

## WITH GRAPH PAPER

केन्द्रीय माध्यमिक शिक्षा बोर्ड, दिल्ली  
 सैकण्डरी स्कूल परीक्षा (कक्षा दसवीं)  
 परीक्षार्थी प्रवेश-पत्र के अनुसार भरें

विषय Subject : MATHEMATICS

विषय कोड Subject Code : 041

परीक्षा का दिन एवं तिथि

Day &amp; Date of the Examination : MONDAY, 03/04/2017

उत्तर देने का माध्यम

Medium of answering the paper : ENGLISH

प्रश्न पत्र के ऊपर लिखे

कोड को दर्शाएँ

Write code No. as written on  
the top of the question paper :Code Number  
3013Set Number  
(1) (2) (3)

आतंरिक उत्तर-पुस्तिका (ओ) की संख्या

No. of supplementary answer -book(s) used



विकलाग व्यक्ति

हैं / नहीं

Person with Disabilities :

Yes / No

NO

किसी शारीरिक अक्षमता से प्रभावित हो तो संबंधित वर्ग में  का निङाजन करें।

If physically challenged, tick the category

 B     D     H     S     C     A

B = दृष्टिहीन, D = मूँह व बठिप, H = शारीरिक रूप से विकलाग, S = रसायनिक

C = डिस्लेक्सिक, A = ऑटिस्टिक

B = Visually Impaired, D = Hearing Impaired, H = Physically Challenged

S = Spastic, C = Dyslexic, A = Autistic

क्या लेखन -- लिपिक उपलब्ध करवाया गया : हैं / नहीं

Whether writer provided : Yes / No

NO

यदि दृष्टिहीन हैं तो उपयोग में लाए गये

सोफ्टवेर का नाम :

If Visually challenged, name of software used :



\*एक खाने में एक अक्षर लिखें। नाम के प्रथम भाग के बीच एक खाना रिक्त छोड़ दें। यदि परीक्षार्थी का नाम 24 अक्षरों से अधिक है, तो केवल नाम के प्रथम 24 अक्षर ही लिखें।

Each letter be written in one box and one box be left blank between each part of the name. In case Candidate's Name exceeds 24 letters, write first 24 letters.

कार्यालय उपयोग के लिए  
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### Section A

1. A = getting a rotten apple.

$$n(s) = 900 \quad - \text{total apples}$$

$$P(A) = 0.18$$

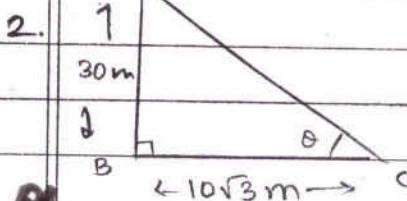
Let  $n(A)$  be number of rotten apples.

Then,  $P(A) = \frac{n(A)}{n(s)} = \frac{n(A)}{900}$

$$0.18 \times 900 = n(A)$$

$$\therefore n(A) = 162$$

So, there are 162 rotten apples in the heap.



Tower AB is 30m and shadow BC is  $10\sqrt{3}$ m.

In  $\triangle ABC$  which is right triangle,

$$\tan \theta = \frac{AB}{BC} = \frac{30}{10\sqrt{3}}$$

$$\tan \theta = \sqrt{3}$$

$$\text{but } \tan 60^\circ = \sqrt{3}. \quad \therefore \theta = 60^\circ.$$

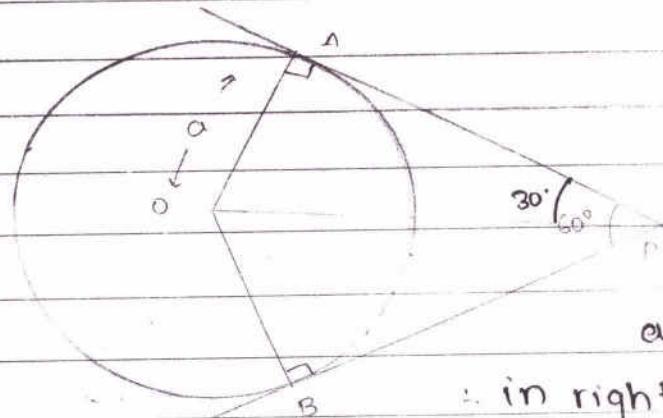
so, angle of elevation of sun is  $60^\circ$ .

$$\begin{array}{r} 18 \\ \times 79 \\ \hline 162 \end{array}$$

$$\begin{array}{r} 162 \\ \times 900 \\ \hline 145800 \end{array}$$

$$\begin{array}{r} 30 \\ \times \sqrt{3} \\ \hline 10\sqrt{3} \end{array}$$

3.



Tangents are equally inclined to line joining the external point P to centre O.

$$\therefore \angle APO = \angle BPO = \frac{60}{2} = 30^\circ$$

also radius & tangent at point of contact.

in right  $\triangle OAP$ ,  $\angle APO = 30^\circ$ .

$$\text{Now } \sin 30^\circ = \frac{AP}{OP} = \frac{AO}{OP}$$

$$\rightarrow \frac{1}{2} = \frac{a}{OP} \quad \dots \text{radius} = a.$$

$$OP = 2a$$

4. Let  $a$  be 1<sup>st</sup> term and  $d$  be the common difference.

$$a_{21} - a_7 = 84$$

$$a + (21-1)d - [a + (7-1)d] = 84$$

$$a + 20d - a - 6d = 84$$

$$14d = 84$$

$$d = 6$$

$\therefore$  common difference is 6.

### Section D

21. The points A, B and C are collinear.

$$\therefore A(\Delta ABC) = 0.$$

Using area formula,

$$x_1 = k+1, \quad x_2 = 3k, \quad x_3 = 5k-1$$

$$y_1 = 2k, \quad y_2 = 2k+3, \quad y_3 = 5k.$$

Using area formula,

$$x_1(y_2-y_3) + x_2(y_3-y_1) + x_3(y_1-y_2) = 0.$$

$$(k+1)(2k+3-5k) + 3k(5k-2k) + (5k-1)(2k-2k-3) = 0$$

$$(k+1)(3-3k) + 3k(3k) + (5k-1)(-3) = 0.$$

$$3(1+k)(1-k) + 3(k)(3k) - 3(5k-1) = 0.$$

$$3[1-k^2 + 3k^2 - 5k+1] = 0$$

$$2k^2 - 5k + 2$$

$$2k^2 - 4k - k + 2$$

$$2k(k-2) - 1(k-2)$$

$$= 0$$

$$= 0$$

$$= 0$$

$$(2k-1)(k-2) = 0.$$

$$\therefore (k-2) = 0 \quad \text{or} \quad (2k-1) = 0$$

$$\therefore k = 2 \quad \text{or} \quad \frac{1}{2}$$

22. In  $\triangle ABC$ ,

$$\angle A + \angle B + \angle C = 180^\circ \quad - \text{angle sum property.}$$

$$105^\circ + 45^\circ + \angle C = 180^\circ$$

$$\therefore \angle C = 30^\circ$$

Steps of construction:

1) Draw  $BC = 7\text{cm}$   ~~$\angle CBY = 45^\circ$  and  $\angle BCZ = 30^\circ$ .~~

Let rays  $BY$  and  $CZ$  intersect at  $A$ .  $\triangle ABC$  is given.

2) From  $B$  draw a ray  $BX$  below  $BC$  making acute angle with  $BC$ . Along it mark 4 points  $B_1, B_2, B_3, B_4$  such that  $BB_1 = B_1B_2 = \dots = B_3B_4$ .

3) Join  $B_4C$ . Make  $\angle BB_4C$  at  $B_3$  such that

the ray intersects  $BC$  at  $C'$ .  $\therefore \angle BB_4C = \angle BB_3C'$ .

so,  $B_4C \parallel B_3C'$ .

4) From  $C'$  make  $\angle BC'A' = \angle C$  so that  $C'A' \parallel CA$ .

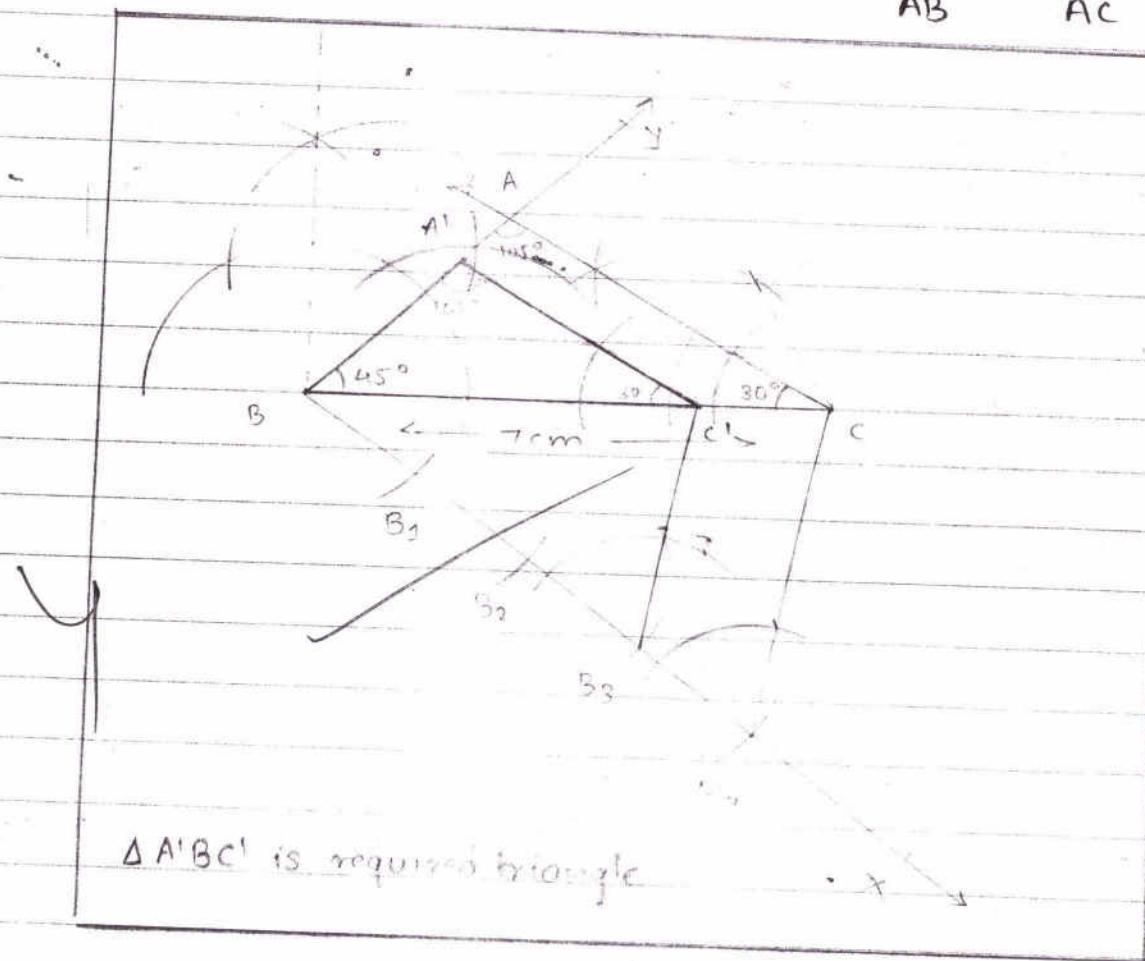
$\triangle A'B'C'$  is the required triangle

$$\begin{array}{r} 105 \\ 45 \\ \hline 150 \end{array}$$

$$\begin{array}{r} 105 \\ 45 \\ \hline 130 \\ 80 \end{array}$$

Justification:

$\angle B = \angle B$ , and  $\angle B'C'A' = \angle BCA$  - construction  
 $\therefore \triangle A'B'C' \sim \triangle ABC$  by  $\text{ss AA}$  so,  $\frac{A'B}{AB} = \frac{A'C'}{AC} = \frac{B'C'}{BC} = \frac{3}{4}$



23.

i)  $A = \text{sum of digits is even.}$

$$n(S) = 6^2 = 36. \quad - \text{total possible outcomes.}$$

$$n(A) = \{(1,3), (1,5), (1,1), (2,2), (2,4), (2,6), (3,1), (3,3), (3,5), \\ (4,2), (4,4), (4,6), (5,1), (5,3), (5,5), (6,2), (6,4), (6,6)\} \\ = 18.$$

$$P(A) = \frac{n(A)}{n(S)} = \frac{18}{36} \\ = \frac{1}{2} \text{ or } 0.5$$

$\therefore$  probability of getting an even sum is  $\frac{1}{2}$  or 0.5.

ii)  $A = \text{product of digits is even}$

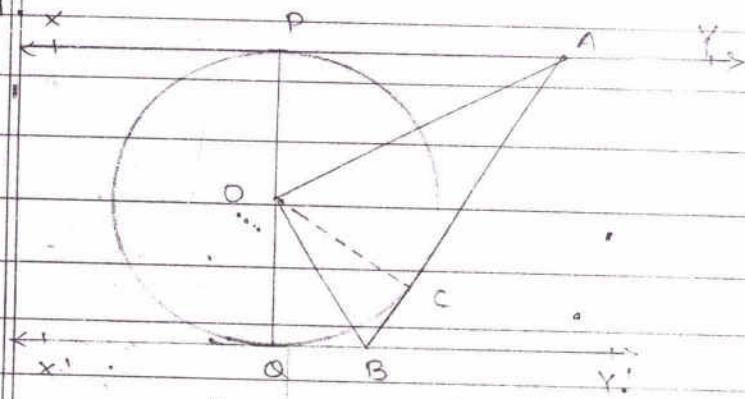
$$n(S) = 36.$$

$$n(A) = \{(1,2), (1,4), (1,6), (2,1), (2,2), (2,3), (2,4), (2,5), (2,6), \\ (3,2), (3,4), (3,6), (4,1), (4,2), (4,3), (4,4), (4,5), (4,6), \\ (5,2), (5,4), (5,6), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6)\} \\ = 27$$

$$\begin{aligned} P(A) &= \frac{n(A)}{n(S)} = \frac{27}{36} \\ &= \frac{3}{4} = 0.75 \end{aligned}$$

∴ probability of getting even product is  $\frac{3}{4}$  or 0.75.

24.



Given: XY || X'Y' - tangents.

POQ is diameter, OC is radius.

Tangent ACB touches XY at A and X'Y' at B.

To prove:  $\angle AOB = 90^\circ$ .

PROOF: XY || X'Y' and AB is transversal.

$\therefore \angle XAB + \angle ABX' = 180^\circ$  - co-interior angles  
or  $\angle PAB = \angle QAB$  — ①

It is known that tangents from a same point are equally inclined to the line joining centre to that point..

$\Rightarrow \angle PAO = \angle CAO$  and  $\angle QBO = \angle CBO$

In ①,

$$\cancel{2\angle CAO + 2\angle CBO = 180^\circ}$$

$$\text{or } \cancel{2\angle BAO + 2\angle ABO = 180^\circ}$$

$$\angle BAO + \angle ABO = 90^\circ \quad \text{--- ②}$$

In  $\triangle AOB$ ,

$$\cancel{\angle BAO + \angle ABO + \angle AOB = 180^\circ} \quad \text{--- angle sum.}$$

$$\text{from ②, } 90^\circ + \angle AOB = 180^\circ$$

$$\therefore \angle AOB = 90^\circ$$

Hence, proved.

25. radius of cylindrical tank  $= \frac{2}{2} = 1\text{ m.}$

its height  $= 3.5\text{ m.} = \frac{35}{10}\text{ m}$

Let the height of water on roof be  $h$ .

Volume of water on roof  $=$  Volume of water in tank.

$$lbh = \pi r^2 h'$$

$$22 \times 20 \times h = \frac{22}{7} \times \frac{35}{10} \times \frac{20}{10} \times 1 \times 1$$

$$h = \frac{22}{2} \times \frac{1}{22} \times \frac{1}{20} \times \frac{1}{40} \text{ m}$$

$$\frac{22}{7} \times 20 \times h^2$$

$$\frac{22}{7} \times \frac{35}{10} \times \frac{20}{10}$$

$$h = \frac{22}{2} \times \frac{1}{22} \times \frac{1}{20}$$

$$= \frac{1}{40}$$

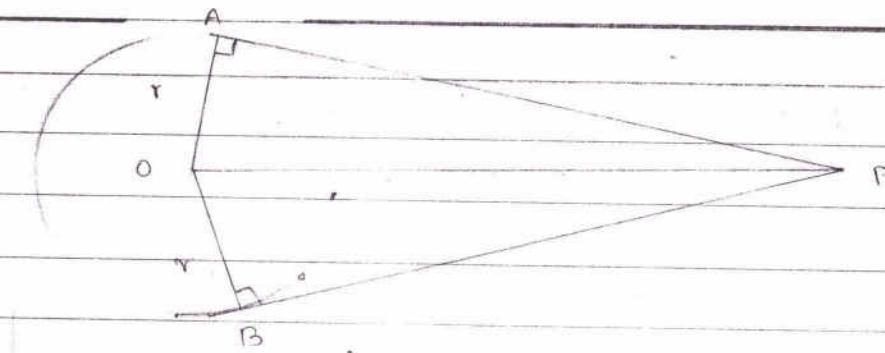
$$\therefore h = \frac{1}{40} \text{ m} = \frac{1}{40} \times 100 \text{ cm}$$

$$= 2.5 \text{ cm}$$

So, the rainfall is 2.5 cm

Views on water conservation:

- a) It is important practice in today's era of irrational water consumption and pollution. It should be practised at municipal level & all places.
- b) It can be done by many simple ways even at domestic level.
- c) Doing it is a sign of environmental consciousness.
- d) Some methods of water conservation are rooftop / surface water harvesting, building small earthen dams, etc.
- e) This conserved water helps refill underground water bodies and so, we must practise water conservation for sustainable development.



Given: Circle  $\text{C}(O, r)$

2 tangents from P at A and B

To prove:  $AP = BP$

Construction: Join  $OA, OB$  and  $OP$

Proof :

In  $\triangle APO$  and  $\triangle BPO$ ,

$OA = OB$  — radii of same circle.

$OP = OP$  — common side.

$\angle OAP = \angle OBP = 90^\circ$  — Radius is  $\perp$  tangent at point of contact

by RHS criterion,

$\triangle APO \cong \triangle BPO$ .

and hence,  $AP = BP$  — by cpct

$\therefore$  lengths of 2 tangents drawn from an external point to a circle are equal.

27. Let  $a, d$  and  $A, D$  be the 1<sup>st</sup> term and common difference of the 2 APs respectively.

Then,

$$\frac{n}{2} [2a + (n-1)d] = \frac{7n+1}{4n+27}$$

$$\frac{m}{2} [2A + (n-1)D]$$

$$\frac{2a + (n-1)d}{2A + (n-1)D} = \frac{7n+1}{4n+27}$$

~~Replacing  $n$  by 17 in both LHS and RHS,~~

$$\frac{2a + (17-1)d}{2A + (17-1)D} = \frac{7(17) + 1}{4(17) + 27}$$

$$\frac{2a+16d}{2A+16D} = \frac{119+1}{68+27}$$

$$\frac{2(a+8d)}{2(A+8D)} = \frac{120}{95}$$

$$a_1 + (n-1)d = a_n$$

$$\frac{a_9}{A_9} = \frac{24}{19}$$

∴ ratio of 9th terms is 24:19

$$7(2m-1)+1$$

$$\begin{array}{r} 14m - 7 + 1 \\ 14m - 6 \end{array}$$

• 120

$$\begin{array}{r} 14 \\ \times 13 \\ \hline 14 \\ 14 \hline 182 \end{array}$$

17

$$\begin{array}{r} 17 \\ \times 5 \\ \hline 85 \end{array}$$

19

100

$$4(2m-1)+27$$

8m-4+27

Sm + 23

$$\begin{array}{r} 72 \\ \times 23 \\ \hline 95 \end{array}$$

28. Let  $\frac{x-1}{2x+1}$  be  $y$ ,

$$y + \frac{1}{y} = 2$$

$$y^2 + 1 = 2y$$

~~$$y^2 - 2y + 1 = 0$$~~

~~$$y^2 - y - y + 1 = 0$$~~

~~$$y(y-1) - 1(y-1) = 0$$~~

~~$$(y-1)(y-1) = 0$$~~

$$\therefore y = 1 \text{ or } 1.$$

$$y$$

Now,  $\frac{x-1}{2x+1} = 1 \quad \text{or} \quad \frac{x-1}{2x+1} = 1$

$$x-1 = 2x+1$$

$$-2 = x$$

$$\therefore x = -2 \text{ or } -2$$

$$\boxed{\therefore x = -2}$$

29. Let B complete a work in  $x$  days.

Then A takes  $x-6$  days to complete it.

Together they complete it in 4 days.

According to work done per day,

$$\frac{1}{x-6} + \frac{1}{x} = \frac{1}{4}$$

$$\frac{x+x-6}{x(x-6)} = \frac{1}{4}$$

$$4(2x-6) = x(x-6)$$

$$8x-24 = x^2-6x$$

$$\therefore x^2-14x+24=0$$

$$x^2-12x-2x+24=0$$

$$x(x-12)-2(x-12)=0$$

$$(x-2)(x-12)=0$$

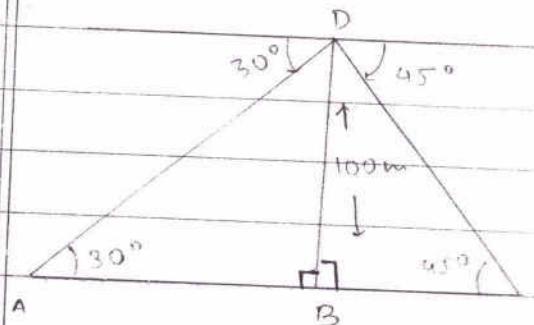
$$\therefore x=2 \text{ or } 12.$$

$x=2$  is not possible because then  $x-6$  is  $\infty$

$$\therefore x=12.$$

So, B takes 12 days to finish the work.

30.

In right  $\triangle ABD$ ,

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

$$\frac{1}{\sqrt{3}} = \frac{100}{AB}$$

$$AB = 100\sqrt{3} \quad \checkmark$$

$= 100 \times 1.732$   
 $= 173.2 \text{ m}$

In right  $\triangle DBC$ ,

$$\tan 45^\circ = \frac{DB}{BC}$$

$$1 = \frac{100}{BC} \Rightarrow BC = 100 \text{ m.}$$

$$\text{Now, } AC = AB + BC = 100 + 173.2 \text{ m} = 273.2 \text{ m}$$

or  $100(\sqrt{3} + 1) \text{ m}$

To find : AC

Solution:

In  $\triangle ABD$ ,  $\angle DAB = 30^\circ$ In  $\triangle BDC$ ,  $\angle BCD = 45^\circ$ .  
also,  $BD = 100 \text{ m.}$ 

$$\begin{array}{r} 625 \\ \times 33 \\ \hline 1875 \\ 18750 \\ \hline 20625 \end{array}$$

$$\begin{array}{r} 11 \\ \frac{3}{4} \times 22 \times 625 - 100 \times 27 \\ \hline 27 \end{array}$$

$$\begin{array}{r} 5156.25 \\ 20625 \\ \hline 3118125 \\ - 27 \\ \hline 42 \end{array}$$

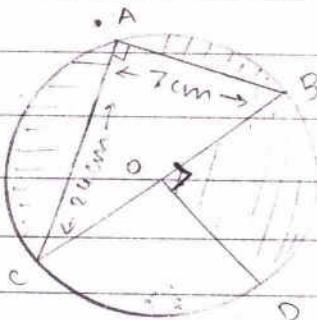
$$\begin{array}{r} 2578.125 \\ 5156.25 \\ \hline 2578.125 \\ - 2578.125 \\ \hline 0 \end{array}$$

$$\begin{array}{r} 368.3035 \\ 2578.125 \\ \hline 42000 \\ - 42000 \\ \hline 0 \end{array}$$

$$\begin{array}{r} 368.3035 \\ 42000 \\ \hline 326.3035 \\ - 326.3035 \\ \hline 0 \end{array}$$

$$\begin{array}{r} 6 \\ \times 27 \\ \hline 18 \\ 18 \\ \hline 0 \end{array}$$

31.



$\angle CAB = 90^\circ$  = angle subtended by diameter.

in right  $\triangle CAB$ ,

by pythagoras theorem,

$$AC^2 + AB^2 = BC^2$$

$$24^2 + 7^2 = BC^2$$

$$576 + 49 = BC^2$$

$$625 = BC^2 \approx \dots \quad \text{---(ignoring -ve value)}$$

$\therefore BC = 25 \text{ cm.}$  = diameter.

$\therefore$  radius =  $12.5 \text{ cm}$  or  $\frac{25}{2} \text{ cm.}$

area of shaded region = area of semicircle + area of quadrant - area of  $\triangle ACB$

$$= \frac{2 \times 1}{2} \times \pi r^2 + \frac{1}{4} \times \pi r^2 - \frac{1}{2} \times AB \times AC$$

$$= \frac{3}{4} \pi r^2 - \frac{1}{2} \times 7 \times 24$$

$$= \frac{3}{4} \times \frac{22}{7} \times \frac{625}{4} - 7 \times 12$$

$$= 368.3035 - 84$$

$$= 284.3035$$

$$\approx 284.3 \text{ cm}^2$$

$\therefore$  The area of shaded region is

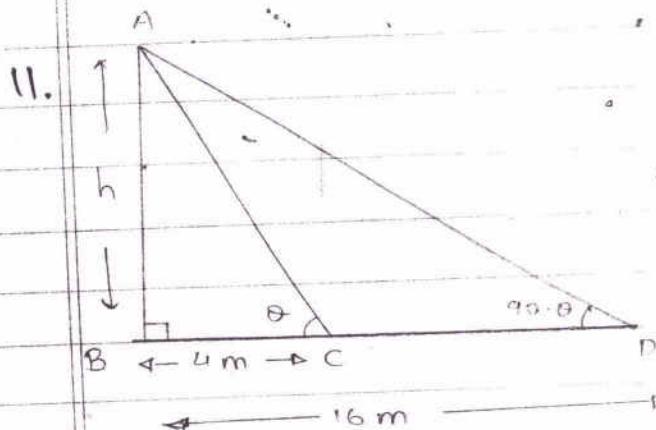
$$\underline{284.3035 \text{ cm}^2}$$

$$\begin{array}{r}
 625 \\
 \times 11 \\
 \hline
 625 \\
 625 \\
 \hline
 6875 \\
 \times 22 \\
 \hline
 20625
 \end{array}$$

$$\begin{array}{r}
 2578.125 \\
 -20625 \\
 \hline
 515 \\
 -466 \\
 \hline
 89
 \end{array}$$

$$\begin{array}{r}
 368.3035 \\
 -2578.125 \\
 \hline
 110
 \end{array}$$

$$\begin{array}{r}
 16 \\
 848.3035 \\
 -84.0000 \\
 \hline
 284.3035
 \end{array}$$



### Section C

It is given that  $\angle ACB$  and  $\angle ADB$  are complementary.

Let them be  $\theta$  and  $90 - \theta$  respectively.

Now,

In right  $\triangle ABC$ ,

$$\tan \theta = \frac{AB}{BC} = \frac{h}{4}$$

$$\tan \theta = \frac{h}{4} \quad \text{--- (1)}$$

In right  $\triangle ABD$ ,

$$\tan(90 - \theta) = \frac{AB}{BD} = \frac{h}{16}$$

$$\cot \theta = \frac{h}{16}$$

$$\tan \theta = \frac{16}{h}$$

$$\tan(90 - \theta) = \cot \theta$$

$$\therefore \cot \theta = \frac{1}{\tan \theta}$$

From ① and ②,

$$\tan \theta = \frac{h}{4} = \frac{16}{h}$$

$$h^2 = 4 \times 16$$

$$h = \sqrt{4 \times 16}$$

$$\therefore h = 2 \times 4$$

$$h = 8 \text{ m} \quad (\text{ignoring -ve value}).$$

$\therefore$  height of tower is 8 m.

12. Let there be  $x$  black balls and 15 white balls.

$$\text{Total balls} = n(S) = 15 + x$$

$$P(\text{drawing black ball}) = 3 \times P(\text{drawing white ball}).$$

$$\Rightarrow \frac{x}{(15+x)} = \frac{3}{4}$$

$$\begin{aligned} &= 3 \times \frac{15}{(15+x)} \\ &= \frac{3 \times 15}{(15+x)} \\ &= 45 \end{aligned}$$

$\therefore$  There are 45 black balls in the bag.

13.

Area of shaded region = Area of semicircle with  $r = 4.5\text{ cm}$

~~se~~ + Area of semicircle with  $d = 3\text{ cm}$

- 2 × area of semicircle with  $d = 3\text{ cm}$

- area of circle with  $d = 4.5\text{ cm}$ .

$$= \frac{1}{2} \times \pi \times (4.5)^2 + \left( \frac{1}{2} \times \pi \times \left(\frac{3}{2}\right)^2 \right) - 2 \times \left( \frac{1}{2} \times \pi \times \left(\frac{3}{2}\right)^2 \right) - \frac{2}{2} \pi \left(\frac{4.5}{2}\right)^2$$

~~$\frac{1}{2} \times \pi \times (4.5)^2$~~

$$= 2 \times \frac{1}{4} \times \pi \times \frac{20.25}{2} - \frac{\pi}{2} \times \frac{9}{4} - \pi \times \frac{20.25}{4}$$

$$= \frac{\pi}{4} \left[ \frac{20.25}{2} - \frac{9}{2} - 20.25 \right]$$

$$= \frac{\pi}{4} [40.5 - 4.5 - 20.25]$$

$$= \frac{\pi}{4} [20.25 - 4.5]$$

$$= \frac{\pi}{4} (15.75)$$

40.5  
- 20.25  
---  
19.75  
- 4.5  
---  
15.75

$$= \frac{22}{7} \times \frac{2.25}{42}$$

$$= \frac{211 \times 2.25}{2}$$

$$= \frac{24.75}{2}$$

$$= 12.375 \text{ cm}^2$$

$\therefore$  area of shaded region is 12.375 cm<sup>2</sup>

~~$$\begin{array}{r} 225 \\ 225 \\ \hline 2475 \end{array}$$~~

~~$$\begin{array}{r} 725 \\ 725 \\ \hline 1250 \end{array}$$~~

14.

$$\begin{matrix} m & R & n \\ \hline P(2, -2) & (\frac{24}{11}, y) & Q(3, 7) \end{matrix}$$

Using section formula,

$$\left(\frac{24}{11}, y\right) = \left(\frac{3m + 2n}{m+n}, \frac{7m - 2n}{m+n}\right) \quad \text{--- (1)}$$

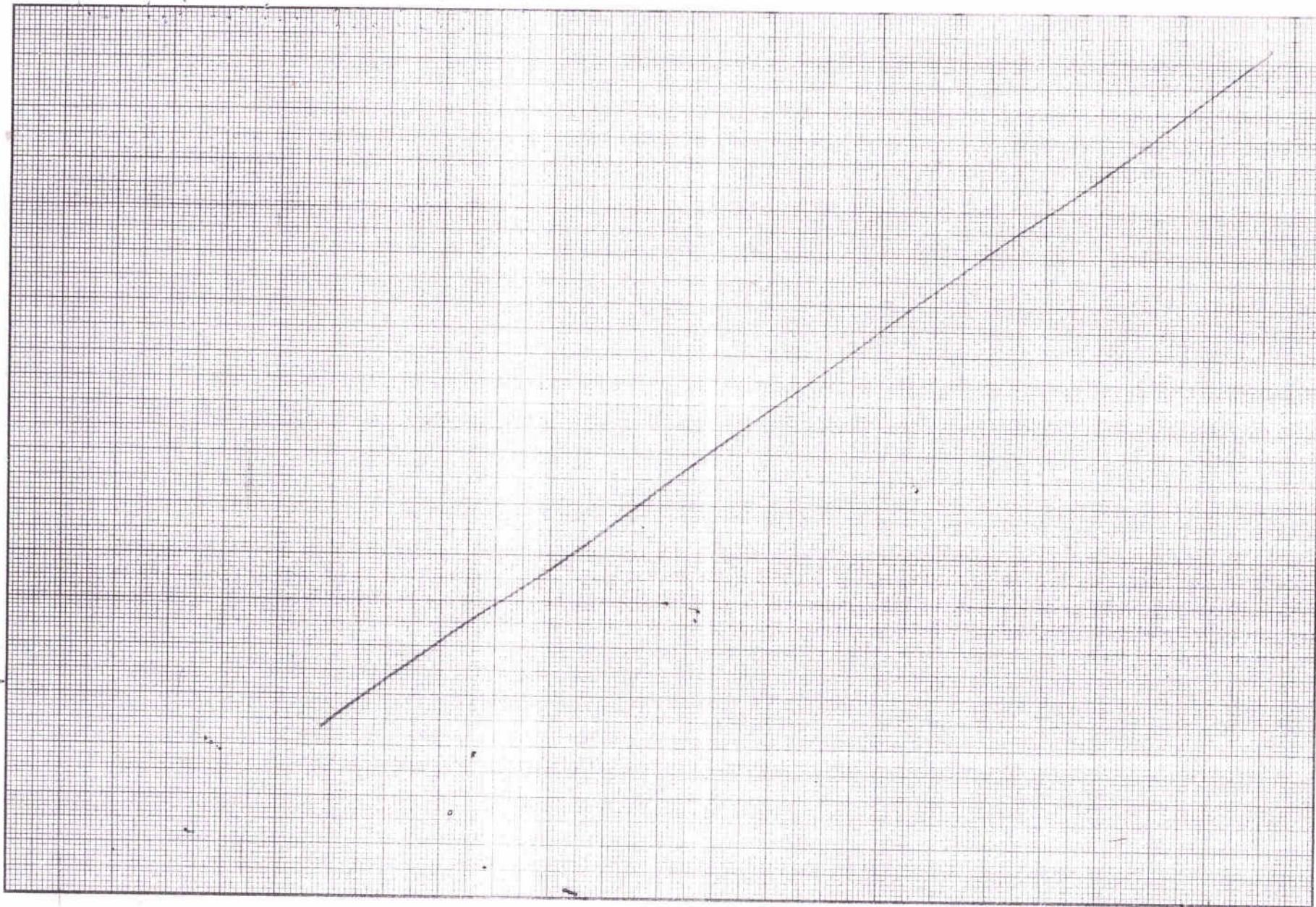
$$\Rightarrow \frac{24}{11} = \frac{3m + 2n}{m+n}$$

$$24m + 24n = 33m + 22n$$

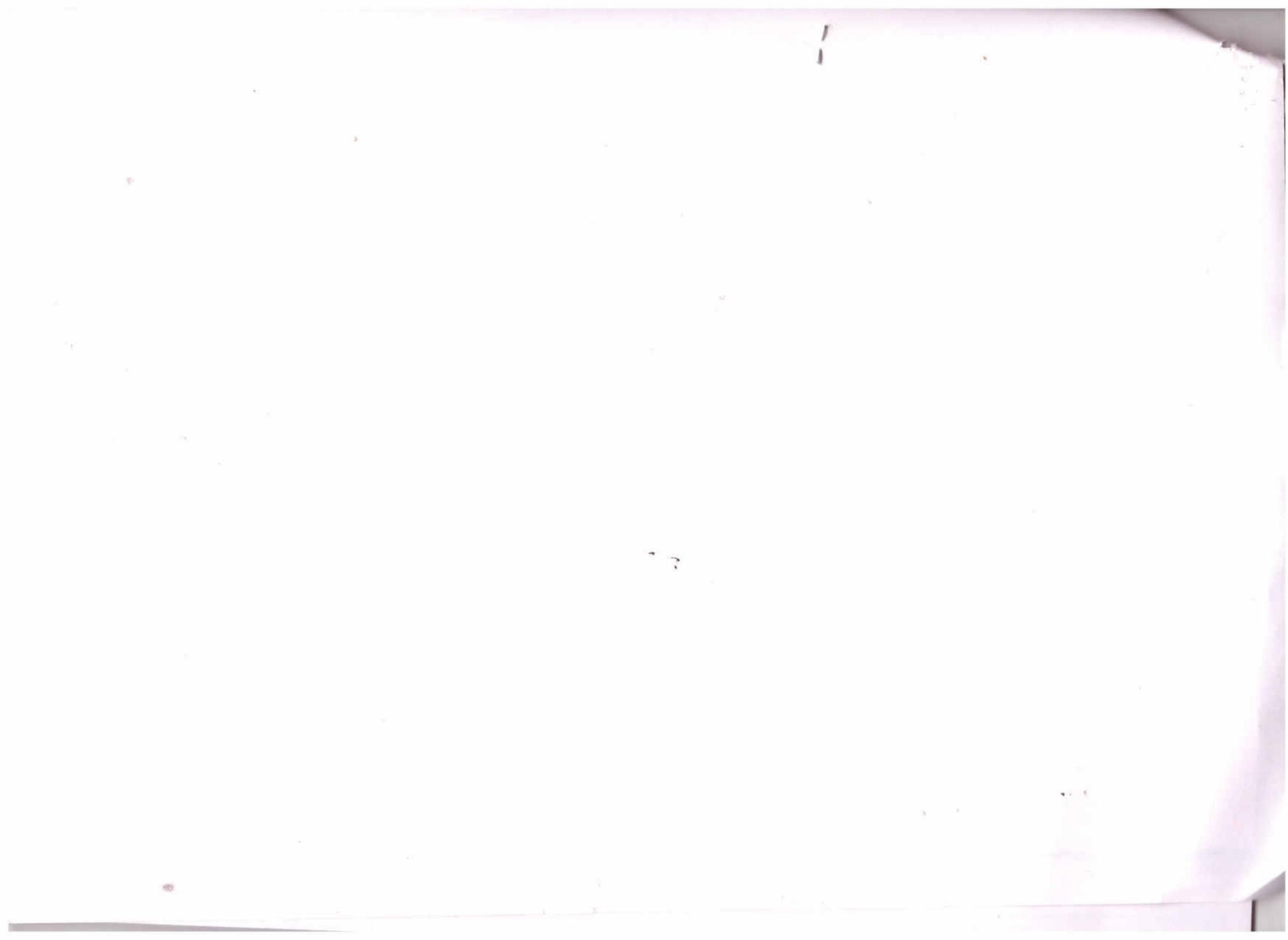
Here  $x_1 = 2, y_1 = -2$

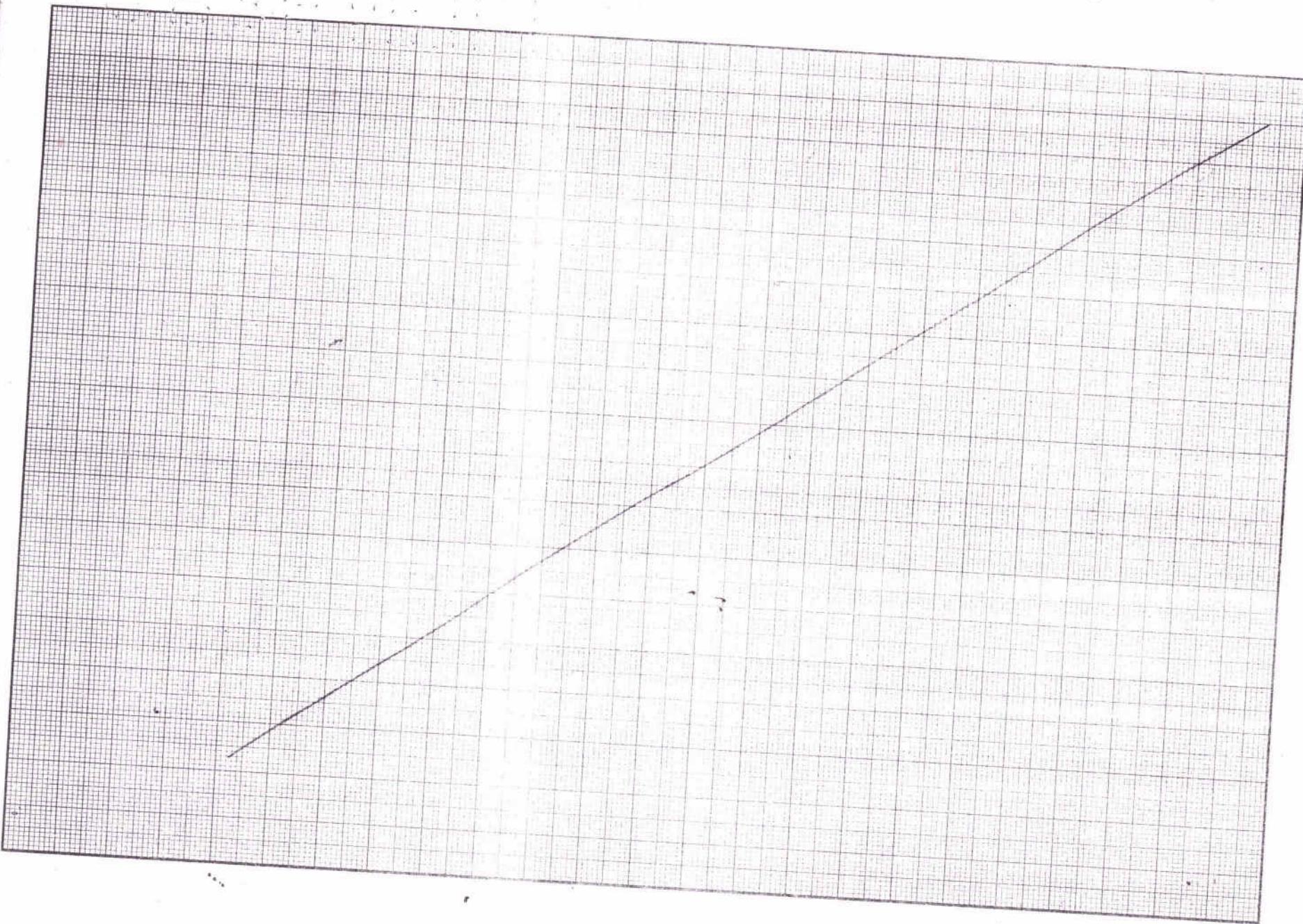
$x_2 = 3, y_2 = 7$

~~$$\begin{array}{r} 2213 \\ -221 \\ \hline 9 \end{array}$$~~

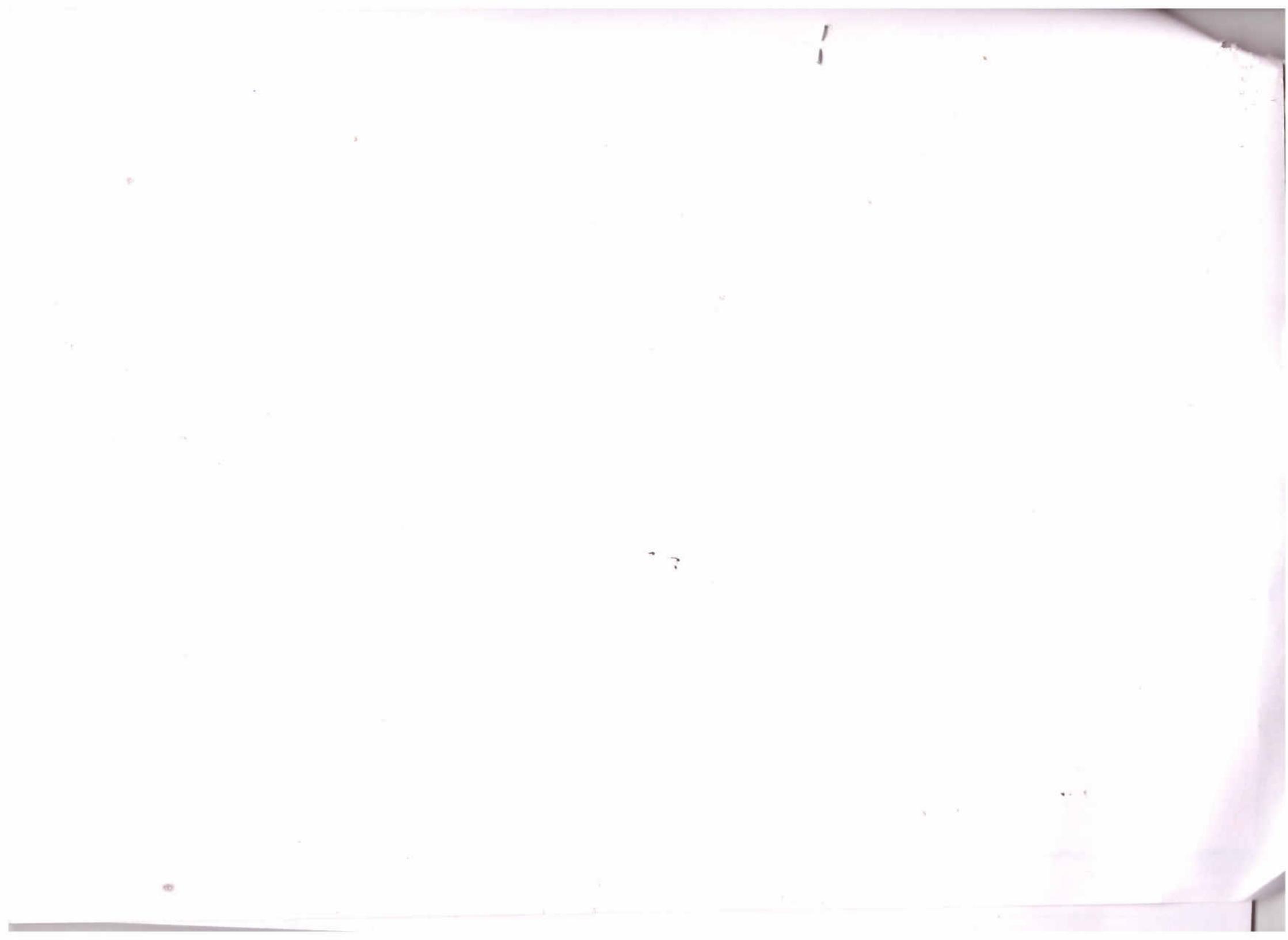


ANSWER





00128



$$2n = 9m$$

$$\frac{2}{9} = \frac{m}{n}$$

$\therefore$  The given point divides the line segment  
in ratio  $2:9$ .

Taking  $m=2$  and  $n=9$ ,

$$y = \frac{7m - 2n}{m+n} \quad (\text{from } ①)$$

$$y = \frac{7(2) - 2(9)}{2+9}$$

$$y = \frac{14 - 18}{11}$$

$$y = \frac{-4}{11}$$

15. speed of water in canal =  $25 \text{ km/hr.}$

$$\text{in } 40 \text{ min} = \frac{40}{60} = \frac{2}{3} \text{ hr.}$$

$$\text{length of water} = 25 \times \frac{2}{3} = \frac{50}{3} \text{ km} = \frac{50000}{3} \text{ m}$$

volume of water in canal in 40 minutes = volume of water for irrigation.

18

$$\frac{54}{10} \times \frac{18}{10} \times \frac{5000}{3} m^3 = \cancel{\frac{10}{10}} \times l \times b \text{ m}^3$$

$$324 \times 5000 = l \times b$$

~~$$1600 \quad 1620000 = l \times b$$~~

area irrigated in 40 minutes is

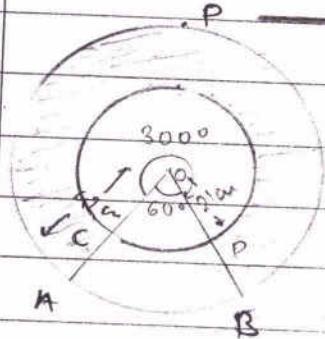
$$1620000 \text{ m}^2$$

$$= \frac{1620000}{1000000}$$

$$= 1.62 \text{ km}^2 \text{ or } 162 \text{ hectares.}$$

17.

16.



$$\angle AOB = \angle COD = 60^\circ \quad R = 42\text{cm}, r = 21\text{cm}.$$

$$\therefore \text{reflex of } \angle AOB = 300^\circ = \theta \quad (360^\circ - 60^\circ)$$

Now,

area of shaded region

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

$$= \frac{300^\circ}{360^\circ} \times \pi \times (R^2 - r^2)$$

$$= \frac{300^\circ}{360^\circ} \times \frac{22}{7} \times (42-21)(42+21)$$

$$= \frac{5}{6} \times \frac{22}{7} \times 21 \times 63$$

$$= 5 \times 11 \times 63$$

$$= 3465 \text{ cm}^2$$

$\therefore$  area of shaded region is  $3465 \text{ cm}^2$  or  $0.3465 \text{ m}^2$

17. For the hollow cylindrical pipe,

$$r = 30 \text{ cm} \quad \text{and} \quad R = 30 + 5 = 35 \text{ cm.}$$

let its length be  $h$ .

volume of the 2 is same.

$$\therefore 44 \times 2.6 \times r \times h =$$

$$4.4 \times 100 \times 2.6 \times 100 \times 100 = \pi h (R^2 - r^2)$$

$$440 \times 260 \times 100 = \frac{22}{7} \times h \times (35^2 - 30^2)$$

$$\begin{array}{r} 63 \\ \times 59 \\ \hline 315 \\ 315 \ 0 \\ \hline 3465 \end{array}$$

$$\begin{array}{r} 63 \\ \hline 315 \\ 315 \ 0 \\ \hline 3465 \end{array}$$

$$440 \times 260 \times 100 = \frac{22 \times h \times 65 \times 5}{7}$$

$$7 \times \frac{440}{22} \times \frac{4}{65} \times \frac{20}{5} \times 100$$

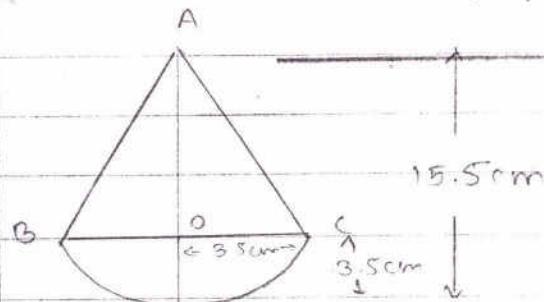
$$= h$$

$$7 \times 20 \times 4 \times 20 = h$$

$$11200 = h$$

$\therefore$  pipe is 11200 cm or 112 m long

18.



$$\text{Height of hemisphere} = r \\ = 3.5 \text{ cm}$$

$$\text{height of cone} = 15.5 \text{ cm} - 3.5 \text{ cm} \\ = 12 \text{ cm} = h.$$

Slant height of cone

$$\begin{aligned} &= \sqrt{r^2 + h^2} \\ &= \sqrt{12.25 + 144} \\ &= \sqrt{156.25} \\ &= 12.5 \text{ cm} \end{aligned}$$

$$65 \\ \times \underline{24} \\ 260$$

$$140 \\ \times \underline{80} \\ 11200$$

$$\begin{array}{r} 156.25 \\ \times 1 \\ \hline 156.25 \\ + 1 \\ \hline 156.25 \\ \end{array}$$

$$\begin{array}{r} 156 \\ \times 2 \\ \hline 78 \\ \end{array}$$

$$\begin{array}{r} 39 \\ \times 3 \\ \hline 117 \\ \end{array}$$

$$13$$

TSA of toy = CSA of cone + CSA of hemi-sphere.

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

$$= \frac{22}{7} \times 12.5 \times 3.5 + 2 \times \frac{22}{7} \times 3.5 \times 3.5$$

~~$$= 22 \times 12.5 \times 0.5 + 22 \times 3.5$$~~

~~$$= 22 \left( 12.5 \times \frac{5}{10} + 3.5 \right)$$~~

~~$$= 22 \left( 12.5 \times \frac{1}{2} + 3.5 \right)$$~~

~~$$= 22 ( 6.25 + 3.5 )$$~~

~~$$= 22 ( 9.75 )$$~~

~~$$= 214.5 \text{ cm}^2$$~~

Total surface area of toy is  $214.5 \text{ cm}^2$

~~625  
350  
975~~

~~975  
12  
1950  
1950  
214.5 0~~

~~975~~

19.

$$a = 9, d = 8, S_n = 636.$$

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

$$636 = \frac{n}{2} [18 + (n-1)8]$$

$$636 = n [9 + (n-1)4]$$

$$636 = n (9 + 4n - 4)$$

$$636 = n (5 + 4n)$$

$$636 = 5n + 4n^2$$

$$4n^2 + 5n - 636 = 0$$

$$4n^2 + 53n - 48n - 636 = 0$$

$$\therefore n & 4n+5$$

$$4n^2 - 48n + 53n = 636 = 0$$

$$4n(n-12) + 53(n-12) = 0$$

$$(4n+53)(n-12) = 0$$

$$\therefore n = \frac{-53}{4} \text{ or } 12.$$

as  $n$  is a natural number,  $\boxed{n=12}$

$\therefore$  12 terms are required to give sum 636.

$$\begin{array}{r} 17 \\ - 9 \\ \hline 8 \end{array}$$

20.

$$\begin{array}{r} 3 | 636 \\ 2 | 212 \\ 2 | 106 \\ \hline 53 \end{array}$$

$$3 \times 2 \times 2 \times 53 \times 2 \times 2$$

20.  $A = (a^2 + b^2)$ ,  $B = -2(ac + bd)$ ,  $C = (c^2 + d^2)$   
 as roots are equal,

$$D = B^2 - 4AC = 0.$$

$$B^2 = 4AC$$

$$[-2(ac + bd)]^2 = 4(a^2 + b^2)(c^2 + d^2)$$

~~$$a(a^2c^2 + 2abcd + b^2d^2) = 4(a^2c^2 + a^2d^2 + b^2c^2 + b^2d^2)$$~~

$$2abcd = a^2d^2 + b^2c^2$$

$$0 = a^2d^2 - 2abcd + b^2c^2$$

$$0 = (ad - bc)^2$$

$$0 = ad - bc$$

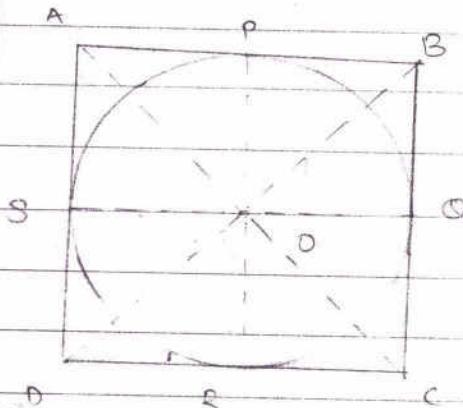
$$ad = bc$$

$$\Rightarrow \boxed{\frac{a}{b} = \frac{c}{d}}$$

Hence, proved.

### Section B

5.



Given : circle touching sides  
of ABCD at P, Q, R & S.

To prove:  $AB + CD = AD + BC$ .

Proof:

$$AP = AS$$

$$PB = BQ$$

$$DR = DS$$

$$CR = CQ$$

tangents from same  
point to a circle are  
equal in length

adding all ④,

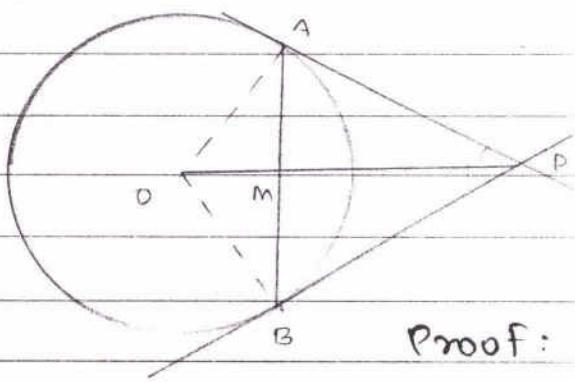
$$AP + PB + DR + CR = AS + BQ + DS + CQ$$

$$AB + CD = AS + SD + BQ + QC$$

$$AB + CD = AD + BC$$

Hence, proved.

6.



Given: chord AB.

tangents AP and BP at A & B

To prove:  $\angle PAM = \angle PB M$

Construction: Join centre O to P

let OP meet AB at M.

Proof:

In  $\triangle AMP$  and  $\triangle BMP$ ,

$AP = BP$  — tangents from same point  
to a circle are equal.

$MP = MP$  — common side

$\angle PAM = \angle BPM$  — tangents are equally inclined  
to line joining the point  
to circle's centre. emergence

by SAS criterion,

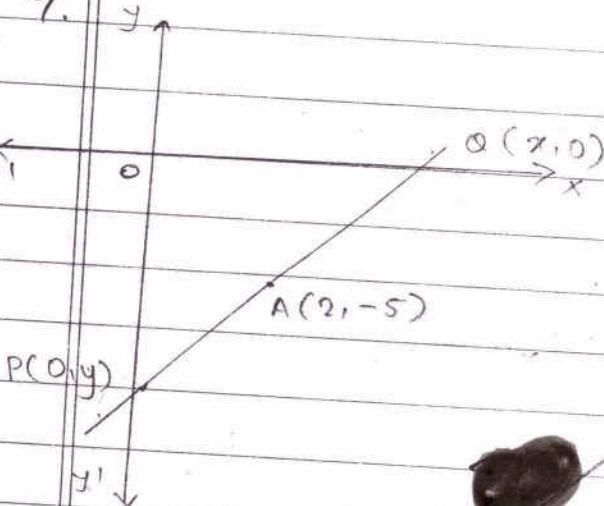
$\triangle AMP \cong \triangle BMP$ .

by cpct.  $\angle PAM = \angle BPM$

Hence, tangents at end points of a chord  
make equal angles with it

TOP

7.



Let coordinates of P be  $(0, y)$  and of Q be  $(x, 0)$ .

~~A  $(2, -5)$  is mid point of PQ.~~

by section formula,

$$(2, -5) = \left( \frac{0+x}{2}, \frac{y+0}{2} \right)$$

$$2 = \frac{x}{2} \quad \text{and} \quad -5 = \frac{y}{2}$$

$$\therefore x = 4 \quad \text{and} \quad y = -10.$$

$\therefore$  P is  $(0, -10)$  and Q is  $(4, 0)$

q.

8.

$$PA = PB$$

$$\therefore PA^2 = PB^2$$

by distance formula,

$$(5-x)^2 + (1-y)^2 = (-1-x)^2 + (5-y)^2$$

$$\Rightarrow (5-x)^2 + (1-y)^2 = (1+x)^2 + (5-y)^2$$

$$25 - 10x + x^2 + 1 - 2y + y^2 = 1 + 2x + x^2 + 25 - 10y + y^2$$

$$-10x - 2y = 2x - 10y$$

$$\begin{aligned} 8y &= 12x \\ 4(2y) &= 4(3x) \\ \therefore 3x &= 2y \end{aligned}$$

Hence, proved.

9. Let  $\alpha$  and  $\beta$  be the roots of given quadratic equation.

$$\beta = 6\alpha$$

Here,  $a = p$ ,  $b = -14$ ,  $c = 8$ .

$$\alpha + \beta = \frac{-(-14)}{p} = \frac{-b}{a}$$

$$9\alpha = \frac{+42}{p}$$

$$\alpha = \frac{2}{p} \quad \text{--- (1)}$$

$$\text{Also, } \alpha\beta = \frac{8}{p} = \frac{c}{a}$$

$$\alpha \times 6\alpha = \frac{8}{p}$$

$$6 \alpha^2 = \frac{8}{P}$$

from ①,

$$6 \left( \frac{2}{P} \right)^2 = \frac{8}{P}$$

$$\frac{6 \times 4}{P^2} = \frac{8 \cdot 2}{P}$$

$$\frac{6}{P^2} = \frac{2}{P}$$

$$\frac{6}{2} = \frac{P^2}{P}$$

$$\therefore P = 3$$

10. let  $a, d$  and  $A, D$  be the 1<sup>st</sup> term and common difference of the 2 A.P.s respectively.  
 $m$  is same.

$$a = 63, d = 2$$

$$A = 3, d = 7$$

$$\begin{aligned}
 a_n &= A_n \\
 \Rightarrow a + (n-1)d &= A + (n-1)D \\
 63 + (n-1)2 &= \cancel{3 + (n-1)7} \\
 63 + 2n - 2 &= 3 + 7n - 7 \\
 61 + 2n &= 7n - 4 \\
 65 &= 5n \\
 13 &= n
 \end{aligned}$$

$\therefore$  When  $n$  is 13, the  $n^{\text{th}}$  terms are equal  
~~i.e.,  $a_{13} = A_{13}$ .~~