

Class-X

Mathematics Standard (041)

SEC-A

1. (c) infinite ✓
2. (d) $a_k = 6$ ✓
3. ~~(a) 7~~ (b) 3 ✓
4. (d) 10 ✓
5. (a) $x^2 - 4x + 1 = 0$ ✓
6. (a) $-\frac{17}{7}$ ✓
7. (d) 3 units ✓
8. (c) 6.5 cm ✓

9. (c) 8000 m^3

10. (b) 21

11. (a) 3 cm

12. (a) $\sin 60^\circ$

13. (b) $\angle B = \angle D$

14. (c) -32

15. (c) $\frac{3}{4}$

16. (a) 30°

17. (b) $\frac{7}{0.01}$

18. (a) decreases by 2 ✓

19. (c) Assertion (A) is ~~true~~, but Reason (R) is false.

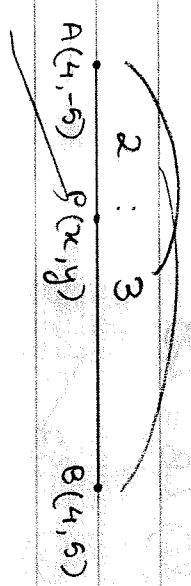
20. (c) Assertion (A) is ~~true~~, but Reason (R) is false,
[only 1 prime factor = 5] $\therefore$ prime factorisation of a prime number is the number itself

SEC-B

21. A(4, -5) and B(4, 5)

(a) Let the coordinates of point P which divides AB such that

AP : AB = 2 : 5 ~~Let P(x, y).~~



$$\frac{AP}{AB} = \frac{2}{5}$$

$$\frac{AP + PB}{AP} = \frac{5}{2}$$

$$\Rightarrow 2PB = 3AP \Rightarrow AP : PB = 2 : 3$$

P divides AB internally in the ratio of 2:3

By section formula,

$$P(x, y) = P\left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}\right)$$

$$\Rightarrow P(x, y) = P\left(\frac{2 \times 4 + 3 \times 4}{2+3}, \frac{2 \times 5 + 3 \times (-5)}{2+3}\right)$$

$$\Rightarrow P(x, y) = P\left(\frac{20}{5}, \frac{-5}{5}\right) = P(4, -1)$$

$\therefore$ Coordinates of P are $\boxed{P(4, -1)}$

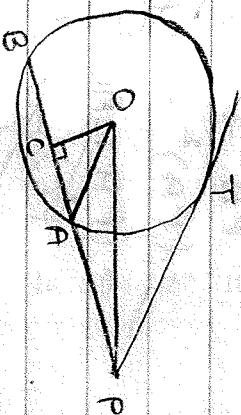
22.

Given: Circle with centre O

PT is a tangent

$OC \perp AB$

To Prove: $PA \cdot PB = PC^2 - AC^2$



Proof:

Perpendicular from centre to chord bisects it

$\Rightarrow C$ is midpoint of AB

($\because \angle OCA = 90^\circ$, given)

$$\Rightarrow BC = CA = \frac{AB}{2}$$

$$\Rightarrow AB = 2AC$$

By Pythagoras Theorem,

$$\text{In right } \triangle OCA, \quad OA^2 = OC^2 + AC^2$$

$$\text{In right } \triangle OCB, \quad OB^2 = OC^2 + BC^2$$

$$\text{LHS} = PA \cdot PB$$

$$= PA \times (PA + AB)$$

$$= PA^2 + PA \cdot AB$$

$$= PA^2 + PA \cdot 2AC$$

$$= (PA)^2 + 2(PA)(AC)$$

$$= (PA + AC)^2 - AC^2$$

$$= PC^2 - AC^2 = \text{RHS}$$

Hence, proved

(from ①)

$$[(a + b)^2 = a^2 + 2ab + b^2]$$

23.

First number = 96

Second number = 120

$$96 = 2^5 \times 3$$

$$120 = 2^3 \times 3 \times 5$$

$$\text{HCF}(96, 120) = 2^3 \times 3$$

$$= 8 \times 3$$

$$= 24$$

2	96	2	120
2	48	2	60
2	24	2	30
2	12	3	15
2	6		5
	3		

$$\text{LCM}(96, 120) = 2^5 \times 3 \times 5$$

$$= 32 \times 3 \times 5$$

$$= 480$$

$$\therefore \text{HCF}(96, 120) = \boxed{24} \text{ and } \text{LCM}(96, 120) = \boxed{480}$$

P.T.O.

24.

Points are $A(5, -6)$ and $B(-1, -4)$

Let the point where y-axis ($x=0$) intersects AB be $P(0, y)$



Let the ratio in which $P(0, y)$ divides AB be $k:1$

By section formula,

$$P(x, y) = \left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n} \right)$$

$$\Rightarrow P(0, y) = \left(\frac{-k+5}{k+1}, \frac{-4k+(-6)}{k+1} \right)$$

$$\Rightarrow 0 = \frac{-k+5}{k+1} \quad \text{and} \quad y = \frac{-4k-6}{k+1}$$

$$\Rightarrow 0 = -k+5$$

$$\Rightarrow k = 5$$

$$\Rightarrow k:1 = 5:1$$

$\therefore$ Ratio is $5:1$

25
(a)

$$a \cos \theta + b \sin \theta = m$$

$$a \sin \theta + b \cos \theta = n$$

To prove: $a^2 + b^2 = m^2 + n^2$

$$a \cos \theta + b \sin \theta = m$$

Squaring both sides,

$$a^2 \cos^2 \theta + b^2 \sin^2 \theta + 2ab \sin \theta \cos \theta = m^2 \quad \left[\frac{(a+b)^2}{a^2 + b^2 + 2ab} \right]$$

$$a \sin \theta + b \cos \theta = n$$

Squaring both sides,

$$a^2 \sin^2 \theta + b^2 \cos^2 \theta + 2ab \sin \theta \cos \theta = n^2 \quad \left[\frac{(a-b)^2}{a^2 + b^2 - 2ab} \right]$$

Adding ① and ②,

$$(a^2 \cos^2 \theta + a^2 \sin^2 \theta) + (b^2 \sin^2 \theta + b^2 \cos^2 \theta) + 2ab \sin \theta \cos \theta$$

$$= m^2 + n^2$$

$$\Rightarrow a^2 (\sin^2 \theta + \cos^2 \theta) + b^2 (\sin^2 \theta + \cos^2 \theta) = m^2 + n^2$$

$$\therefore \sin^2 \theta + \cos^2 \theta = 1$$

$$\Rightarrow a^2 + b^2 = m^2 + n^2$$

$$\text{LHS} = \text{RHS}$$

Hence, proved

SEC-C

26.
(a)

Let us assume, to the contrary, that $\sqrt{3}$ is rational.

$$\Rightarrow \sqrt{3} = \frac{p}{q} \quad \text{where } q \neq 0, p \text{ and } q \text{ are coprime positive integers}$$

Squaring both sides,

$$\Rightarrow 3 = \frac{p^2}{q^2}$$

$$\Rightarrow p^2 = 3q^2$$

$$\Rightarrow 3 \text{ divides } p^2$$

$$\Rightarrow 3 \text{ divides } p$$

($\because 3$ is prime)

$$\text{So, let } p = 3m$$

Substituting in

$$(3m)^2 = 3q^2$$

$$\Rightarrow 9m^2 = 3q^2$$

$$\Rightarrow q^2 = 3m^2$$

$$\Rightarrow 3 \text{ divides } q^2$$

$$\Rightarrow 3 \text{ divides } q$$

From (3) and (4),

3 divides both p and q

But p and q are coprime, i.e. $\text{HCF}(p, q) = 1$ (Using (1))

which is a contradiction

$\therefore$ our supposition is wrong
 $\therefore \sqrt{3}$ must be irrational.

Hence, proved

27

Let the first term of AP be a
and common difference be d

AP: $a, a+d, a+2d, \dots$

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

$$a_p = a + (p-1)d = q$$

$$\Rightarrow a + pd - d = q$$

$$a_q = a + (q-1)d = p$$

$$\Rightarrow a + qd - d = p$$

Subtracting ① from ②,

$$\begin{aligned} a + qd &= p \\ a + pd - d &= q \\ \hline (q-p)d &= p-q \\ \Rightarrow d &= -1 \end{aligned}$$

Substituting in ①,

$$\begin{aligned} a + p(-1) - (-1) &= q \\ \Rightarrow a + 1 &= p + q \end{aligned}$$

$$\begin{aligned} a_n &= a + (n-1)d \\ &= a + (n-1)(-1) \\ &= a - n + 1 \\ &= (a+1) - n \\ &= p + q - n \end{aligned}$$

$$\text{LHS} = \text{RHS}$$

(Substituting from ③)

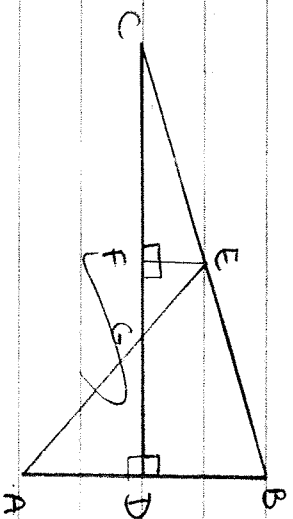
Hence, proved

28
(a)

Given: CD is $\perp$ bisector of AB

EF $\perp$ CD

AE intersects CD at G



To Prove: $\frac{CF}{CD} = \frac{FG}{DG}$

Proof

In $\triangle EFG$ and $\triangle ADG$,

$$\angle EFG = \angle ADG = 90^\circ$$

(given, linear pair with $\angle EFC$ and $\angle BDC$)

$$\angle EGF = \angle AGD$$

(vertically opposite angles)

$$\therefore \triangle EFG \sim \triangle ADG$$

(by AA similarity criterion)

$$\Rightarrow \frac{EF}{AD} = \frac{FG}{DG}$$

(cpst)

$$\frac{EF}{BD} = \frac{FG}{DG}$$

In $\triangle ECF$ and $\triangle BCD$,

$$\angle EFC = \angle BDC = 90^\circ$$

(given)

$$\angle ECF = \angle BCD$$

(common angle)

$$\therefore \triangle ECF \sim \triangle BCD$$

(by AA similarity criterion)

$$\Rightarrow \frac{EF}{BD} = \frac{CF}{CD}$$

(cpst)

But $AD = BD$ ($\because$ CD bisects AB)

$$\Rightarrow \frac{EF}{AD} = \frac{EF}{BD} = \frac{CF}{CD}$$

From ① and ②,

$$\frac{EF}{AD} = \frac{CF}{CD} = \frac{EF}{CD} = \frac{CF}{DG}$$

$$\therefore \frac{EF}{CD} = \frac{CF}{DG}$$

Hence, proved

29.

Let the speed of person 1 be x km/h
and speed of person 2 be y km/h ($x > y$)

$$\text{distance} = \text{speed} \times \text{time}$$

$$\text{Given distance} = 16 \text{ km}$$

Case 1: Towards each other

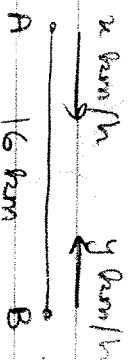
$$\text{Time} = 2h$$

$$\text{Speed} = (x+y) \text{ km/h}$$

$$\text{Distance} = 2(x+y) \text{ km}$$

$$\Rightarrow 16 = 2x + 2y$$

$$\Rightarrow x + y = 8$$



Case 2: Same direction

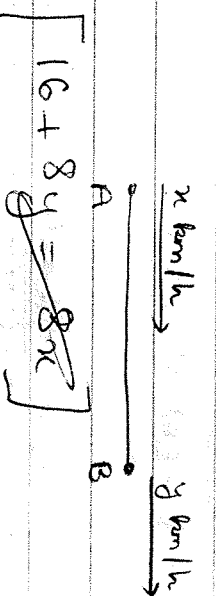
$$\text{Time} = 8h$$

$$\text{Speed} = (x-y) \text{ km/h}$$

$$\text{Distance (only AB)} = 8(x-y)$$

$$\Rightarrow 16 = 8x - 8y$$

$$\Rightarrow x - y = 2$$



Adding ① and ②,

$$x + y = 8$$

$$\oplus x - y = 2$$

$$\hline 2x = 10$$

$$\Rightarrow x = 5$$

Substituting in ①

$$y = 3 \text{ km}$$

$$\therefore \begin{array}{l} \text{Speed of person 1} = 5 \text{ km/h} \\ \text{Speed of person 2} = 3 \text{ km/h} \end{array}$$

$$30. \frac{\tan \theta}{1 - \cot \theta} + \frac{\cot \theta}{1 - \tan \theta} = 1 + \sec \theta \csc \theta$$

$$\begin{aligned} \text{LHS} &= \frac{\tan \theta}{1 - \cancel{\cot \theta}} + \frac{\cot \theta}{1 - \cancel{\tan \theta}} \\ &= \frac{\tan \theta}{1 - \frac{1}{\tan \theta}} + \frac{1}{1 - \tan \theta} \\ &= \frac{\tan^2 \theta}{\tan \theta - 1} + \frac{1}{\tan \theta (1 - \tan \theta)} \end{aligned}$$

$$= \frac{\tan^2 \theta - 1}{\tan \theta - 1}$$

$$= \frac{\tan^3 \theta - 1}{\tan \theta - 1}$$

$$= \frac{(\tan \theta - 1) \tan \theta}{\tan \theta - 1}$$

$$= \frac{(\tan \theta - 1) (\tan^2 \theta + 1 + \tan \theta)}{\tan \theta - 1} \quad \left[(a-b)(a^2+ab+b^2) = a^3-b^3 \right]$$

$$= \frac{1 + \tan^2 \theta + \tan \theta}{\tan \theta}$$

$$= \frac{\tan \theta + \sec^2 \theta}{\tan \theta}$$

$$= \frac{\tan \theta + \sec^2 \theta}{\tan \theta}$$

$$= \frac{1 + \frac{1}{\cos^2 \theta} \times \cos \theta}{\tan \theta}$$

$$= \frac{1 + \frac{1}{\cos \theta}}{\tan \theta} \quad \left(\sec \theta = \frac{1}{\cos \theta} \right)$$

$$= \frac{1 + \sec \theta}{\tan \theta}$$

$$= \text{RHS}$$

Hence, proved

31

Classes	Frequency (f_i)	Midpoints (x_i)	$u_i = \frac{x_i - A}{h}$	$f_i u_i$
25 - 30	14	27.5	-3	-42
30 - 35	22	32.5	-2	-44
35 - 40	16	37.5	-1	-16
40 - 45	6	A (42.5)	0	0
45 - 50	5	47.5	1	5
50 - 55	3	52.5	2	6
55 - 60	4	57.5	3	12
$\Sigma f_i = 70$				$\Sigma f_i u_i = -79$

$$\text{Mean} = \bar{x} = A + h \frac{\Sigma f_i u_i}{\Sigma f_i}$$

$$= 42.5 + \frac{5 \times (-79)}{70}$$

$$= 42.5 - 39.5$$

$$= 42.5 - 5.642$$

$$= 36.858 \approx 36.86$$

$$\therefore \text{Mean} = 36.86 \text{ (approx.)}$$

SEC-D

32. Introduction

2 cases are formed

A = hot-air balloon

C = first observer

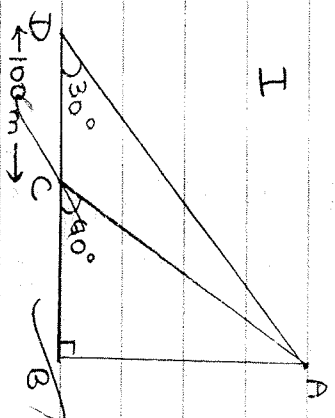
D = second observer

Angle of elevation of A from C = $\angle ACB = 60^\circ$

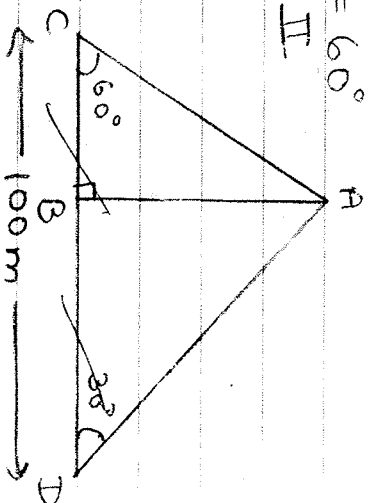
Angle of elevation of A from D = $\angle ADB = 30^\circ$

CD = 100 m

I



II



(a). Let height of basket = $AB = h$ m

Case I : In $\triangle ABC$, In $\triangle ABD$,

$$\tan 60^\circ = \frac{AB}{BC} \quad \tan 30^\circ = \frac{AB}{BD}$$

$$\Rightarrow \sqrt{3} = \frac{h}{BC} \quad \Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{BC + 100}$$

$$\Rightarrow BC = \frac{h}{\sqrt{3}} \quad \Rightarrow BC + 100 = h\sqrt{3}$$

$$BC + 100 = \frac{h\sqrt{3}}{\sqrt{3}}$$

$$\Rightarrow \frac{h}{\sqrt{3}} + 100 = h\sqrt{3}$$

$$\Rightarrow 100 = h\sqrt{3} - \frac{h\sqrt{3}}{3}$$

$$\Rightarrow \frac{2h\sqrt{3}}{3} = 100$$

$$\Rightarrow h = \frac{150}{\sqrt{3}} = 50\sqrt{3} \text{ m}$$

$$\therefore \text{Height of basket} = \boxed{50\sqrt{3} \text{ m}}$$

Case 2 : In $\triangle ABC$,

$$\tan 60^\circ = \frac{AB}{BC}$$

In $\triangle ABD$,

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

$$\Rightarrow \sqrt{3} = \frac{h}{BC}$$

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

$$\Rightarrow BC = \frac{h}{\sqrt{3}}$$

$$\Rightarrow BD = h\sqrt{3}$$

$$BC + BD = 100 \text{ m}$$

$$\Rightarrow \frac{h}{\sqrt{3}} + h\sqrt{3} = 100$$

$$\Rightarrow \frac{4h\sqrt{3}}{3} = 100$$

$$\Rightarrow h = 25\sqrt{3}$$

$$\therefore \text{Height of basket} = \boxed{25\sqrt{3} \text{ m}}$$

(b) Case 1: Dist of A from C = AC

In $\triangle ABC$,

$$\sin 60^\circ = \frac{AB}{AC}$$

$$\Rightarrow \frac{\sqrt{3}}{2} = \frac{50\sqrt{3}}{AC}$$

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

$$\therefore \text{Distance of basket from first observer} = \boxed{100 \text{ m}}$$

Case 2: Dist. of A from C = AC

In $\triangle ABC$,

$$\sin 60^\circ = \frac{AB}{AC}$$

$$\Rightarrow \frac{\sqrt{3}}{2} = \frac{25\sqrt{3}}{AC}$$

$$\Rightarrow AC = 50 \text{ m}$$

$\therefore$ Distance of observer from first observer = $\boxed{50 \text{ m}}$

(c) Case 1: To find - BD

$$BD = BC + CD$$

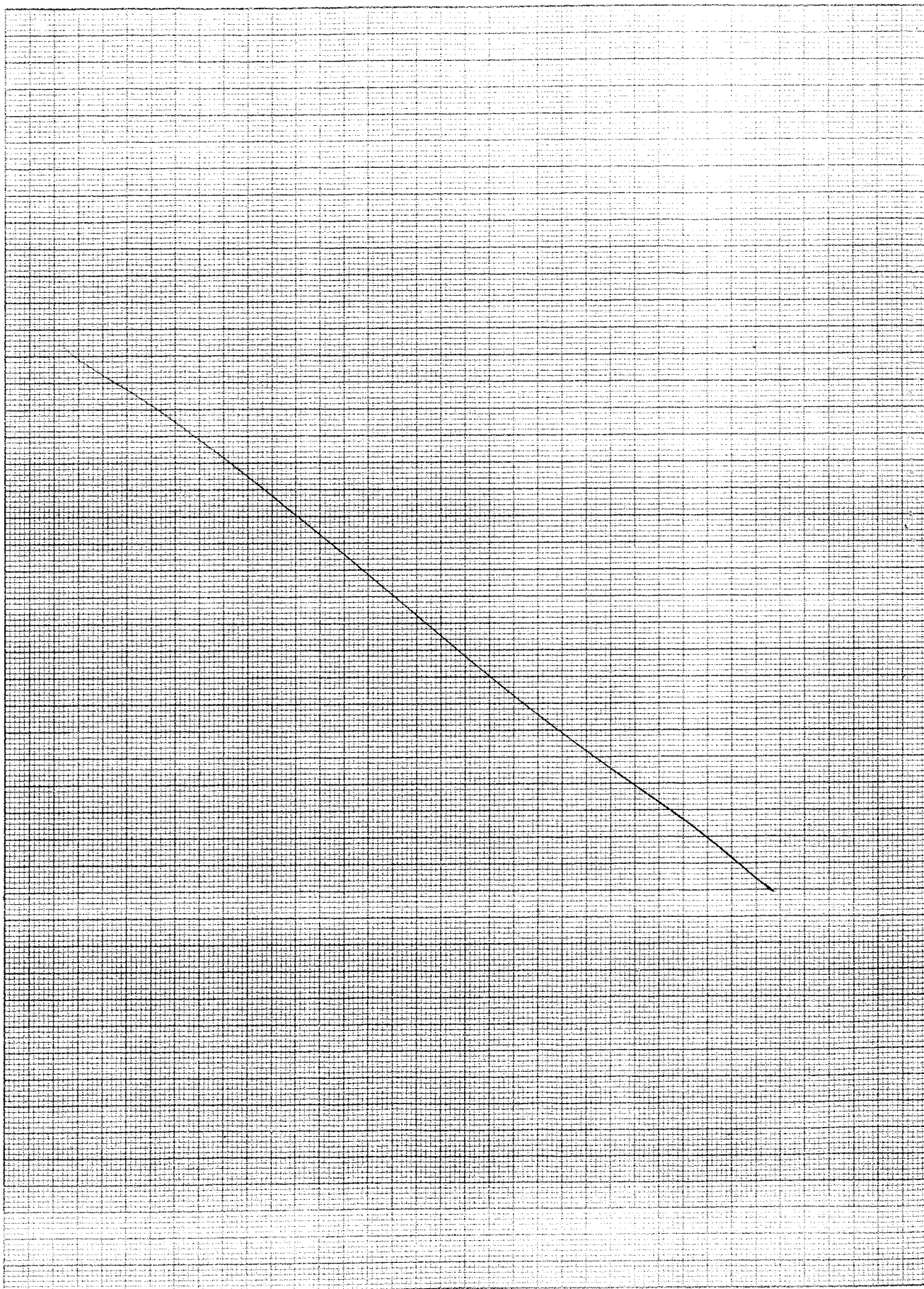
$$= \frac{h}{\sqrt{3}} + 100$$

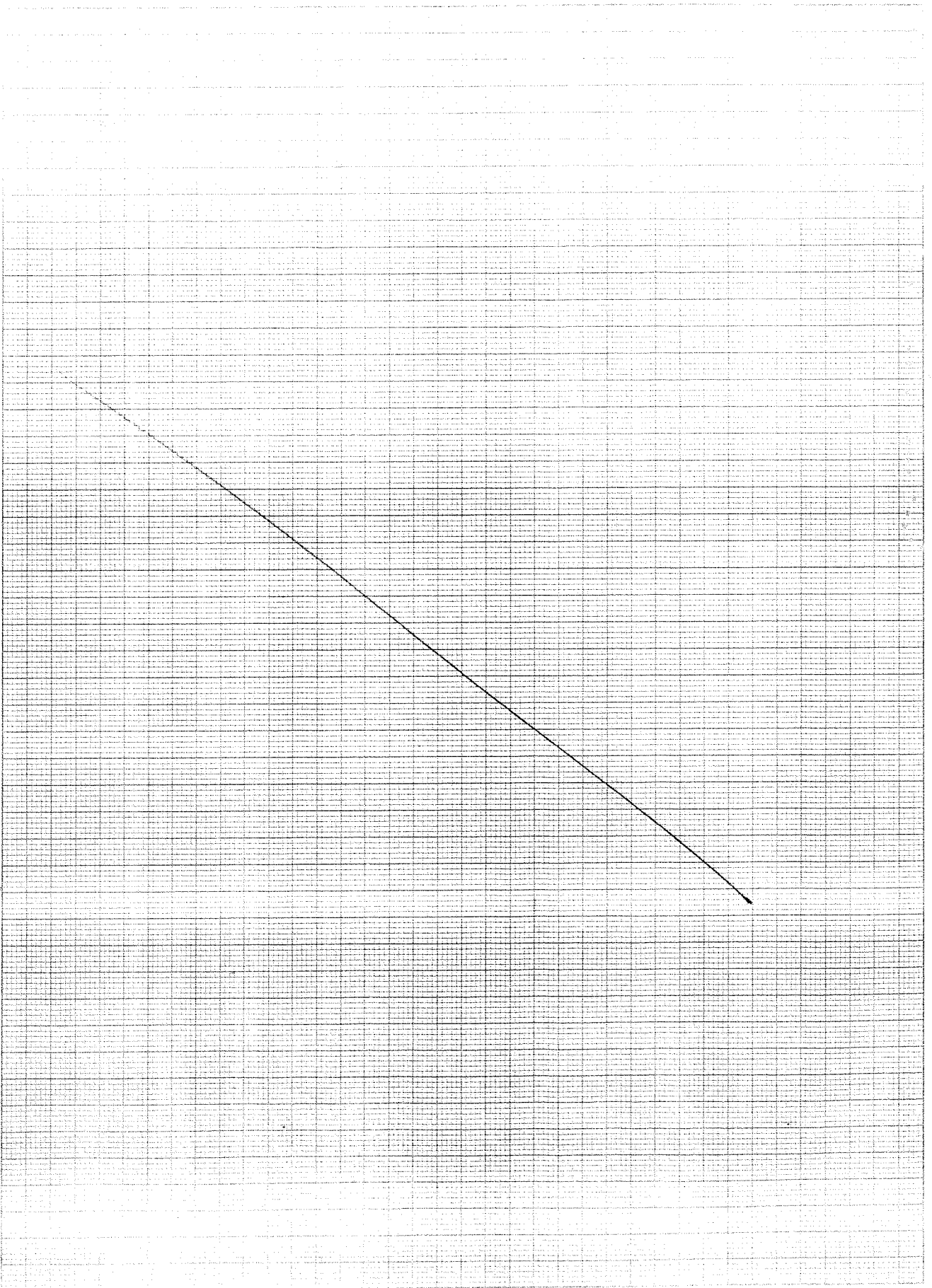
(from ①)

$$= \frac{50\sqrt{3}}{\sqrt{3}} + 100$$

$$= 50 + 100 = 150$$

$\therefore$ Horizontal distance BD = $\boxed{150 \text{ m}}$





Case 2 : To find - BD

$$\begin{aligned} BD &= h\sqrt{3} \\ &= 25\sqrt{3} \times \sqrt{3} \\ &= 75 \end{aligned}$$

(Given ②)

∴ Horizontal distance BD = $\boxed{75 \text{ m}}$

33.
(a.)

Given : $\triangle ABC$

Incircle with radius $r = 4 \text{ cm}$

$$BD = 10 \text{ cm}$$

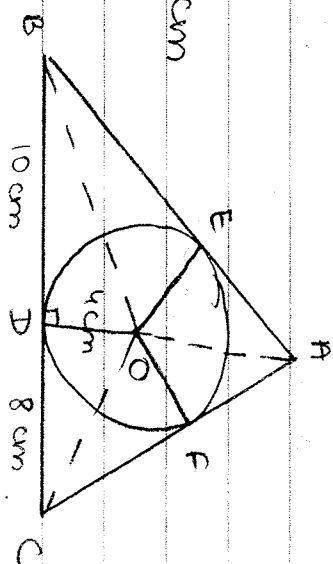
$$CD = 8 \text{ cm}$$

$$\text{ar}(\triangle ABC) = 90 \text{ cm}^2$$

To find : Lengths of AB and AC.

Construction : Join OE, OF, OA, OB, OC

$$OD = OE = OF = r = 4 \text{ cm} \quad (\text{radius})$$



Tangents from same external point are equal in length.

From pt. A, $AE = AF = x$ (let it be)

From pt. B, $BE = BD = 10 \text{ cm}$

From pt. C, $CD = CF = 8 \text{ cm}$

$$\text{Area of } \Delta = \frac{1}{2} \times b \times h$$

Area of $\Delta ABC = \text{Area of } \Delta OAB + \text{Area of } \Delta OBC$
+ Area of ΔOCA

$$\Rightarrow 90 = \frac{1}{2} \times OE \times AB + \frac{1}{2} \times OD \times BC + \frac{1}{2} \times OF \times AC$$

$$\Rightarrow 90 = \frac{1}{2} \times x \times (AE + BE) + \frac{1}{2} \times x \times (BD + CD) \\ + \frac{1}{2} \times x \times (CF + AF)$$

$$\Rightarrow 90 = \frac{1}{2} \times x \times (x + 10) + \frac{1}{2} \times x \times (10 + 8) + \frac{1}{2} \times x \times (8 + x)$$

$$\Rightarrow 90 = \frac{1 \times 4}{2} (x + 10 + 10 + 8 + 8 + x)$$

$$\Rightarrow 45 = 2x + 36$$

$$\Rightarrow 2x = 9$$

$$\Rightarrow x = 4.5$$

$$AB = AE + BE = 4.5 + 10 = 14.5 \text{ cm}$$

$$AC = AF + CF = 4.5 + 8 = 12.5 \text{ cm}$$

$$\therefore AB = 14.5 \text{ cm}$$

$$AC = 12.5 \text{ cm}$$

34. Let the original average speed be x km/h.

$$\text{Original : distance} = 54 \text{ km}$$

$$\text{speed} = x \text{ km/h}$$

$$\text{time} = \frac{\text{distance}}{\text{speed}} = \frac{54}{x} \text{ h}$$

Given: distance = 63 km

$$\text{speed} = (x+6) \text{ km/h}$$

$$\text{time} = \frac{\text{distance}}{\text{speed}} = \frac{63}{x+6} \text{ h}$$

$$\frac{54}{x} + \frac{63}{x+6} = 3$$

$$\Rightarrow 3 \left(\frac{18}{x} + \frac{21}{x+6} \right) = 3$$

$$\Rightarrow \frac{18x + 108 + 21x}{x^2 + 6x} = 1$$

$$\Rightarrow 39x + 108 = x^2 + 6x$$

$$\Rightarrow x^2 - 33x - 108 = 0$$

$$\Rightarrow x^2 - 36x + 3x - 108 = 0$$

$$\Rightarrow x(x-36) + 3(x-36) = 0$$

$$\Rightarrow (x-36)(x+3) = 0$$

$$\Rightarrow x = 36 \text{ or } x = -3$$

∴ speed cannot be negative,
 $n = -3$ will be neglected.
 $\Rightarrow n = 36$

∴ Average speed of train (original) = $\boxed{36 \text{ km/h}}$

35

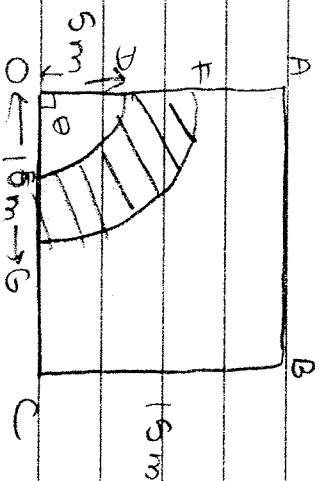
Square field OABC

Side = 8 = 15 m

Quadrant

$\angle DOE = \theta = 90^\circ$

(all angles of square = 90°)
 Radius = length of rope
 $= r = 5 \text{ m}$



Area grazed by horse = Area of sector DOE.

$$= \frac{\theta}{360} \times \pi \times r^2$$

$$= \frac{96}{360} \times \frac{314}{100} \times 5 \times 5$$

$$= \frac{96}{360} \times \frac{314}{100} \times 25$$

$$157$$

$$25$$

$$785$$

$$314 \times$$

$$3925 \times 3$$

$$2 \quad 7775$$

$$= 1962.5$$

Now, new radius = new length of rope = $R = 10\text{m}$

Increase in grazing area = Area of sector for -

Area of sector DOE

$$= \frac{\theta}{360} \times \pi \times R^2 - \frac{\theta}{360} \times \pi \times r^2$$

$$360^\circ$$

$$360^\circ$$

$$= \frac{90}{360} \times \frac{314}{100} \times (10^2 - 5^2)$$

$$360$$

$$100$$

$$= \frac{90}{360} \times \frac{314}{100} \times 15 \times 5$$

$$360$$

$$100$$

$$\left[\frac{a^2 - r^2}{(a+r)(a-r)} \right]$$

$$= 1177.5$$

$$200$$

$$= \boxed{5.8875 \text{ m}^2}$$

$$\therefore \text{Original area grazed} = \boxed{1.9625 \text{ m}^2}$$

$$\text{Increase in area} = \boxed{5.8875 \text{ m}^2}$$

SEC-E

36. Golf ball = Sphere

$$\text{Radius} = R = \frac{4.2}{2} = 2.1 \text{ cm}$$

Dimple = Hemisphere

$$\text{Radius} = r = 2 \text{ mm} = 0.2 \text{ cm}$$

(i) SA of 1 dimple = CSA of hemisphere

$$= 2\pi r^2$$

$$= 2 \times \frac{22}{7} \times 2 \times 2$$

$$= \frac{176 \text{ cm}^2}{700}$$

$$= \boxed{0.2514 \text{ cm}^2}$$

(iv) Vol to make = Vol. of hemisphere
1 sample = $\frac{2\pi r^3}{3}$

$$= \frac{2 \times 22 \times 2 \times 2 \times 2}{3 \times 7 \times 10 \times 10 \times 10}$$

$$= \frac{352}{21000}$$

$$= \boxed{0.01676 \text{ cm}^3}$$

$$\begin{array}{r} 21000 \overline{) 3520} \\ \underline{21000} \\ 14200 \\ \underline{10500} \\ 3700 \\ \underline{2100} \\ 1600 \\ \underline{1050} \\ 550 \\ \underline{3520} \end{array}$$

$$\begin{array}{r} 21000 \overline{) 3520} \\ \underline{21000} \\ 14200 \\ \underline{10500} \\ 3700 \\ \underline{2100} \\ 1600 \\ \underline{1050} \\ 550 \\ \underline{3520} \end{array}$$

(iii) Vol of golf = Vol of sphere - Vol of 315 hemispheres
(iv)
$$= \frac{4\pi R^3}{3} - 2\pi r^3 \times 315$$

$$= \frac{4 \times 22 \times 22 \times 21 \times 21}{3 \times 7 \times 10 \times 10 \times 10} - \frac{2 \times 22 \times 2 \times 2 \times 2 \times 315}{3 \times 7 \times 10 \times 10 \times 10}$$

$$= 38.808 - 5.28$$

$$= \cancel{33.588} - \cancel{33.588} \boxed{33.528 \text{ cm}^3}$$

37 (i)

Spinner I - Spinner II

- | | | |
|------------------------|---|-------|
| Red (R) - Red (R) | { | R_R |
| Red (R) - Blue (B) | | R_B |
| Red (R) - Green (G) | | R_G |
| Green (G) - Red (R) | | G_R |
| Green (G) - Blue (B) | | G_B |
| Green (G) - Green (G) | | G_G |
| Blue (B) - Red (R) | | B_R |
| Blue (B) - Blue (B) | | B_B |
| Blue (B) - Green (G) | | B_G |
| Yellow (Y) - Red (R) | | Y_R |
| Yellow (Y) - Blue (B) | | Y_B |
| Yellow (Y) - Green (G) | | Y_G |

Total no. of outcomes = $\boxed{9}$

$$(ii) X = \{RB\}$$

Favourable outcomes = 1

$$P(\text{making profit}) = \frac{\text{No. of favourable outcomes}}{\text{Total no. of outcomes}} = \boxed{\frac{1}{9}}$$

(iii) (a) No. of participants = 99

Winning

$$\text{No.} = \frac{1}{9} \times 99 = 11$$

Amount = ₹(-10) (school has to pay)

$$\text{Value} = ₹(-110)$$

[loss]

Loss

$$\text{No.} = 99 - 11 = 88$$

Amount = ₹5 (pay to school)

$$\text{Value} = ₹440$$

[gain]

$$\text{Net} = +440 - 110$$

$$= +330$$

∴ 80, the school most likely collected Rs. 330

38.

(1)

$$p(t) = 20t - 16t^2$$

$$20t - 16t^2 = 0$$

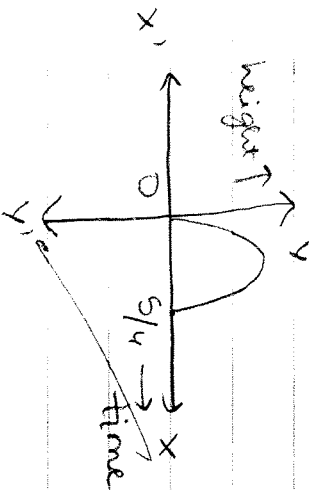
$$-4t(4t - 5) = 0$$

$$t = 0 \text{ or } t = \frac{5}{4}$$

$\therefore$ Zeros of $p(t) = 20t - 16t^2$ are

$$\boxed{0 \text{ and } \frac{5}{4}}$$

(ii) (a)



$\rightarrow$ opens downwards ($a < 0$)
 $\rightarrow$ intersects x -axis at $(0,0)$ and $(\frac{5}{4}, 0)$

(iii)

Water level is hit when $h = 0$

(b)

$$h = 20t - 16t^2$$

$$\Rightarrow 0 = -4t(4t - 5)$$

$$\Rightarrow t = 0 \text{ or } t = \frac{5}{4}$$

∵ Delphin has started at $t = 0$
→ at $t = \frac{5}{4}$ s, delphin reaches water level again.

$$\begin{aligned}\text{distance covered} &= \text{speed} \times \text{time} \\ &= 20 \text{ cm/s} \times \frac{5}{4} \text{ s} \\ &= \boxed{25 \text{ cm}}\end{aligned}$$

END ∴