Class-X

Mathematics Basic (241)

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Section-C

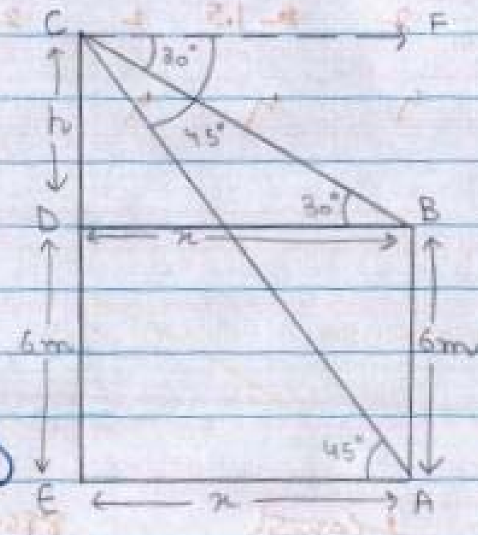
Here, AB represents a ~~towe~~ tall building of ht. 6m and CE ~~p~~ represents a multi-storeyed building.

Also, $CF \parallel DB$

$\Rightarrow \angle FCB = \angle CBD = 30^\circ$ (Alt. Int. ∠'s)

$CF \parallel AE$

$\Rightarrow \angle FCA = \angle CAE = 45^\circ$ (Alt. Int. ∠'s)



In rt. ΔCDB

$$\tan 30^\circ = \frac{CD}{DB} = \frac{h}{x}$$

$$\frac{1}{\sqrt{3}} = \frac{h}{x}$$

$$x = \sqrt{3}h \quad — (1)$$

In rt. ΔCEA

$$\tan 45^\circ = \frac{CE}{EA} = \frac{h+6}{x}$$

3

$1 = \frac{h+6}{\sqrt{3}h}$ (from eqn. 1)

$\sqrt{3}h = h + 6$

$\sqrt{3}h - h = 6$

$h(\sqrt{3}-1) = 6$

$h = \frac{6}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1}$

$h = \frac{6(\sqrt{3}+1)}{3-1} = \frac{\overset{3}{\cancel{6}}(\sqrt{3}+1)}{\cancel{2}_1}$

$h = 3(1.73+1)$

$h = 3(2.73)$

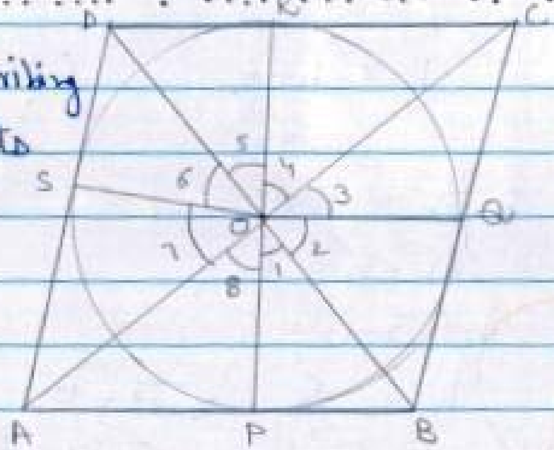
$h = 8.19\,m$

$\therefore$ ht. of multi storeyed building $= h+6 = 8.19+6$
$= 14.19\,m$

Also, Dist. between the 2 buildings, $x = \sqrt{3}h$
$= (1.73)(8.19)$
$= 14.1687\,m$
or $14.17\,m$

$$\begin{array}{r} 1.73 \\ \times 8.19 \\ \hline 1557 \\ 173\times \\ 1384\times\times \\ \hline 14.1687 \end{array}$$

12. (a) Given :- A quadrilateral ABCD circumscribing a circle with centre O at points P, Q, R, S.



To prove :- $\angle AOB + \angle COD = 180°$

~~Profe~~ Proof :- In ΔPOB and ΔQOB

$OP = OQ$ (Radii)

$OB = OB$ (common)

$PB = QB$ [length of tangents from common ext pt. to a circle are equal]

$\therefore \Delta POB \cong \Delta QOB$ (by SSS)

$\Rightarrow \angle 1 = \angle 2$ (cpct)

Ully, $\angle 3 = \angle 4$

$\angle 5 = \angle 6$

$\angle 7 = \angle 8$

Now, In quardrilateral ABCD

$\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 + \angle 6 + \angle 7 + \angle 8 = 360°$ (Complete angle)

$\angle 1 + \angle 1 + \angle 4 + \angle 4 + \angle 5 + \angle 5 + \angle 8 + \angle 8 = 360°$

$2\angle 1 + 2\angle 4 + 2\angle 5 + 2\angle 8 = 360°$

$2(\angle 1 + \angle 4 + \angle 5 + \angle 8) = 360°$

5

$(\angle 1+\angle 8)+(\angle 4+\angle 5)= 180^\circ$

$\Rightarrow \angle AOB + \angle COD = 180^\circ$

Hence proved

13. a) Total no. of articles $= x$

Cost of one article $= 2x+1$

Cost of production of x articles $= 210$

But, $x(2x+1) = 210$

$2x^2 + x = 210$

$2x^2 + x - 210 = 0$

$\therefore$ The required eqn. is $2x^2+x-210=0$

b) Now, to find no. of articles we need to solve the above eqn.

$2x^2+x-210=0$

~~$2x^2+21x-20x-210=0$~~

$2x^2-20x+21x-210=0$

$2x(x-10)+21(x-10)=0$

$(2x+21)(x-10)=0$

$$\begin{array}{r} 210 \\ \times 2 \\ \hline 420 \end{array}$$

420 = 2 × 210; 210 = 2 × 105; 105 = 3 × 35; 35 = 5 × 7

Either, $x = \frac{-21}{2}$

or $x = 10$

Since, no. of articles cannot be -ve.

$\Rightarrow x = 10$

$\therefore$ No. of articles = 10

Cost of one article = $2x+1$

$= 2(10)+1 = 20+1$

$= ₹21$

14. a) Vol. of water on roof = Vol. of water in pit

$l \times b \times h = 3 \times 3 \times 2$

$100 \times h = 3 \times 3 \times 2$

$h = \frac{3 \times 3 \times 2}{100}$

$h = \frac{18}{100}$

$h = 0.18 m$

$\therefore$ ht. of standing water on roof = 0.18 m

b) Vol. of cuboidal pit $= 3 \times 3 \times 2$

$= 18 m^3$

Vol. of cylindrical pit $= \pi r^2 h$

$= \frac{\cancel{22}^{11}}{7} \times \frac{3}{\cancel{2}_1} \times \frac{3}{\cancel{2}} \times \cancel{2}$

$= \frac{99}{7}$

$= 14.14 m^3$

Hence, cuboidal tank will hold more water.

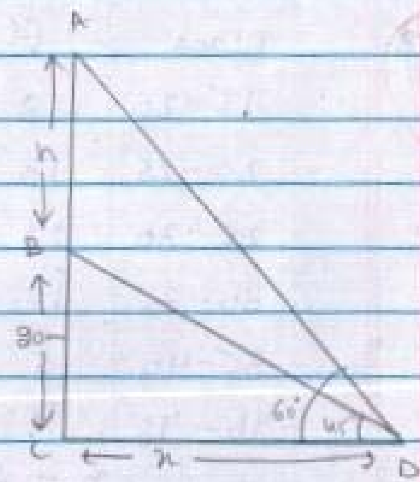
Section-B

7. Here, AB is the transmission tower & BC is the building of ht. 20m

In rt. Δ BCD

$\tan 45° = \frac{20}{x}$

$1 = \frac{20}{x} \Rightarrow x = 20m$



In rt. ΔACD

$$\tan 60^\circ = \frac{h + 20}{x}$$

$$\Rightarrow \sqrt{3} = \frac{h+20}{20}$$

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

$$h = 20\sqrt{3} - 20$$

$$h = 20(\sqrt{3} - 1)\ m$$

$\therefore$ ht. of transmission tower $= 20(\sqrt{3}-1)\ m$

8.

Class	fi	cf
15-20	8	8
20-25	13	21
25-30	21	42
30-35	12	54
35-40	5	59
40-45	4	63
	$n = 63$	

$$\frac{n}{2} = \frac{63}{2} = 31.5$$

$\Rightarrow$ Median class $= 25-30$

$l = 25$

$cf = 21$

$f = 21$

$h = 5$

$$\text{Median} = l + \left[\frac{\frac{n}{2} - cf}{f}\right] h$$

$$= 25 + \left[\frac{31.5 - 21}{21}\right] 5$$

$$= 25 + \left[\frac{10.5}{21}\right] 5$$

$$= 25 + \left[\frac{\cancel{105}^{5}}{\cancel{210}_{\cancel{10}_{2}}}\right] \cancel{5}^{1}$$

$$= 25 + \frac{5}{2}$$

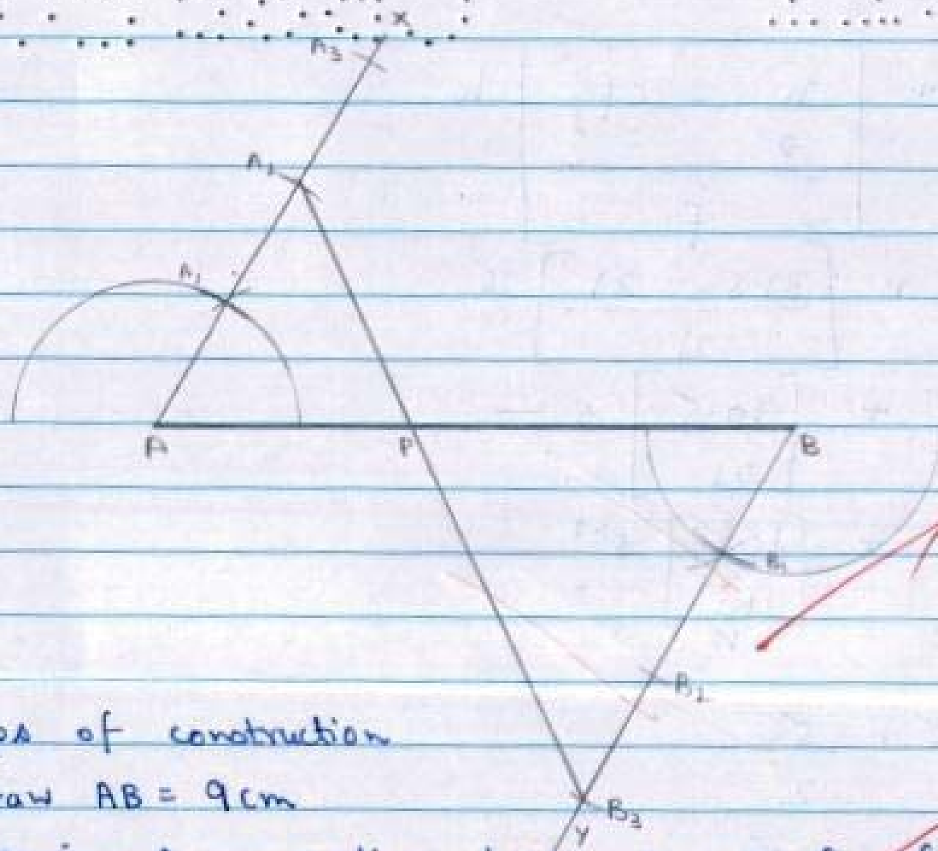
$$= 25 + 2.5$$

$$\therefore \text{Median} = 27.5$$

$$\begin{array}{r} 31.5 \\ \underline{21.0} \\ 10.5 \end{array}$$

$$\begin{array}{r} 21 \\ \underline{05} \\ 105 \end{array}$$

9. (b)



Steps of construction

1. Draw AB = 9cm
2. Keeping A as radius draw an angle of 60° (∠XAB)
3. Again, Keeping B as radius draw an angle of 60° (∠YBA) towards opp. side of line segment AB.
4. ~~Keeping~~ Taking a suitable radius divide line AX and BY into 3 equal parts.
5. Join A2 and B3.

Hence, AP : BP = 2:3

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10.

Mileage	fi	xi	di	fidi
10-12	13	11	-4	-52
12-14	18	13	-2	-36
14-16	10	15 = a	0	0
16-18	7	17	2	14
18-20	2	19	4	8
	$\Sigma fi = 50$			$\Sigma fidi = -66$

$$\text{Mean}, \bar{x} = a + \frac{\Sigma fidi}{\Sigma fi}$$

$$= 15 - \frac{66}{50}$$

$$= \frac{750 - 66}{50}$$

$$= \frac{684}{50}$$

$\therefore$ Mean = 13.68

52
36
88

22
-66

750
-66
684

$\frac{684}{5}$

136.8

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Section- A

1. (b) No. of cones = $\dfrac{\text{Vol. of sphere}}{\text{Vol. of 1 cone}}$

$$= \frac{\frac{4}{\cancel{3}}\cancel{\pi}r^3}{\frac{1}{\cancel{3}}\cancel{\pi}r^2 h}$$

$$= \frac{4r^3}{r^2 h}$$

$$= \frac{\cancel{4} \times 3 \times 3 \times \cancel{3}}{\cancel{2} \times \cancel{2} \times \cancel{3}}$$

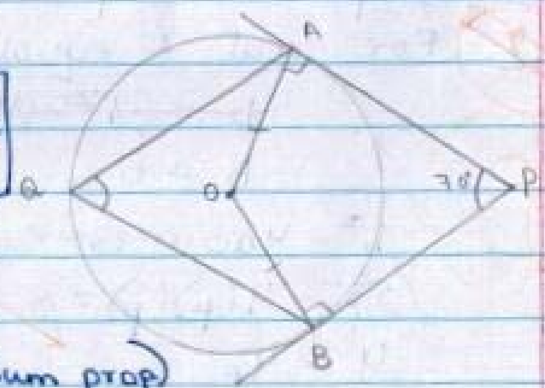
$\therefore$ No. of cones = 9 cones

13

2. $\angle APB = 70^\circ$

$\angle PAO = \angle PBO = 90^\circ$

[Tangent to a circle is perp. to the radius through pt. of contact]



In quadrilateral PAOB

$70^\circ + 90^\circ + 90^\circ + \angle AOB = 360^\circ$

(Angle Sum prop)

$250^\circ + \angle AOB = 360^\circ$

$\angle AOB = 360^\circ - 250^\circ$

$\angle AOB = 110^\circ$

Now,

$\angle AQB = \frac{1}{2} \angle AOB$

[by degree measure theorem i.e, the angle subtended at the centre is half the angle subtended ~~to~~ at any other part of the circle]

$\Rightarrow \angle AQB = \frac{1}{2} \times 110$

$\therefore \angle AQB = 55^\circ$

14

3. a) $px^2 + 2x + p = 0$

For real & equal roots

$$\cancel{D = b^2 - 4ac}$$

$$D = 0$$

$$b^2 - 4ac = 0$$

$$(2)^2 - 4(p)(p) = 0$$

$$4 - 4p^2 = 0$$

$$\cancel{-}4p^2 = \cancel{-}4$$

$$p^2 = 1$$

$$\therefore p = 1$$

4) $S_{10} = 4S_5$

$$\frac{n}{2}[2a + (n-1)d] = 4\left[\frac{n}{2}\{2a + (n-1)d\}\right]$$

$$\frac{\cancel{10}^5}{\cancel{2}_1}[2a + 9(6)] = \cancel{4}^2\left[\frac{5}{\cancel{2}_1}\{2a + 4(6)\}\right]$$

$$\begin{array}{r} 24 \\ \times 5 \\ \hline 120 \end{array}$$

$$5(2a + 54) = 2[10a + 120]$$

$$10a + 270 = 20a + 240$$

$$20a - 10a = 270 - 240$$

$10a = 30$

$\therefore a = 3$

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5. $a_1 = 17$

$a_4 = 44$

$a + 3d = 44$

$17 + 3d = 44$

$3d = 44 - 17$

$3d = 27$

$d = 9$

$\therefore a_{15} = a + 14d$

$= 17 + 14(9)$

$= 17 + 126$

$\therefore a_{15} = 143$

$$\begin{array}{r} 44 \\ -17 \\ \hline 27 \end{array}$$

16.

6. Modal class = 130 - 140

$$\text{Mode} = l + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] h$$

$$= 130 + \left[\frac{11 - 8}{22 - 8 - 7}\right] 10$$

$$= 130 + \left[\frac{3}{7}\right] 10$$

$$= 130 + \frac{30}{7}$$

$$= \frac{910 + 30}{7}$$

$$= \frac{940}{7} = 134.285$$

$\therefore$ ~~Mean~~ Mode = 134.29 (approx.)