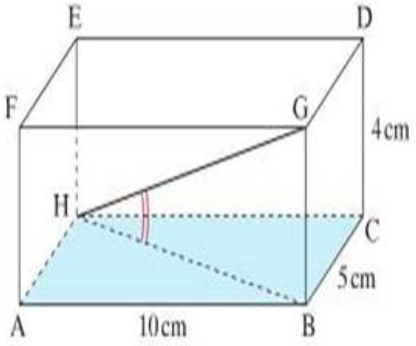
Exercise 2.6

1. An open rectangular box has dimensions 10 cm by 5 cm by 4 cm, as shown.
   (i) Find the length of the diagonal [GH].
   (ii) Find the measure of the angle between GH and the base of the box.



Ex 2.6

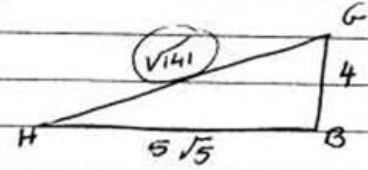
Q1 (i) Find Diagonal of Base

$x^2 = 10^2 + 5^2$

$x^2 = 125$

$x = \sqrt{125} = 5\sqrt{5}$

Hence find GH

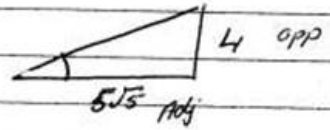


$x^2 = (5\sqrt{5})^2 + 4^2$

$x^2 = 141$

$x = \sqrt{141} = 11.87$

(ii) Find angle GHB



$\text{Tan}\theta = \frac{O}{A}$

$\text{Tan}\, H = \frac{4}{5\sqrt{5}}$

$H = \text{Tan}^{-1}\left(\frac{4}{5\sqrt{5}}\right) = 19.69^\circ = 19^\circ 42'$

2. The diagram shows a vertical radio mast [BT] which stands at the corner of a horizontal rectangular plot ABCD.
The mast is 12 m in height and |BC| = 15 m.
The angle of elevation of the top of the mast from A is 25°.

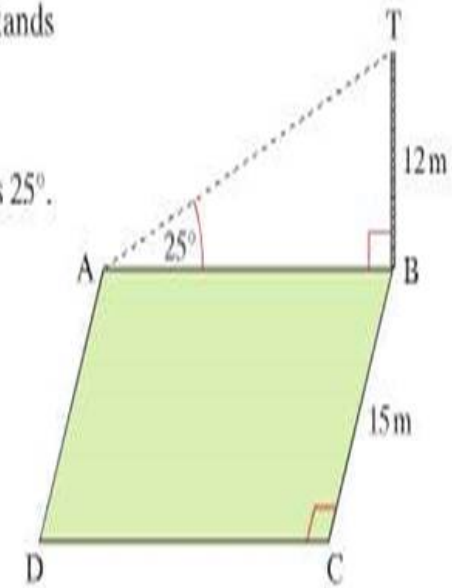
(i) Find the length of [AB].

(ii) Calculate the angle of elevation of the top of the mast from C.

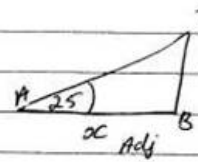
(iii) Find |DB|.

(iv) Calculate the angle of elevation of the top of the mast from D.

Give each answer correct to one decimal place.



Q2 (i)

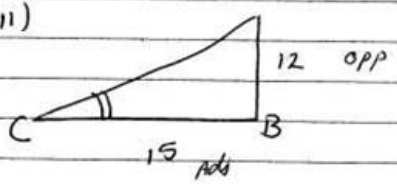


$\tan 25 = \frac{12}{x}$

$x = \frac{12}{\tan 25}$

$x = 25.7\text{m}$

(ii)

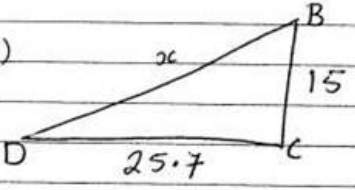


$\tan C = \frac{12}{15}$

$C = \tan^{-1}\left(\frac{12}{15}\right)$

$C = 38.7°$

(iii)

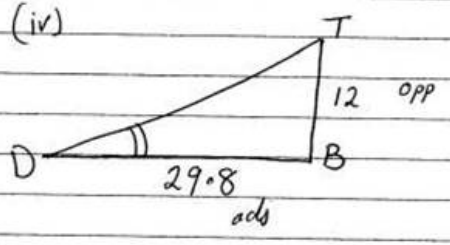


$x^2 = 15^2 + 25.7^2$

$x^2 = 885.49$

$x = \sqrt{885.49} = 29.8\text{m}$

(iv)



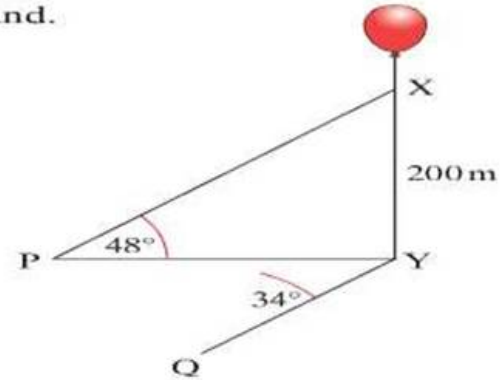
$\tan D = \frac{12}{29.8}$

$D = \tan^{-1}\left(\frac{12}{29.8}\right)$

$D = 21.9°$

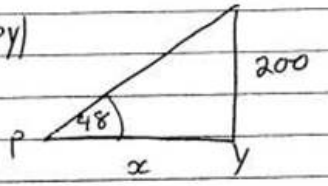
3. A balloon X is 200 metres vertically above a point Y on level ground.
Two points P and Q are also on level ground.
The angle of elevation of X from P is 48°.
The angle of elevation of X from Q is 34°.

(i) Find |PY| and |QY| correct to the nearest metre.
(ii) If $|\angle PYQ| = 84°$, find |PQ| correct to the nearest metre.



Q03 |PY|

(i)

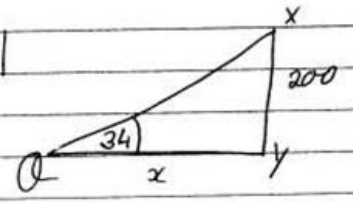


$\tan 48 = \frac{200}{x}$

$x = \frac{200}{\tan 48}$

$x = 180\,m$

|QY|



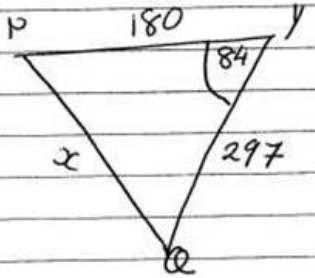
$\tan 34 = \frac{200}{x}$

$x = \frac{200}{\tan 34}$

$x = 297\,m$

(ii)

|PQ|



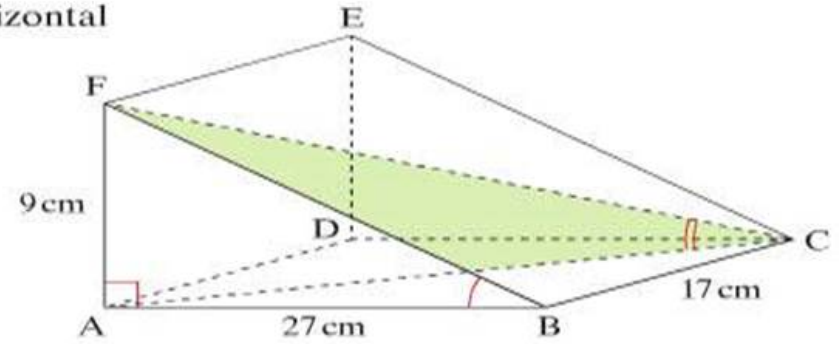
$x^2 = 180^2 + 297^2 - 2(180)(297)\cos 8$

$x^2 = 120609 - 11176.18$

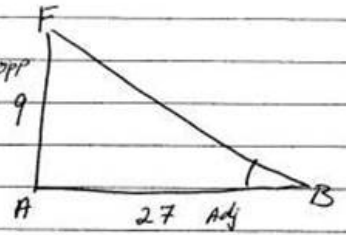
$x^2 = 109432.82$

$x = 331\,m$

4. In the given model of a ramp, ABCD is a horizontal rectangle and ADEF is a vertical rectangle.
Find (i) $|\angle ABF|$
(ii) $|AC|$
(iii) $|\angle ACF|$.
Give each answer correct to one decimal place.



Q4 (i) $|\angle ABF|$

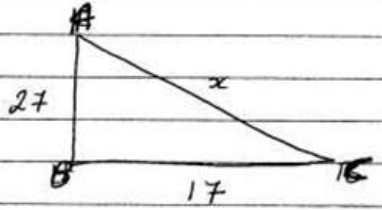


$\tan B = \frac{9}{27}$

$B = \tan^{-1}\left(\frac{9}{27}\right)$

$B = 18.4^\circ$

(ii) $|AC|$

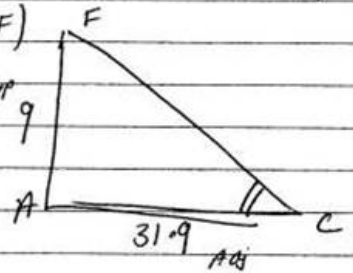


$x^2 = 27^2 + 17^2$

$x^2 = 1018$

$x = \sqrt{1018} = 31.9\text{cm}$

(iii) $|\angle ACF|$



$\tan C = \frac{9}{31.9}$

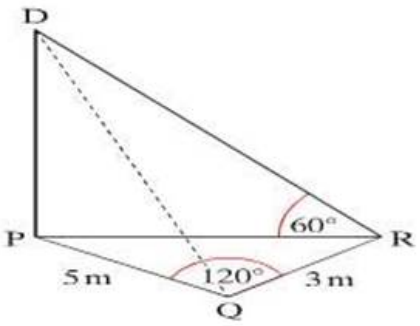
$C = \tan^{-1}\left(\frac{9}{31.9}\right)$

$C = 15.8\text{cm}$

5. P, Q and R are points on a horizontal plane.
[PD] is a vertical mast.
The angle of elevation of D from R is 60°.
If $|PQ| = 5\,m$, $|QR| = 3\,m$ and $|\angle PQR| = 120°$, find

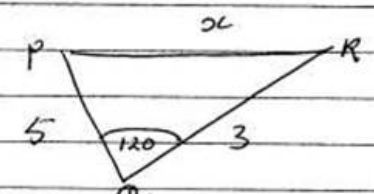
(i) $|PR|$

(ii) $|DQ|$, corect to the nearest metre.



Q5

(i) $|PR|$



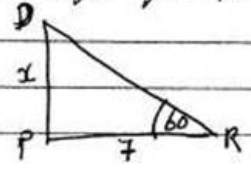
$x^2 = 5^2 + 3^2 - 2(5)(3)\cos(120)$

$x^2 = 34 - (-15)$

$x^2 = 49$

$x = \sqrt{49} = 7m$

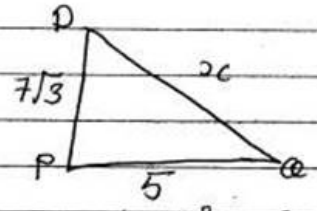
(ii) $|DQ|$ first find $|DP|$



$\tan 60 = \frac{x}{7}$

$\tan(60) \times 7 = x$

$7\sqrt{3}m = x$



$x^2 = (7\sqrt{3})^2 + 5^2$

$x^2 = 172$

$x = \sqrt{172} = 2\sqrt{43}$.

$x = 13.1\,m$

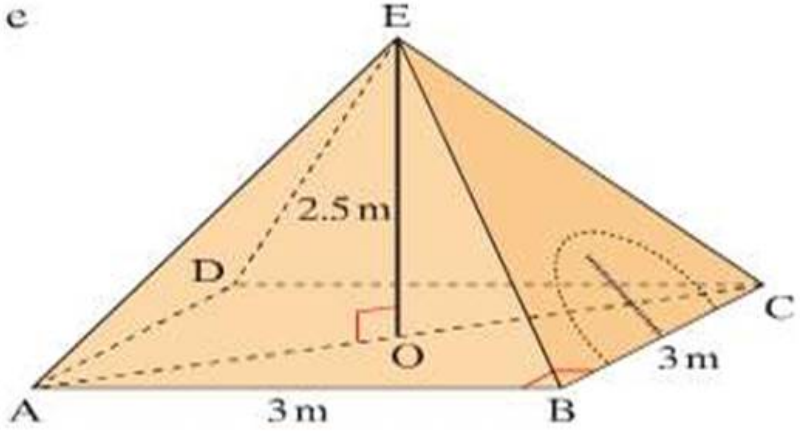
$\approx 13m$

6. A tent in the shape of a pyramid has a square base of side 3 metres and a central vertical pole of height 2.5 m.

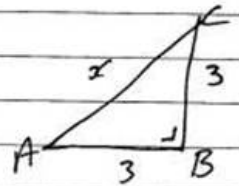
(i) Calculate the length of the slanted edge [AE], correct to one decimal place.

(ii) Find the total area of the four triangular faces. Give your answer in m^2, correct to one decimal place.

e



Q6 (i) |AE| first find diagonal of Base.

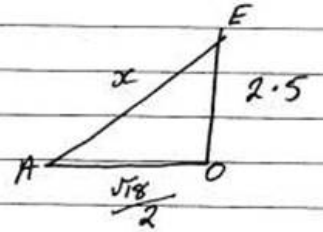


$x^2 = 3^2 + 3^2$

$x^2 = 18$

$x = \sqrt{18}$

$\Rightarrow \frac{1}{2}$ of base $= \sqrt{18}/2$ m

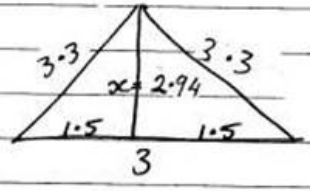


$x^2 = (2{\cdot}5)^2 + \left(\frac{\sqrt{18}}{2}\right)^2$

$x^2 = 10{\cdot}75\,m$

$x = 3{\cdot}3\,m$

(ii) Area of $\Delta = \frac{1}{2}$ base $\times$ h.



$3{\cdot}3^2 = (1{\cdot}5)^2 + x^2$

$10{\cdot}89 = 2{\cdot}25 + x^2$

$10{\cdot}89 - 2{\cdot}25 = x^2$

$8{\cdot}64 = x^2$

$x = \sqrt{8{\cdot}64} = 2{\cdot}94\,m$

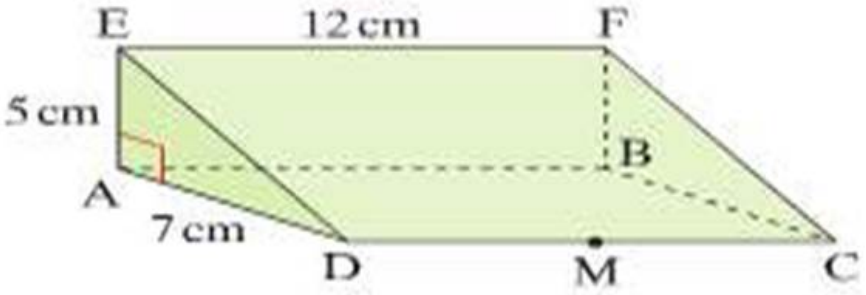
Area of $\Delta = 1{\cdot}5 \times 2{\cdot}94 = 4{\cdot}41\,m^2$

4 Δ's $= 4{\cdot}41 \times 4 = 17{\cdot}6\,m^2$

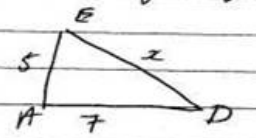
8. In the solid figure shown, ABCD is a horizontal rectangle and ABFE is a vertical rectangle.
M is the midpoint of [CD].
Given that $|AD| = 7\,\text{cm}$, $|AE| = 5\,\text{cm}$ and $|EF| = 12\,\text{cm}$, find

(i) $|DF|$ (ii) $|\angle BDF|$ (iii) $|\angle FMB|$.

Give each answer correct to one decimal place.

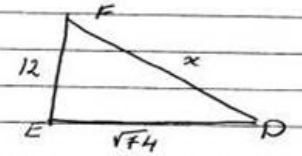


(i) $|DF|$ first find $|ED|$



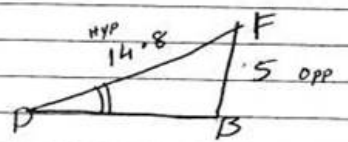
$x^2 = 5^2 + 7^2$
$x^2 = 74$
$x = \sqrt{74}$

Hence find $|DF|$



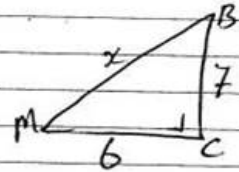
$x^2 = 12^2 + (\sqrt{74})^2$
$x^2 = 218$
$x = \sqrt{218} = 14.8$

(ii) $|\angle BDF|$

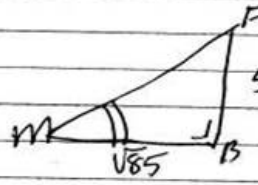


$\text{Sin } D = \frac{5}{14.8}$
$D = \text{Sin}^{-1}\left(\frac{5}{14.8}\right)$
$D = 19.7°$

(iii) $|\angle FMB|$ first find $|MB|$

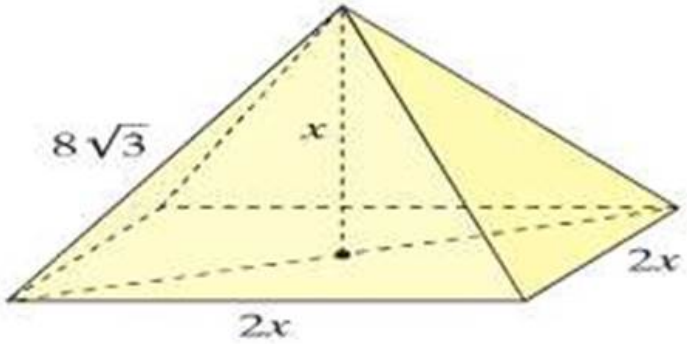


$x^2 = 7^2 + 6^2$
$x^2 = 85$
$x = \sqrt{85}$

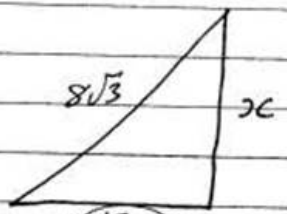


$\text{Tan } m = \frac{5}{\sqrt{85}}$
$m = \text{Tan}^{-1}\left(\frac{5}{\sqrt{85}}\right)$
$m = 28.5°$

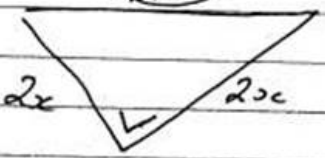
9. The diagram represents a right pyramid.
The base is a square of side $2x$ cm.
The length of each of the slant edges is $8\sqrt{3}$ cm.
The height of the pyramid is x cm.
Calculate the value of x.



Q9



Find diagonal of base:

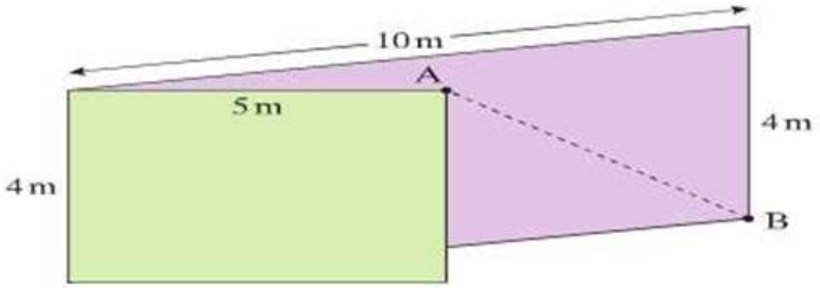


$Hyp^2 = (2x)^2 + (2x)^2$
$Hyp^2 = 4x^2 + 4x^2$
$Hyp^2 = 8x^2$
$Hyp = \sqrt{8x^2} = 2\sqrt{2}x$

$\Rightarrow \frac{1}{2}$ Diagonal $= \frac{2\sqrt{2}x}{2} = \sqrt{2}x$

$(8\sqrt{3})^2 = x^2 + (\sqrt{2}x)^2$
$192 = x^2 + 2x^2$
$192 = 3x^2$
$64 = x^2$
$8 = x$

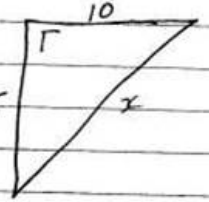
10. The given diagram shows two walls of length 10 metres and 5 metres meeting at right angles.
The height of each wall is 4 metres.



Calculate the distance between the points A and B on the walls.
Give your answer in metres, correct to one decimal place.

Q10

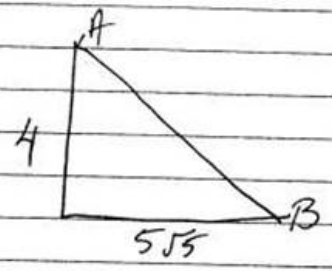
find dis from pt below A (on ground level) to B



$x^2 = 10^2 + 5^2$

$x^2 = 125$

$x = \sqrt{125} = 5\sqrt{5}$

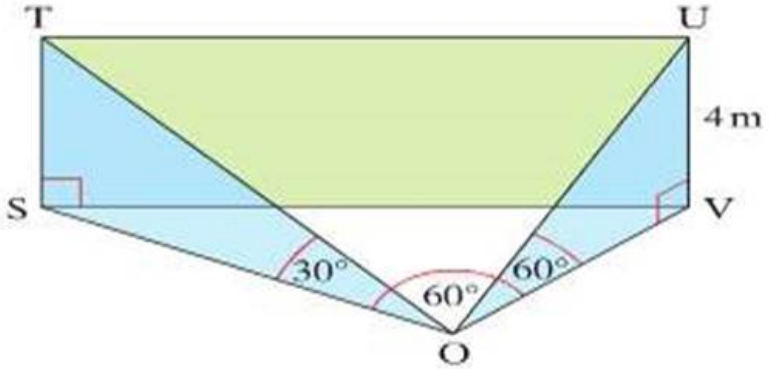


$x^2 = 4^2 + (5\sqrt{5})^2$

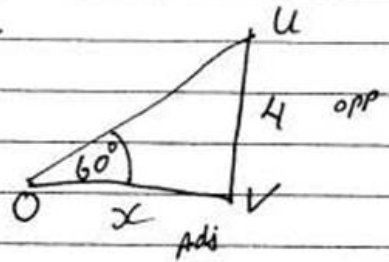
$x^2 = 141$

$x = \sqrt{141} = 11.9\text{m}$

11. The given figure shows a vertical wall TUVS four metres in height.
From a point O on level ground, the angle of elevation from O to U is 60° and the angle of elevation of T from O is 30°.
If $|\angle SOV| = 60°$, find the length of the wall [SV] in metres, correct to 1 place of decimals.



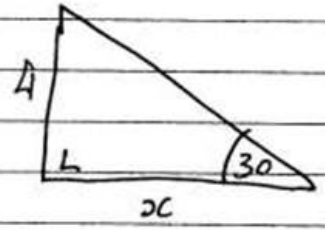
Q11



$\tan 60 = \frac{4}{x}$

$x = \frac{4}{\tan 60}$

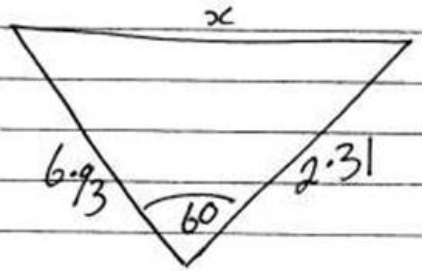
$x = 2 \cdot 31$



$\tan 30 = \frac{4}{x}$

$x = \frac{4}{\tan 30}$

$x = 6 \cdot 93$



$x^2 = (6 \cdot 93)^2 + (2 \cdot 31)^2 - 2(6 \cdot 93$ (Cos

$x^2 = 53 \cdot 361 - 16 \cdot 008$

$x^2 = 37 \cdot 3527$

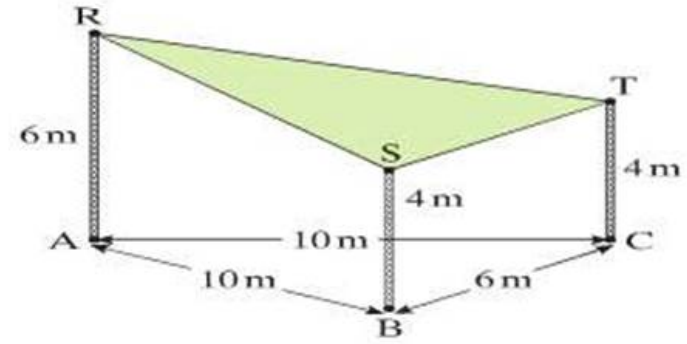
$x = 6 \cdot 1$

Q12

12. The given figure shows three vertical poles supporting a triangular roof RST.
$|AB| = |AC| = 10$ metres, $|AR| = 6$ m, $|SB| = |TC| = 4$ m and $|BC| = 6$ m.

(i) Find the area of the shelter ABC.

(ii) Find the area of the roof RST.

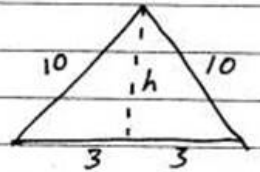


Q12

(i) Area $= \frac{1}{2}$ base $\times$ H.

$A = (3)(9.54)$

$= 28.6\ m^2$



Find h.

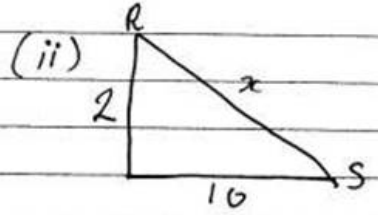
$10^2 = 3^2 + h^2$

$100 - 9 = h^2$

$91 = h^2$

$9.54 = h.$

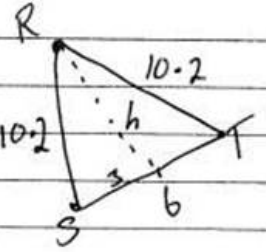
(ii)



$x^2 = 2^2 + 10^2$

$x^2 = 104$

$x = 10.2$



$(10.2)^2 = 3^2 + h^2$

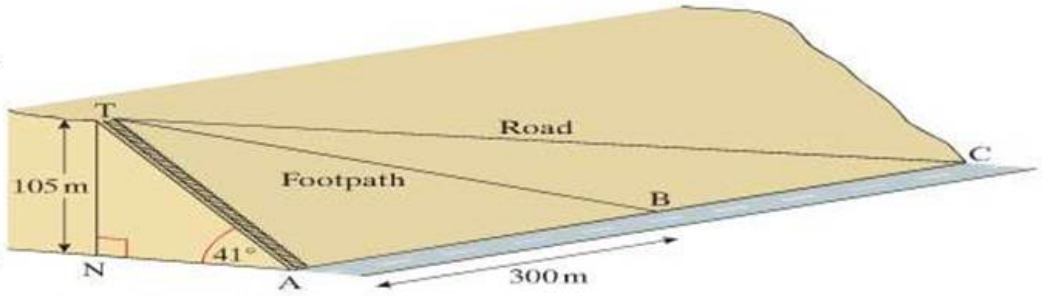
$95.04 = h$

$9.75 = h$

Area $= \frac{1}{2}(6)(9.75)$

Area $= 29.2\ m^2$

13. The diagram shows a plane hillside, which slopes at an angle of 41° to the horizontal. The vertical height of the hill is 105 m. A straight horizontal road ABC runs along the bottom of the hill. A funicular railway AT runs straight up the hillside.



(i) Calculate the length of the railway [AT], correct to the nearest metre.

A footpath goes straight from B to T, where |AB| = 300 m

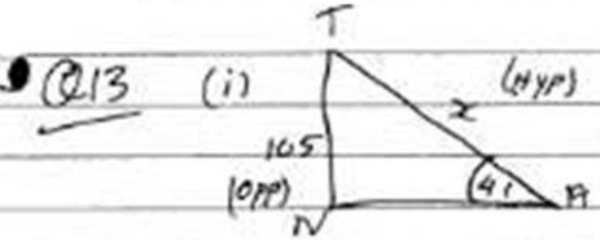
(ii) Calculate the length of the footpath [BT].

The straight road CT has a 'gradient of 1 in 5', meaning that it rises one metre vertically for every five metres travelled **along the road**.

(iii) Find the length of the road [CT].

(iv) Find |BC|, correct to the nearest metre.

Q13 (i)

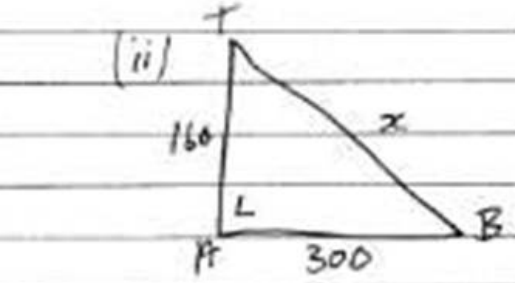


$\sin 41 = \frac{105}{x}$

$x = 105 / \sin 41$

$x = 160\text{ m}$

(ii)



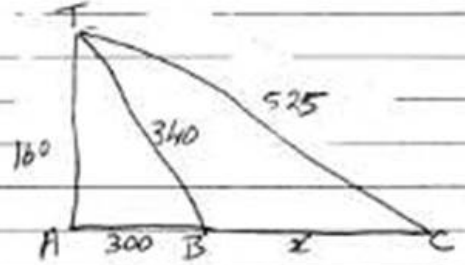
$x^2 = 300^2 + 160^2$

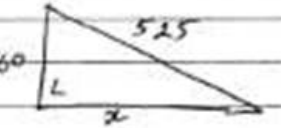
$x^2 = 115600$

$x = 340\text{ m}$

(iii) $105 \div 1 \times 5 = 525\text{m}$.

(iv)





$525^2 = 160^2 + x^2$

$250025 = x^2$

$500.02 = x$

$|BC| = 500 - 300$

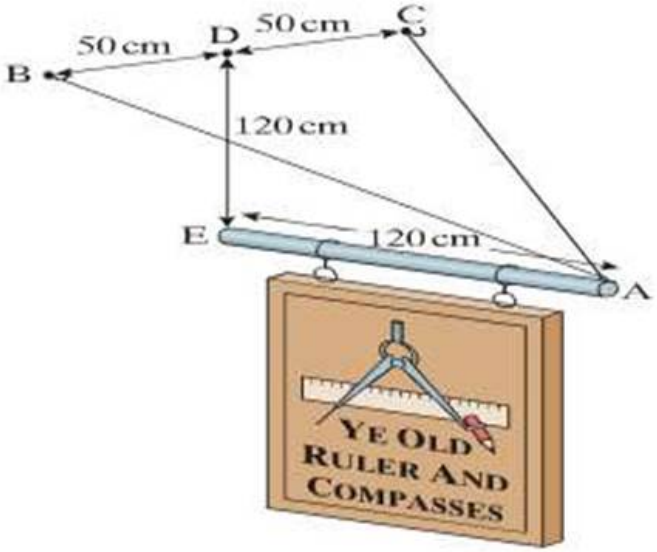
$= 200.02$

14. In the given diagram, a pole [EA] supports an inn sign. The pole is perpendicular to a vertical wall and is supported by two wires [AB] and [AC].
The hooks at B and C are in a horizontal line and D is 120 cm vertically above E.

(i) Calculate the length of [DA].

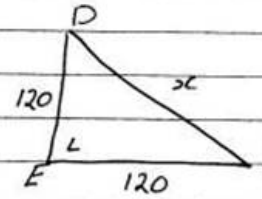
(ii) Calculate the length of each wire, correct to the nearest centimetre.

(iii) Find the angle that the wire AB makes with the wall, correct to the nearest degree.



Q14

(i) |DA|

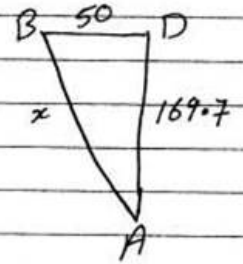


$x^2 = 120^2 + 120^2$

$x^2 = 28800$

$x = 169.7$ cm

(ii)

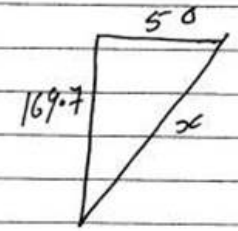


$x^2 = 50^2 + 169.7^2$

$x^2 = 31298.09$

$x = 176.91$

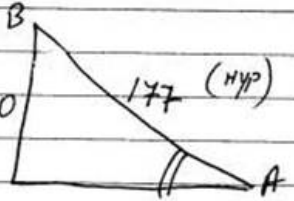
$= 177$ cm



$x^2 = 50^2 + 169.7^2$

$x = 177$ cm

(iii)



$\sin A = \frac{120}{177}$

$A = \sin^{-1}\left(\frac{120}{177}\right)$

$A = 42.68°$

$A = 43°$