LIBERTY PAPER SET

STD. 10 : Mathematics (Standard) [N-012(E)]

Full Solution

Time : 3 Hours **ASSIGNTMENT PAPER 3**

Section-A

1. (A) 4 **2.** (B) $\frac{800}{x+20}$ **3.** (C) 5 **4.** (B) 70° **5.** (B) $2\pi r^2$ **6.** (D) 3 **7.** 18 **8.** – 8 **9.** 2 **10.** 8.4 **11.** (a, a) **12.** $\pi r^2 h$ **13.** False **14.** True **15.** False **16.** True **17.** 20 – 30 **18.** 0.9 **19.** 4 **20.** $ax^2 + bx + c = 0, a \neq 0$ **21.** (b) $\frac{c}{a}$ **22.** (c) $-\frac{d}{a}$ **23.** (b) 1 **24.** (c) – 1

Section-B

25. Let, $5 + 2\sqrt{7}$ be rational.

Therefore, $5 + 2\sqrt{7} = \frac{a}{b}$, where a and b are integers having no common factors other then 1.

Noe, $5 + 2\sqrt{7} = \frac{a}{b}$,

$\Rightarrow 2\sqrt{7} = \frac{a}{b} - 5$

$\Rightarrow 2\sqrt{7} = \frac{a-5b}{b}$

$\Rightarrow \sqrt{7} = \frac{a-5b}{2b}$

Since, a and b are integers, therefore, $\sqrt{7}$ is rational.

This contradicts the fact that $\sqrt{7}$ is irrational.

Therefore, our assumption was wrong.

Hence, $5 + 2\sqrt{7}$ is irrational.

26. Here, $\frac{4}{3}x + 2y = 8$

and $2x + 3y = 12$

$\frac{4}{3}x + 2y - 8 = 0$

and $2x + 3y - 12 = 0$

$a_1 = \frac{4}{3}, b_1 = 2, c_1 = -8$

$a_2 = 2, b_2 = 3, c_2 = -12$

Now, $\frac{a_1}{a_2} = \frac{4/3}{2} = \frac{2}{3}, \frac{b_1}{b_2} = \frac{2}{3}, \frac{c_1}{c_2} = \frac{-8}{-12} = \frac{2}{3}$

Here, $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

Hence, the given pair of liners equations is consistent and dependent.

27. Suppose, the size of the base = x cm

Hence, the measurement of altitude = $(x - 7)$ cm

According to Pythagoras theorem,

$(\text{Base})^2 + (\text{Altitude})^2 = (\text{Hypotenuse})^2$

$\therefore (x)^2 + (x - 7)^2 = (13)^2$

$\therefore x^2 + x^2 - 14x + 49 = 169$

$\therefore 2x^2 - 14x + 49 - 169 = 0$

$\therefore 2x^2 - 14x - 120 = 0$

$\therefore x^2 - 7x - 60 = 0$

$\therefore x^2 - 12x + 5x - 60 = 0$

$\therefore x(x - 12) + 5(x - 12) = 0$

$\therefore (x + 5)(x - 12) = 0$

$\therefore x + 5 = 0$ OR $x - 12 = 0$

$\therefore x = -5$ OR $x = 12$

But the size of the base should not be negative.

The base of the given triangle = 12 cm

The altitude of this triangle will be = 12 – 7 = 5 cm.

28. $3x^2 - 2x + \dfrac{1}{3} = 0$

$\therefore 9x^2 - 6x + 1 = 0$

$\therefore a = 9, b = -6, c = 1$

$\therefore b^2 - 4ac = (-6)^2 - 4(9)(1) = 36 - 36 = 0$

$\therefore b^2 - 4ac = 0$, the given equdratic equation has two equal real roots.

$$\therefore \quad x = -\frac{b}{2a} = -\frac{(-6)}{2(9)} = \frac{6}{18} = \frac{1}{3}$$

The roots are : $\dfrac{1}{3}, \dfrac{1}{3}$

29. Here, $a = 7$, $d = 13 - 7 = 6$

$a_n = a + (n - 1)\, d$

$a_{20} = a + (20 - 1)\, d$

$= a + 19d$

$= 7 + 19\,(6)$

$= 7 + 114$

$a_{20} = 121$

30. Here, $2tan^2 45° + x - Sin^2 60° = 2$

$\therefore 2\,(1)^2 + x - \left(\dfrac{\sqrt{3}}{2}\right)^2 = 2$

$\therefore 2\,(1) + x - \dfrac{3}{4} = 2$

$\therefore 2 + x - \dfrac{3}{4} = 2$

$\therefore x = 2 - 2 + \dfrac{3}{4}$

$\therefore x = \dfrac{3}{4}$

31. $2\ sin\ \theta + cos\ \theta = 2$

$\therefore\ 2\ sin\ \theta = 2 - cos\ \theta$

$\therefore\ (2\ sin\ \theta)^2 = (2 - cos\ \theta)^2$

$\therefore\ 4\ sin^2\ \theta = 4 - 4\ cos\ \theta + cos^2\ \theta$

$\therefore\ 4\ (1 - cos^2\ \theta) = 4 - 4\ cos\ \theta + cos^2\ \theta$

$\therefore\ 4 - 4\ cos^2\ \theta = 4 - 4\ cos\ \theta + cos^2\ \theta$

$\therefore\ 4 - 4\ cos^2\ \theta - 4 + 4\ cos\ \theta - cos^2\ \theta = 0$

$\therefore\ -5\ cos^2\ \theta + 4\ cos\ \theta = 0$

$\therefore\ 5\ cos^2\ \theta - 4\ cos\ \theta = 0$

$\therefore\ cos\ \theta\ (5\ cos\ \theta - 4) = 0$

$\therefore\ cos\ \theta = 0$ OR $5\ cos\ \theta - 4 = 0$

$\therefore\ cos\theta = 0$ OR $cos\ \theta = \frac{4}{5}$

($cos\theta = 0$) Not possible

$\therefore\ cos\ \theta = \frac{4}{5}$ ...(1)

$\therefore\ cos^2\ \theta = \frac{16}{25}$

$\therefore\ 1 - sin^2\ \theta = \frac{16}{25}$

$\therefore\ sin^2\ \theta = 1 - \frac{16}{25}$

$\therefore\ sin^2\ \theta = \frac{25-16}{25}$

$\therefore\ sin^2\ \theta = \frac{9}{25}$

$\therefore\ sin\ \theta = \frac{3}{5}$ ...(2)

$$tan\ \theta = \frac{sin\ \theta}{cos\ \theta} = \frac{\frac{3}{5}}{\frac{4}{5}} = \frac{3}{4}$$

or

Here $2\ \sin\ \theta + \cos\ \theta = 2$

$\therefore\ \frac{2\ sin\ \theta}{cos\ \theta} + \frac{cos\ \theta}{cos\ \theta} = \frac{2}{cos\theta}$ ($\therefore$ divide by $\cos\ \theta \neq 0$)

$\therefore\ 2tan + 1 = 2\sec\ \theta$

$\therefore\ (2tan\ \theta + 1)^2 = 4\sec^2\ \theta$ ($\therefore$ Square both side)

$\therefore\ 4tan^2\theta + 4tan\ \theta + 1 = 4\ (1 + \tan^2\ \theta)$

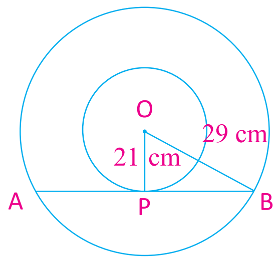
$\therefore\ 4tan^2\theta + 4tan\ \theta + 1 = 4 + 4tan^2\ \theta$

$\therefore\ 4tan\theta = 4 + 4tan^2\ \theta - 4tan^2\ \theta - 1$

$\therefore\ 4tan\theta = 3$

$\therefore\ tan\theta = \frac{3}{4}$

32.



Here we have,

r_1 = 29 cm

r_2 = 21 cm

Length of chord $= 2\sqrt{r_1^2 - r_2^2}$

$= 2\sqrt{29^2 - 21^2}$

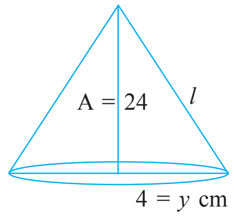
$= 2\sqrt{841 - 441}$

$= 2\sqrt{400}$

= 2(20)

= 40 cm

33.



Far one r = 7 cm, h = 24 cm

$r^2 = r^2 + h^2$

$= (7)^2 + (24)^2$

= 49 + 576

= 625

l = 25 cm

Now, the surface area of the cone $= \pi rl$

$= \frac{22}{7} \times 7 \times 25$

$= 550 \text{ cm}^2$

34. Here, maximum frequency is 7 which belongs to class 40 – 55. Hence, 40 – 55 is the modal class.

∴ l = lower limit of the modal class = 40

h = class size = 15

f_1 = frequency of the modal class = 7

f_0 = frequency of the class preceding the modal class = 3

f_2 = frequency of the class succeeding the modal class = 6

Mode Z $= 1 + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$

$= 40 + \left(\frac{7-3}{2(7)-3-6}\right) \times 15$

$= 40 + \frac{4 \times 15}{14-9}$

$= 40 + \frac{4 \times \cancel{15}^{3}}{\cancel{5}}$

= 40 + 12

∴ Z = 52

35. Here, mean $\bar{x} = 18$

class	f_i	x_i	u_i	f_iu_i
11 – 13	7	12	–2	–14
13 – 15	6	14	–1	–6
15 – 17	f	16 = a	0	0
17 – 19	13	18	1	13
19 – 21	20	20	2	40
21 – 23	5	22	3	15
23 – 25	4	24	4	16
Total	$\Sigma f_i = f + 55$		–	$\Sigma f_iu_i = -20 + 84 = 64$

$a = 16, \quad h = 2$

Mean $x = a + \dfrac{\Sigma f_iu_i}{\Sigma f_i} \times h$

$\therefore\ 18 = 16 + \dfrac{64}{f+55} \times 2$

$\therefore\ 18 - 16 = \dfrac{64 \times 2}{55}$

$\therefore\ 2 = \dfrac{64 \times 2}{f+55}$

$\therefore\ f + 55 = \dfrac{64 \times 2}{2}$

$\therefore\ f + 55 = 64$

$\therefore\ f = 64 - 55$

$\therefore\ f = 9$

$\therefore$ The missing frequency $f = 9$

36. Out of the two friends, one girl, say, Salma's birthday can be any day of the year. Now, Mona's birthday can also be any day of 365 days in the year.

We assume that these 365 outcomes are equally likely.

(i) If Mona's birthday is different from Salma's, the number of favourable outcomes for her birthday is 365 – 1 = 364

So, P (Mona's birthday is different from Salma's birthday) = $\dfrac{364}{365}$

(ii) P (Salma and Mona have the same birthday)

= 1 – P (both have different birthdays)

$= 1 - \dfrac{364}{365}$

$= \dfrac{1}{365}$

37. Two dice are thrown same time, then the result are following :

(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6)
(2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6)
(3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6)
(4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6)
(5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6)
(6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)

$\therefore$ Total number of outcomes = 36

(i) Suppose A be the event "the number of two dice are same"

There are 6 results (1, 1), (2, 2), (3, 3), (4, 4), (5, 5) and (6, 6) for the event

$\therefore$ The number of outcomes favourable to

A = 6

$\therefore$ P (A) = $\frac{6}{36} = \frac{1}{6}$

Section-C

38. Suppose $\alpha = 2 + \sqrt{3}$, $\beta = 2 - \sqrt{3}$

$\therefore$ $\alpha + \beta = 2 + \sqrt{3} + 2 \;\; \sqrt{3} = 4$

$\alpha \bullet \beta = (2 + \sqrt{3})(2 - \sqrt{3}) = 4 - 3 = 1$

$\therefore$ The requird quadratic polynomial

$= k\,[x^2 - (\alpha + \beta)\,x + \alpha\,\beta],\ k \neq 0,\ k \in R$

$= k\,[x^2 - 4x + 1]$

39. Here $6x^2 - 13x + 6 = 0$

$\therefore$ $6x^2 - 9x - 4x + 6 = 0$

$\therefore$ $3x\,(2x - 3) - 2\,(2x - 3) = 0$

$\therefore$ $(2x - 3)(3x - 2) = 0$

$\therefore$ $2x - 3 = 0$ OR $3x - 2 = 0$

$\therefore$ $2x = 3$ OR $3x = 2$

$\therefore$ $x = \frac{3}{2}$ OR $x = \frac{2}{3}$

Suppose $\alpha = \frac{3}{2}$, $\beta = \frac{2}{3}$

$a = 6,\ b = -13,\ c = 6$

Sum of zeros $(\alpha + \beta) = \frac{3}{2} + \frac{2}{3} = \frac{9+4}{6} = \frac{(-13)}{6} = \frac{-b}{a} = \frac{-\text{coefficient of } x}{\text{coefficient of } x^2}$

Product of zeros $(\alpha + \beta) = \left(\frac{3}{2}\right)\left(\frac{2}{3}\right) = \frac{6}{6} = \frac{c}{a} = \frac{\text{coefficient term}}{\text{coefficient of } x^2}$

40. Here for first AP, 65, 67, 69,...

$\therefore$ A = 65, D = 67 − 65 = 2

$\therefore$ $An = A + (n - 1)D$

$\therefore$ $An = 65 + (n - 1)(2)$

$\therefore$ $An = 65 + 2n - 2$

$\therefore$ $An = 63 + 2n$ ...(1)

for second AP, 10, 17, 24,...

a = 10, d = 17 − 10 = 7

$\therefore$ $an = a + (n - 1)d$

$\therefore$ $an = 10 + (n - 1)7$

$\therefore$ $an = 10 + 7n - 7$

$\therefore$ $an = 3 + 7n$ ...(2)

compare (1) & (2)

$An = an$

$63 + 2n = 3 + 7n$

$2n - 7n = 3 - 63$

$-5n = -60$

$5n = 60$

$n = \frac{60}{5}$

$n = 12$

So, n = 12 term will be equal in both APs.

41. Here $a = -2$, $d = -5 - (-2) = -5 + 2 = -3$, $a_n = -227$

we have, $a_n = a + (n - 1)\, d$

$\therefore\ -227 = -2 + (n - 1)(-3)$

$\therefore\ -227 + 2 = (n - 1)(-3)$

$\therefore\ -225 = (n - 1)(-3)$

$\therefore\ \frac{-225}{-3} = n - 1$

$\therefore\ n - 1 = 75$

$\therefore\ n = 75 + 1$

$n = 76$

Here, $a_n = l = -227$

$Sn = \frac{n}{2}(a + l)$

$\therefore\ S76 = \frac{76}{2}[-2 + (-227)]$

$\therefore\ S76 = 38(-229)$

$\therefore\ S76 = -8702$

42. Suppose, A (1, 2), B (4, y), C (x, 6) and D (3, 5) are the vertices of parallelogram ABCD.

Co-ordinates from the midpoint of the diagonal AC

= Co-ordinates from the midpoint the diagonal BD.

$\therefore\ \left(\frac{1+x}{2}, \frac{2+6}{2}\right) = \left(\frac{4+3}{2}, \frac{y+5}{2}\right)$

$\therefore\ \frac{1+x}{2} = \frac{4+3}{2} \quad , \quad \frac{2+6}{2} = \frac{y+5}{2}$

$\therefore\ 1 + x = 7 \quad , \quad 8 = y + 5$

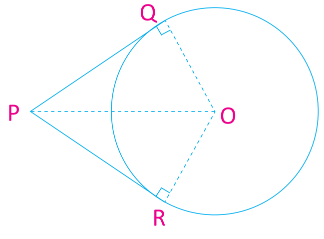
$\therefore\ x = 7 - 1 \quad , \quad y = 8 - 5$

$\therefore\ x = 6 \quad , \quad y = 3$

43. Given : A circle with centre O, a point P lying outside the circle with two tangents PQ, QR on the circle from P.

To prove : PQ = PR

Figure :



Proof : Join OP, OQ and OR. Then $\angle OQP$ and $\angle ORP$ are right angles because these are angles between the radii and tangents and according to theorem 10.1 they are right angles.

Now, in right triangles OQP and ORP,

OQ = OR (Radii of the same circle)

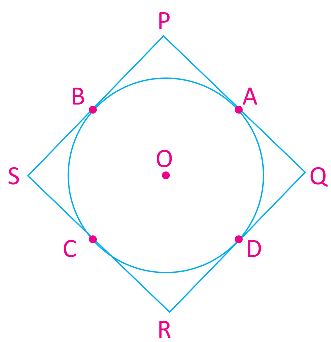
OP = OP (Common)

$\angle OQP = \angle ORP$ (Right angle)

Therefore, Δ OQP $\cong$ Δ ORP (RHS)

This gives, PQ = PR (CPCT)

44.



Here sides of given quadrilateral touch circle at points A, B, C, D with. $\overline{PQ}$, $\overline{PS}$, $\overline{SR}$ & $\overline{RQ}$ respectively.

$\therefore$ PA = PB ...(1)

QA = QD ...(2)

RC = RD ...(3)

SC = SB ...(4)

Add (1), (2), (3), (4) results,

PA + QA + RC + SC = PB + QD + RD + SB

$\therefore$ (PA + QA) + (RC + SC) = (QD + RD) + (PB + SB)

$\therefore$ PQ + RS = QR + PS

Hence proved.

45. $r = 14$ cm

Total angle = 360°

$\therefore$ Angle for 15 minute duration $= \dfrac{360 \times 3}{12}$

$= 90°$

$\therefore$ Area during 15 mins $= \dfrac{\pi r^2 \theta}{360}$

$= \dfrac{22 \times 14 \times 14 \times 90}{7 \times 360}$

$= \dfrac{2 \times 11 \times 7 \times 2 \times 14}{7 \times 4}$

$= 22 \times 7$

$= 154 \text{ cm}^2$

Remaining area to complete 1 circle

$= \pi r^2 -$ Area in 15 mins

$= \left(\frac{22}{7} \times 14 \times 14\right) - 154$

$= (22 \times 2 \times 14) - 154$

$= 616 - 154$

$= 462 \text{ cm}^2$

46. Total number of balls = 7 green + 5 yellow + 8 brown = 20

(i) Suppose A be the event "Selected ball is green"

Numbers of green balls = 7

$\therefore$ The number of outcomes favourable to A = 7

$\therefore P(A) = \frac{7}{20}$

(ii) Suppose B be the event "Selected ball is brown"

Numbers of brown balls = 8

$\therefore$ The number of outcomes favourable to B = 8

$\therefore P(B) = \frac{8}{20} = \frac{2}{5}$

(iii) Suppose C be the event "Selected ball is not a yellow"

Numbers of yellow balls = 5

$\therefore$ Number of without yellow balls = 20 – 5 = 15

$\therefore$ The number of outcomes favourable to C = 15

$\therefore P(C) = \frac{15}{20} = \frac{3}{4}$

Section-D

47. Suppose, the larger number is x and the smaller number is y.

The difference of two positive integers is 5.

$\therefore x - y = 5$ ....(1)

and the difference of their inverse is $\frac{1}{10}$

$\therefore \frac{1}{y} - \frac{1}{x} = \frac{1}{10}$ ....(2)

As per equation ....(1)

$y = x - 5$ ....(3)

put value of eqn. (3) in equ. (2)

$\therefore \frac{1}{x-5} - \frac{1}{x} = \frac{1}{10}$

$\therefore 10x - 10(x - 5) = x(x - 5)$

$\therefore 10x - 10x + 50 = x^2 - 5x$

$\therefore 50 = x^2 - 5x$

$\therefore x^2 - 5x - 50 = 0$

$\therefore x^2 - 10x + 5x - 50 = 0$

$\therefore x(x - 10) + 5(x - 10) = 0$

$\therefore (x - 10)(x + 5) = 0$

$\therefore x - 10 = 0$ OR $x + 5 = 0$

$\therefore x = 10$ OR $x = -5$

but x is a positive integes then negative is not possible.

$\therefore\ x \neq -5$

$\therefore\ x = 10$

Put $x = 10$ in equation (3)

$\therefore\ y = 10 - 5$

$\therefore\ y = 5$

Hence, required two numbers are 10 and 5.

48. (a) Let, $x + y = 4$ ...(1)

$2x = 8 + 3y$

$2x - 3y = 8$ ...(2)

From equation (1),

$x = 4 - y$ ...(3)

Put value of quation (3) in eq. (2)

$2(4 - y) - 3y = 8$

$\therefore\ 8 - 2y - 3y = 8$

$\therefore\ -5y = 8 - 8$

$\therefore\ -5y = 0$

$\therefore\ y = 0$

Put $y = 0$ in equation (3)

$x = 4 - 0$

$x = 4$

$x = 4,\ y = 0$

(b) The □ ABCD is cyelic quadriateral then the opoosite angle of them is complementary.

$\angle A + \angle C = 180°$

$2x - y + x - 2y = 180°$

$3x - 3y = 180°$

$x - y = 60°$ ...(1)

and $\angle B + \angle D = 180°$

$2y + x = 180°$ ...(2)

Do equ : (2) – (1)

$x + 2y = 180°$

$x - y = 60°$

$-\ +\quad -$

$3y = 120°$

$y = 40°$

From (1)

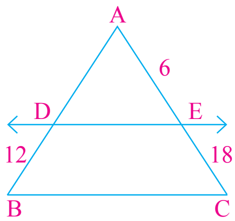
$x - 40° = 60°$

$x = 60° + 40°$

$x = 100°$

Hence $x = 100°$ and $y = 40°$

49.



(a) Here DE || BC in Δ ABC

$\therefore \frac{AD}{BD} = \frac{AE}{EC}$

$\therefore \frac{AD}{12} = \frac{6}{18}$

$\therefore AD = \frac{\cancel{6} \times \cancel{12}^{4}}{\cancel{18}_{3}}$

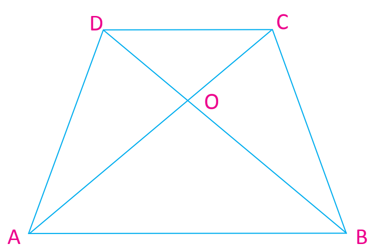
$\therefore$ AD = 4 cm

(b) Here $\frac{PE}{EQ} = \frac{4}{7}$ and $\frac{PF}{FR} = \frac{6}{10.5} = \frac{\cancel{6}^{2} \times \cancel{10}^{2}}{\cancel{105}_{\cancel{21}_{7}}} = \frac{4}{7}$

$\therefore \frac{PE}{EQ} = \frac{PF}{FR}$

$\therefore$ EF || QR ($\because$ According to Theorem 6.2)

50.



Here, ABCD is a trapezium where AB || DC.

$\therefore$ ∠CAB = ∠ACD and ∠DBA = ∠BDC ...(1)

Now, in Δ OAB and Δ OCD,

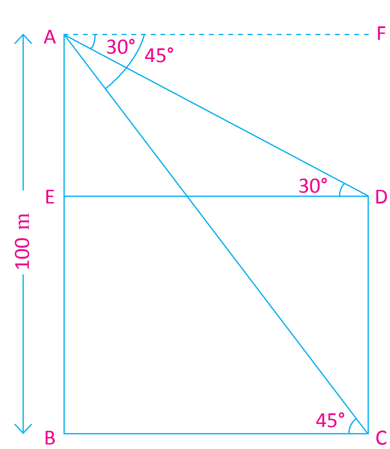
∠OAB = ∠OCD and ∠OBA = ∠ODC (As per (1))

$\therefore$ Δ OAB ~ Δ OCD (AA criterion)

$\therefore \frac{AO}{CO} = \frac{BO}{DO}$

$\therefore \frac{AO}{BO} = \frac{CO}{DO}$

51.



Here, AB = 100 m

$\angle$ FAD = $\angle$ ADE = 30°

$\angle$ FAC = $\angle$ ACB = 45°

In ΔABC,

$\therefore$ $\tan 45° = \frac{AB}{BC}$

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

$\therefore$ BC = 100 m.

In ΔAED,

$\therefore$ $\tan 30° = \frac{AE}{ED}$

$\therefore$ $\frac{1}{\sqrt{3}} = \frac{AE}{BC}$ ($\because$ ED = BC)

$\therefore$ $\frac{1}{\sqrt{3}} = \frac{AE}{100}$

$\therefore$ $AE = \frac{100}{\sqrt{3}}$

$\therefore$ AE = 0.58 × 100

$\therefore$ AE = 58 m

Here, as per figure, A – E – B

AE + EB= AB

$\therefore$ 58 + CD = 100 ($\because$ EB = CD)

$\therefore$ CD = 100 – 58

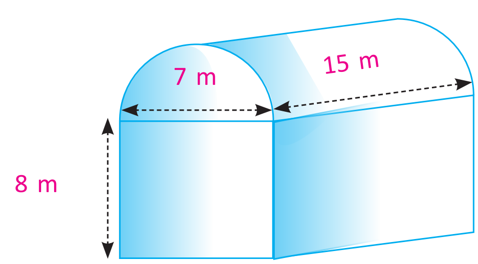
$\therefore$ CD = 42 m

Height of tower is 42 m

Distance between cliff & tower is 100 m.

52.

Cuboid	Half Cylinder
l = 7 m	h_1 = Breadth of cuboid = 15 m
b = 15 m	d = Length of cuboid = 7 m
h = 8 m	$\therefore r_1 = \frac{7}{2}$ m



The required volume

$= \text{Volume of cuboid} + \frac{1}{2}\text{ Volume of cylinder}$

$= lbh + \frac{1}{2}\pi r_1^2 h_1$

$= (7 \times 15 \times 8) + \left(\frac{1}{2} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 15\right)$

$= 840 + \frac{1155}{4}$

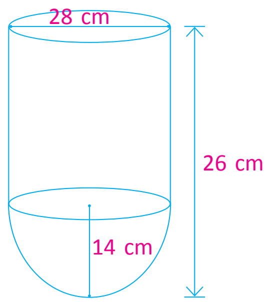
$= 840 + 288.75$

$= 1128.75 \text{ m}^3$

Now, the total space occupied by the machinery = 300 m^3 and the total space occupied by the workers = 20 × 0.08 = 1.6 m^3

Therefore, the volume of the air, when there are machinery and workers = 1128.75 – 300 – 1.6 = 827.15 m^3

53.



d = 28 cm

$\therefore\ r = \frac{28}{2} = 14$ cm

h = total height – r

$\therefore\ h = 26 - 14$

$\therefore\ h = 12$ cm

Inner surface area of vessel

= curved surface of cylinder + curved surface of hemisphere

$= 2\pi rh + 2\pi r^2$

$= 2\pi r\,(h + r)$

$= 2 \times \frac{22}{7} \times 14 \times (12 + 14)$

$= 44 \times 2(26)$

$= 2288\ \text{cm}^2$

Inner surface area of vessel is 2288 cm^2.

54.

Class	Frequency	Cumulative frequency
20 – 30	15	15
30 – 40	16	15 + 16 = 31
40 – 50	38	31 + 38 = 69
50 – 60	15	69 + 15 = 84
60 – 70	9	84 + 9 = 93
70 – 80	7	93 + 7 = 100
	n = 100	

Here, $n = 100$ $\frac{n}{2} = \frac{100}{2} = 50$

50 lies with cf value 69

$\therefore$ class = 40 – 50, $l = 40$, $cf = 31$,

$h = 10$, $f = 38$

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

$$= 40 + \left[\frac{50 - 31}{38}\right] \times 10$$

$$= 40 + \left[\frac{19 \times 10}{19 \times 2}\right] \times 10$$

$$= 40 + 5$$

$$M = 45$$

Median of given data is 45 years.