BANGALORE SAHODAYA SCHOOLS COMPLEX ASSOCIATION
PRE-BOARD EXAMINATION -2 (2024 − 2025)
GRADE X

Date: 06.01.2025 **Max Marks: 80**

Subject: Mathematics – Standard (Code − 041) **Time: 3 hours**

Marking Scheme

	SECTION A	
	Section A consists of 20 questions of 1 mark each.	
S.NO.		**Marks**
1.	(b) $5^3 \times {}^3y^{\,3}$	**1**
2.	(c) all real values except 10	**1**
3	(c) 16 : 9	**1**
4.	(d) -3, 3	**1**
5.	(a) BD . CD = AD^2	**1**
6.	(d) 0.7	**1**
7.	(a) 0	**1**
8.	(c) 2 : 3	**1**
9.	(c) 30−40	**1**
10.	(c) $(p^2 - 1)/(p^2 + 1)$	**1**
11.	(b) 14 : 11	**1**
12.	(d) 55°	**1**
13.	(b) 1	**1**
14.	(c) $\sqrt{(b^2 - a^2)}/b$	**1**
15.	(b) isosceles and similar.	**1**
16.	(c) 6 cm	**1**
17.	(a) 60°	**1**
18.	(d) 23/50	**1**
19.	(a)Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).	**1**

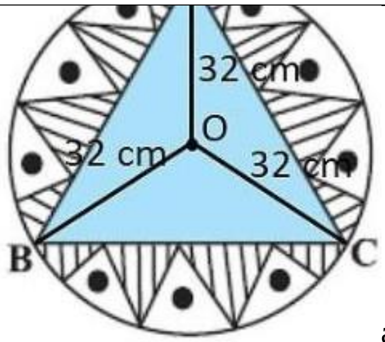
20.	(b)Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).	**1**
	SECTION B	

	Section B consists of 5 questions of 2 marks each.	
21.	Let us assume that $7 + \sqrt{3}$ is rational. $7 + \sqrt{3} = \frac{a}{b}$, where a and b are co-primes $b \neq 0$. $\sqrt{3} = \frac{a}{b} - 7$ $= \frac{a}{b} - \frac{7}{1} = \frac{a-7b}{b}$ $\frac{a-7b}{b}$ is a rational number. But this contradicts the fact that $\sqrt{3}$ is irrational. So, our assumption was wrong. **OR** Find the largest number which divides 70 and 125, leaving remainders 5 and 8 respectively $70 - 5 = 65$ $125 - 8 = 117$ HCF (65, 117) = 13	**1** **1** **1** **1**
22.	$\sin(A + B) = \sin 90°$ $A + B = 90°$………(1) $\cos(A - B) = \cos 30°$ $A - B = 30°$..........(2) From (1) and (2) $A = 60°$ and $B = 30°$	**0.5** **0.5** **1**
23.	$\Delta AOB \sim \Delta COD$ (AA − similarity) $\frac{AO}{CO} = \frac{BO}{DO}$ (CPST) $\frac{x+5}{x+3} = \frac{x-1}{x-2}$ $(x + 5)(x - 2) = (x + 3)(x - 1)$ $3x - 10 = 2x - 3$ $x = 7$	**0.5** **1** **0.5**

24.	Midpoint of AC $=\left(\frac{x1+x2}{2},\frac{y1+y2}{2}\right)$ $=((-2+4)/2,\ (1+b)/2)$ $=(2/2,\ (1+b)/2)$ $=(1,(1+b)/2)$ Midpoint of BD $= =\left(\frac{x1+x2}{2},\frac{y1+y2}{2}\right)$ $= ((a+1)/2,\ (0+2)/2)$ $= ((a+1)/2,\ 2/2)$ $= ((a+1)/2,1)$ Since, diagonals of a parallelogram bisect each ether, $\therefore (1,\ (1+b)/2)=((a+1)/2,\ 1)$ On comparing, we get $\therefore (a+1)/2 = 1 \qquad (1+b)/2 = 1$	**1** **1**
	a + 1 = 2 | $\Rightarrow 1 + b = 2$ a = 1 | $\Rightarrow b = 1$ **OR** Given AP/AB = 2/5 AP/PB = 2/3 m = 2, n =3 Let P(x, y) $x = \frac{(mx2+nx1)}{(m+n)}$ $y = \frac{(my2+ny1)}{(m+n)}$ $x = \frac{(2\times4+3\times4)}{(3+2)} = \frac{20}{5} = 4$ $y = \frac{(2\times5+3\times-5)}{(3+2)} = \frac{-5}{5} = -1$ The co-ordinates of P(4, −1)	**1** **0.5** **0.5** **1**
25.	i) P(hearts) = 13/49 ii) P(black king) = 1/49	**1** **1**
	SECTION C	
	Section C consists of 6 questions of 3 marks each.	

26.	Prime factorization HCF (180, 240, 540) = 20 the volume of the largest beaker that can be used to empty each of them at an exact number of times = 20 ml.	**1** **1.5** **0.5**
27.	If α and β are zeroes of the quadratic polynomial f(x) = $2x^2 - 4x + 6$, find the value of $\alpha + \beta = -\frac{b}{a} = \frac{4}{2} = 2$ $\alpha\beta = \frac{c}{a} = \frac{6}{2} = 3$ $\alpha^{-1} + \beta^{-1} + \alpha\beta = \frac{\alpha + \beta}{\alpha\beta} + \alpha\beta = \frac{2}{3} + 3 = \frac{11}{3}$.	**0.5** **0.5** **2**

28.



area of a circle = $\frac{1}{2} \times \frac{22}{7} \times 32^2 = 22528/7\ m^2$ **1**

In right triangle Δ OMB

$\sin O = \frac{\text{side opposite to angle O}}{\text{Hypotenuse}}$

$\sin 60° = \frac{BM}{OB}$

$\frac{\sqrt{3}}{2} = \frac{BM}{32}$

$\frac{\sqrt{3}}{2} \times 32 = BM$

$16\sqrt{3} = BM$

$BM = 16\sqrt{3}$

In right triangle Δ OMB

$\cos O = \frac{\textit{side adjacent to angle O}}{\textit{Hypotenuse}}$

$\cos 60° = \frac{OM}{OB}$

$\frac{1}{2} = \frac{OM}{32}$

$\frac{32}{2} = OM$

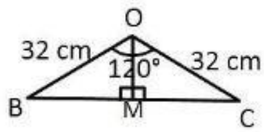
$16 = OM$

$OM = 16$

$BM = \frac{1}{2}BC$

$2BM = BC$

$BC = 2BM$



Putting value of BM

$BC = 2 \times 16\sqrt{3}$

$BC = 32\sqrt{3}$

Now,

Area of Δ BOC = $\frac{1}{2} \times$ Base × Height

$= \frac{1}{2} \times BC \times OM$ **1**

$= \frac{1}{2} \times 32\sqrt{3} \times 16$

$= 16\sqrt{3} \times 16$

$= 256\sqrt{3}$

	Area of design = Area of circle – area of triangle ABC $= \frac{22528}{7} - 768\sqrt{3}\ cm^2$	**1**
	OR sides of triangle are a = 15 cm, b = 16 cm and c = 17 cm semi-perimeter of triangle S = (a + b + c)/2 = (15 + 16 + 17)/2 = 48/2 = 24 ∴ Area of triangular field=√s(s-a)(s-b)(s-c) [by Heron's formula] $=\sqrt{24 \times 9 \times 8 \times 7}$ $= 2 \times 3 \times 4\sqrt{21}$ $=24\sqrt{21} = 24\ (4.58) = 109.92\ m^2$ angle sum of triangle is 180° hence area of three sectors = ½ area of one circle. $= \frac{1}{2}(\pi r^2)$ $= \frac{1}{2} \times \frac{22}{7} \times 7^2 = 77\ m^2$ Area of the field which cannot be grazed by the three animals = $109.92 - 77 = 32.92\ m^2$	**0.5** **0.5** **0.5** **1** **0.5**
29.	Solve the following quadratic equation: $\sqrt{3}x^2 + 10x + 7\sqrt{3} = 0$ $ax^2 + bx + c = 0$ a = $\sqrt{3}$, b = 10, c = $7\sqrt{3}$ x = $\frac{-b \pm\sqrt{b^2-4ac}}{2a}$ $= \frac{-10 \pm\sqrt{10^2-4.\sqrt{3}.7\sqrt{3}}}{2\sqrt{3}}$ $= \frac{-10 \pm\sqrt{100-84}}{2\sqrt{3}}$ $= \frac{-10 \pm\sqrt{16}}{2\sqrt{3}}$ $= \frac{-10 \pm 4}{2\sqrt{3}}$ $x = \frac{-10+4}{2\sqrt{3}} = -\sqrt{3}$ $x = \frac{-10-4}{2\sqrt{3}} = \frac{-7}{\sqrt{3}}$ **OR** The length of a theatre screen is 7 ft more than twice its width. Find the dimensions of the screen if its area is 184 square feet. Let width of the screen = x ft	**1** **1** **0.5** **0.5**

<table>
<tr><td></td><td>Length = 2x +7
Area = l.b = 184 square ft
(2x + 7) x = 184
$2x^2 + 7x - 184 = 0$
(2x +23)(x – 8) = 0
X = −23/2 (width cannot be -ve)
X = 8
Width = 8ft
Length = 2(8) +7 = 16 +7 = 23ft</td><td>0.5

1

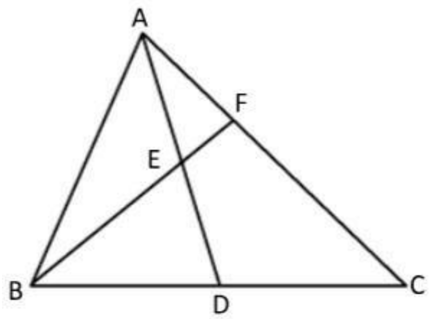
1

0.5</td></tr>
<tr><td>30.</td><td>If $7sin^2\theta + 3cos^2\theta = 4$, then find the value of θ.
$sin^2\theta + cos^2\theta = 1$

$7sin^2\theta + 3(1 - sin^2\theta) = 4$
$7sin^2\theta - 3sin^2\theta + 3 - 4 = 0$
$4sin^2\theta - 1 = 0$
$(2\sin\theta + 1)(2sin\theta - 1) = 0$
$\sin\theta = -1/2$ or ½
$\sin\theta = ½$
$\sin\theta = \sin 30°$
$\theta = 30°$</td><td>

0.5
0.5

1

1</td></tr>
<tr><td>31.</td><td>In a given triangle if AC = BC and AE = BE then prove that AF = BD


From triangle ABC
Since AC = BC
∠BAC = ∠ABC (angles opp to equal sides are equal).............. (1)
Similarly, from triangle ABE
AE = BE

∠BAE = ∠ABE (angles opp to equal sides are equal) ....(2)
Subtract eqn(2) from (1)
∠EAF = ∠EBD
∠AEF = ∠BED
ΔAEF ~ Δ BED (AA- similarity)
AE/BE = AF/BD (CPST)
But (AE = BE)
1 = AF/BD
AF = BD

OR
Prove that if a line is drawn parallel to one side of a triangle to intersect the other two sides in two distinct points, then the other two sides are divided in the same ratio.</td><td>1

1

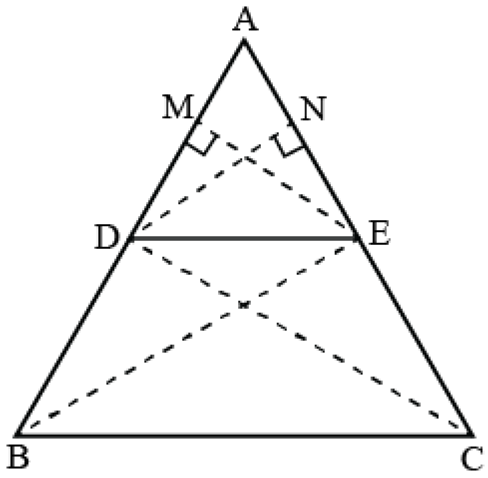
0.5

0.5</td></tr>
</table>

Given, To prove, construction, Diagram ………………….. **1**

Theorem Proof **2**

To prove: $\frac{AD}{DB} = \frac{AE}{EC}$



to E and C to D.

Proof: In ΔADE and ΔBDE

$$\frac{ar(\Delta ADE)}{ar(\Delta BDE)} = \frac{\frac{1}{2}\times AD\times EM}{\frac{1}{2}\times DB\times EM} \text{.................................... (i)}$$

In ΔADE and ΔCDE

$$\frac{ar(\Delta ADE)}{ar(\Delta CDE)} = \frac{\frac{1}{2}\times AE\times DN}{\frac{1}{2}\times EC\times DN} \text{....................... (ii)}$$

∴ ar(ΔBDE) = ar(ΔCDE) .... (iii)

[Triangles on the same base and between the same parallel sides are equal in area]

From eq. (i), (ii) and (iii)

$\frac{AD}{DB} = \frac{AE}{EC}$

SECTION D

Section D consists of 4 questions of 5 marks each.

32. Given below is the frequency distribution of the heights of 50 students of a class:

Height in cm	140−145	145−150	150 −155	155−160	160−165
No. of students	8	12	15	10	5
Cf	8	20	35	45	50

i) Table **0.5**

Median = $l + \left(\frac{\frac{n}{2} - fc}{f}\right) h$ **0.5**

since n/2 = 25

median class is 150-155

l = 150 h =5 fc = 20 f = 15 **0.5**

Median = $l + \left(\frac{\frac{n}{2} - fc}{f}\right) h$

= $150 + \left(\frac{25-20}{15}\right) 5$

$= 150 + \frac{25}{15}$

$= 150 + \frac{5}{3}$

$= 150 + 1.67$ **1**

Median height =151.67 cm

ii) Mean height

CI	F	x	D = x -a	fd
140-145	8	142.5	-10	-80
145-150	12	147.5	-5	-60
150-155	15	152.5	0	0
155-160	10	157.5	5	50
160-165	5	162.5	10	50

1.5

$$\sum fd = -40$$ **0.5**

Mean = a + $\frac{\sum fd}{\sum f}$

$= 152.5 + \frac{-40}{50}$ **0.5**

$= 152.5 - 0.8$

Mean height = 151.7 cm

OR

CI	F	x	fx
0-20	16	10	160
20-40	x	30	30x
40-60	25	50	1250
60-80	16	70	1120
80-100	y	90	90y
100-120	10	110	1100

2

Table

$$\sum fx = 3630 + 30x + 90y$$ **1**

$$\sum f = 67 + x + y = 90$$

x + y = 23…...............(1)

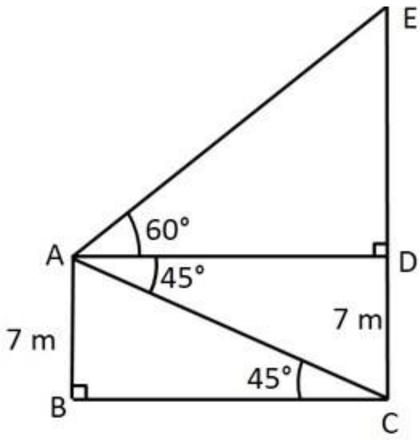
mean = $\frac{\sum fx}{\sum f} = \frac{3630+30x+90y}{90} = 56$ **1**

3630 +30x +90y = 5040

x + 3y = 47…......................(2)

on solving eqn (1) and (2) **1**

x = 11 y =12

33.	Diagram  $\tan C = \frac{Side\ opposite\ to\ angle\ C}{Side\ adjacent\ to\ angle\ C}$ $\tan 45° = \frac{AB}{BC}$ $1 = \frac{AB}{BC}$ $1 = \frac{7}{BC}$ BC = 7m Since BC = AD So, AD = 7m Now, In a right angle triangle ADE, $\tan A = \frac{Side\ opposite\ to\ angle\ A}{Side\ adjacent\ to\ angle\ A}$ $\tan 60° = \frac{ED}{AD}$ $\sqrt{3}$ = ED/7 ED = $7\sqrt{3}$ EC = ED +DC = $7\sqrt{3} + 7 = 7(\sqrt{3} + 1) = 7(1.73+1) = 7(2.73) = 19.11$ m	1 1 1 1 1
34.	Distance covered = speed × distance ⇒ Distance = x × y = xy .... (i) First condition : If the speed of the man increases by 1/2 km/hr, the journey time will reduce by 1 hour. Distance covered = $(x + \frac{1}{2})(y - 1)$ km	1

$xy = (x + \frac{1}{2})(y - 1)$

And we finally get,

$-2x + y - 1 = 0$ ....(ii)

From the second condition :

If the speed reduces by 1 km/hr, then the time of journey increases by 3 hours. **1**

$xy = (x - 1)(y + 3)$

$\Rightarrow xy = xy - 1y + 3x - 3$

$\Rightarrow xy = xy + 3x - 1y - 3$

$\Rightarrow 3x - y - 3 = 0$..........................(iii)

From (ii) and (iii), the value of x can be calculated by

(ii) + (iii) $\Rightarrow$

$x - 4 = 0$ **1**

$x = 4$

Now, y can be obtained by using x = 4 in (ii)

$-2(4) + y - 1 = 0$ **1**

$\Rightarrow y = 1 + 8 = 9$

Hence, putting the value of x and y in equation (i), we find the distance

Distance covered = xy

$= 4 \times 9$ **1**

= 36 km

Hence distance is 36 km and the speed of walking is 4 km/hr.

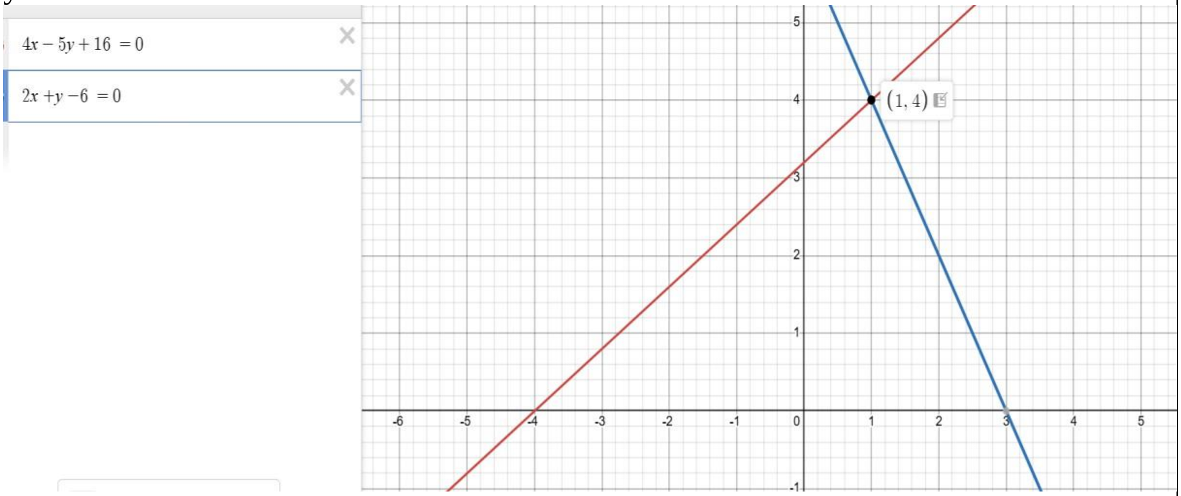
OR

Solve the following system of linear equations graphically:
$4x - 5y + 16 = 0$ and $2x + y - 6 = 0$
Shade the region bounded by these lines and the x-axis. Also find the area of the shaded region.

x	-4	-2.7	-1.5
y	0	1	2

x	3	2.5	2
y	0	1	2

1



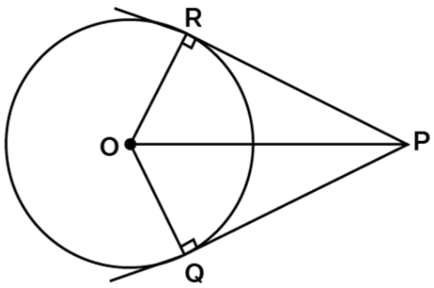
3

Area of the triangle $= \frac{1}{2} \times$ Base$\times$Height$= \frac{1}{2} \times \times 7 \times 4 = 14$ sq. units **1**

35. If P is an external point of a circle having center at O, then prove that the length of the tangents PQ and PR drawn to a circle are equal, also prove that OP is the bisector of ∠ROQ.

Given, to prove, diagram…… **1**

Proof of the theorem: **2**



Given : PQ and PR be the two tangents to the circle with centre O.

To Prove : PQ = PR **1**

∠POQ = ∠POR

Proof :

In ΔPOQ and ΔPOR

OQ = OR (radii of the same circle)

∠OQP = ∠ORP = 90∘ (since tangent at any point of a circle is perpendicular to the radius through the point of contact) **1**

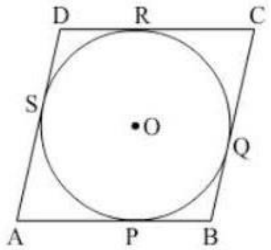
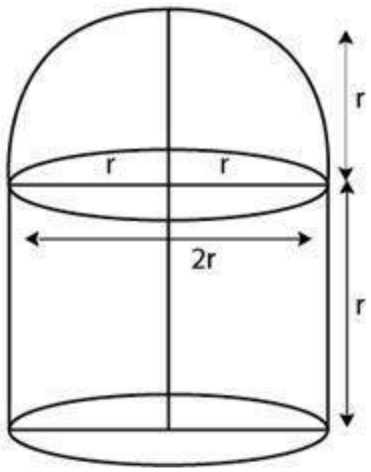
OP = OP (common)

∴ΔPOQ ≅ ΔPOR (by R.H.S. congruence criterion) **0.5**

∴ PQ = PR (CPCT)

∠POQ = ∠POR (CPCT) **0.5**

Hence the length of the tangents drawn from an external point to a circle are equal.

	 We know that the tangents drawn to a circle from an external point are equal in length. ∴ AP = AS, BP = BQ, CR = CQ and DR = DS. AP + BP + CR + DR = AS + BQ + CQ + DS (AP + BP) + (CR + DR) = (AS + DS) + (BQ + CQ) ∴ AB + CD = AD + BC or 2AB = 2AD (since AB = DC and AD = BC of parallelogram ABCD) ∴ AB = BC = DC = AD hence ABCD is a rhombus.	**1** **0.5** **0.5**
	SECTION E	
	Case study-based questions are compulsory.	
36.	Diagram: Let total height of the building = internal diameter of the dome = 2 r m  ∴ Radius of building (or dome) = r = r m Height of cylinder = 2r – r = r m ∴ Volume of the hemispherical dome cylinder = $\frac{2}{3}\pi r^3$ ∴ Total volume of the building = Volume of the cylinder + Volume of hemispherical dome $= \pi r^2 h_{cy} + \frac{2}{3}\pi r^3$ $= \pi r^2 r + \frac{2}{3}\pi r^3 = \pi r^3 \left(1 + \frac{2}{3}\right) = \frac{5}{3}\pi r^3 = 41\frac{19}{21}\ m^3$ $\frac{5}{3}\pi r^3 = \frac{880}{21}$	**1** **1**

$\frac{5.22}{3.7} r^3 = \frac{880}{21}$

$\frac{110}{21} r^3 = \frac{880}{21}$

$r^3 = 8$ **1**

ii) $\Rightarrow$ r = 2m

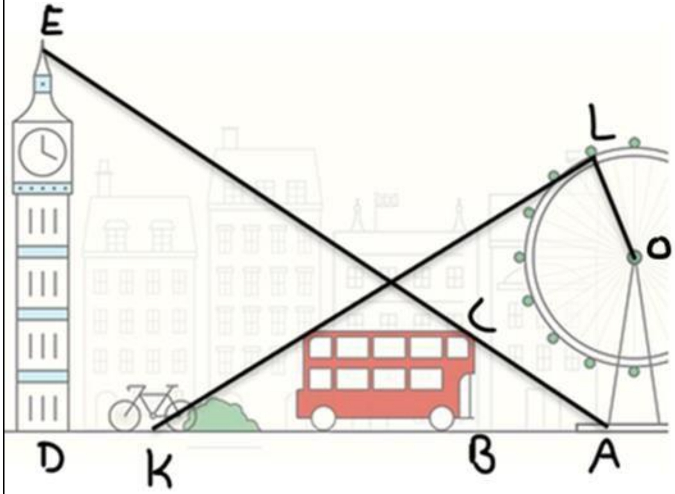
OR

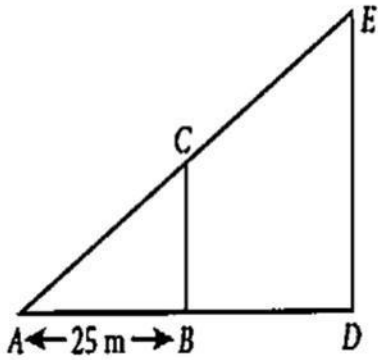
ii) ∴ Height of the building = 2 r = 2×2 = 4 m **2**

iii) Find the inner curved surface area of the dome.

CSA of dome = $2\pi r^2 = 2\pi.4 = 8\pi = \frac{8\times22}{7} = \frac{176}{7} = 25.14$ sq.m **1**

37.





Based on the above information, answer the following questions:

i) $\Delta ABC \sim \Delta ADE (AA)$ **1**

$\frac{AB}{AD} = \frac{BC}{DE} = \frac{AC}{AE}$ (CPST)

ii)

BD = 2(25) = 50 m

AD = 50 + 25 = 75 m **1**

$\frac{AB}{AD} = \frac{BC}{DE}$

$\frac{25}{75} = \frac{BC}{DE} = \frac{1}{3}$ **1**

Ratio is 1 : 3

OR

Tan 60° $= \frac{BC}{AB}$ **1**

$\sqrt{3} = \frac{BC}{25}$ **1**

	$BC = 25\sqrt{3}$ m = height of the bus. iii) What is the measure of $\angle KLO$? Give reason. $\angle KLO = 90°$ (angle at the point of contact is 90°)	**1**
38	416, 403, 390... a = 416 d = 403 − 416 = −13 i) How many bottles did they collect in day 11? $a_n = a + (n-1)d$ $a_{11} = 416 + 10(-13)$ $a_{11} = 286$ bottles ii) Find the total number of bottles collected in first 11 days. $S_n = \frac{n}{2}(2a + (n-1)d)$ $S_{11} = \frac{11}{2}(2(416) + 10(-13))$ $S_{11} = 3861$ bottles **OR** Find the nth term of the given A.P. $a_n = a + (n-1)d$ $an = 416 + (n-1) - 13$ $= 416 + 13 - 13n$ $= 429 - 13n$ iii) On which day was the number of bottles collected zero? $a_n = a + (n-1)d = 0$ $416 + (n-1) - 13 = 0$ $429 - 13n = 0$ $n = \frac{429}{13} = 33$rd day	**1** **0.5** **1** **0.5** **0.5** **1** **0.5** **0.5** **0.5**