrt{841} = 29 \text{ m}\right]$$

$= 4818 \text{ m}^2$

(ii) Volume of tent = Volume of cone + Volume of cylinder $= \frac{1}{3}\pi r^2 h_1 + \pi r^2 h = \pi r^2\left(\frac{1}{3}h_1 + h\right)$, where h_1 is the height of cone.

$$= \frac{22}{7} \times (21)^2\left[\frac{20}{3} + 22\right] = \frac{9702}{7} \times \frac{86}{3} = 39732 \text{ m}^3$$

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Self Evaluation Sheet

*Once you complete **SQP-3**, check your answers with the given solutions and fill your marks in the marks obtained column according to the marking scheme. Performance Analysis Table given at the bottom will help you to check your readiness.*

Q. No.	Chapter	Marks Per Question	Marks Obtained
1	Some Applications of Trigonometry	2	
2	Circles	2	
3	Statistics	2	
4	Arithmetic Progressions / Arithmetic Progressions	2	
5	Statistics	2	
6	Surface Areas and Volumes / Surface Areas and Volumes	2	
7	Statistics	3	
8	Constructions / Constructions	3	
9	Some Applications of Trigonometry	3	
10	Statistics	3	
11	Arithmetic Progressions	4	
12	Circles / Circles	4	
13	Quadratic Equations	2 × 2	
14	Surface Areas and Volumes	2 × 2	
	Total Marks	**40**	....
		Percentage	..............%

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Performance Analysis Table

If your marks is

> 90%	**TREMENDOUS!**	*You are done! Keep on revising to maintain the position.*
81-90%	**EXCELLENT!**	*You have to take only one more step to reach the top of the ladder. Practise more.*
71-80%	**VERY GOOD!**	*A little bit of more effort is required to reach the 'Excellent' bench mark.*
61-70%	**GOOD!**	*Revise thoroughly and strengthen your concepts.*
51-60%	**FAIR PERFORMANCE!**	*Need to work hard to get through this stage.*
40-50%	**AVERAGE!**	*Try hard to boost your average score.*