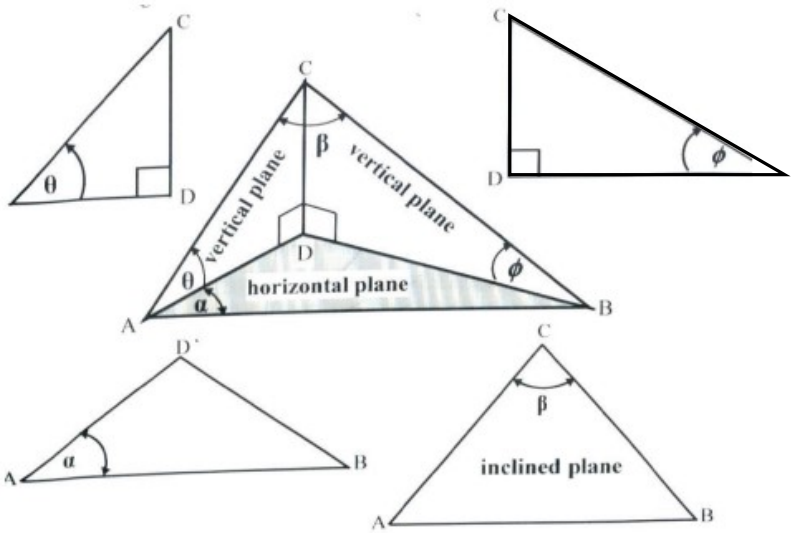
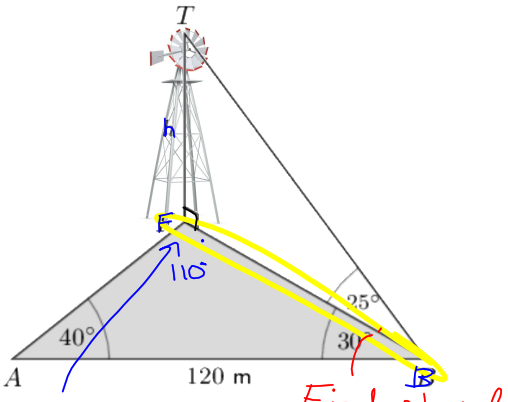
Lesson 4.5 Problems in Three Dimensions

Strategies for solving 3D Trig Problems

- Break the problem into two dimensional triangles.
- Use SOHCAHTOA in right angle triangles.
- Use Sine and Cosine laws in oblique triangles.
- Start in the triangle with the most given information.
- Look for common sides between triangles.
- Communicate your solution carefully - identify the triangle within which you are working.
- Label vertices so that it is simple to refer to side lengths and angles.



Ex. 1 Determine the height of the windmill.



Find shared side!

$\angle AFB = 180 - 40 - 30$
$= 110°$

$$\frac{a}{\sin 40} = \frac{120}{\sin 110}$$

$$a = \sin 40 \cdot \frac{120}{\sin 110}$$

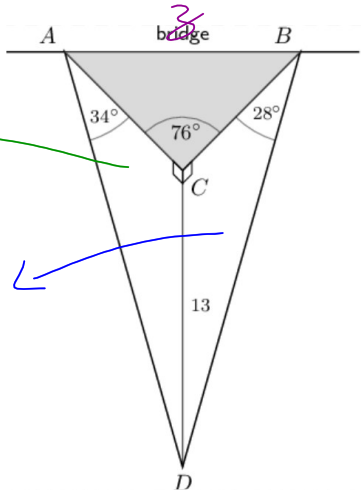
$$\doteq 82.1$$

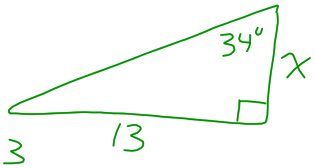
$$\tan 25° = \frac{h}{82.1}$$

$$h = 82.1 \cdot \tan 25°$$
$$\doteq 38.3$$

∴ The windmill is 38.3m high

Ex. 2 Annika and Balerie are standing at opposite ends of a bridge and Charles and Denis are standing in the river below. The angle between Annika's sightlines to Charlie and Denis is 34^0 and the angle between Balerie's sightlines to Charlie and Denis is 28^0. How long is the bridge? Additional measurements are included in the diagram.

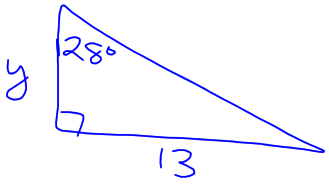




$\tan 34^\circ = \frac{13}{x}$

$x = \frac{13}{\tan 34^\circ}$

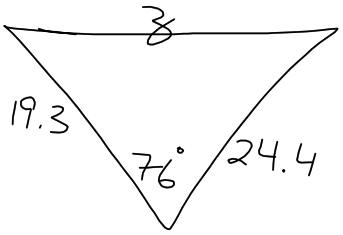
$\doteq 19.3$



$\tan 28^\circ = \frac{13}{y}$

$y = \frac{13}{\tan 28^\circ}$

$\doteq 24.4$

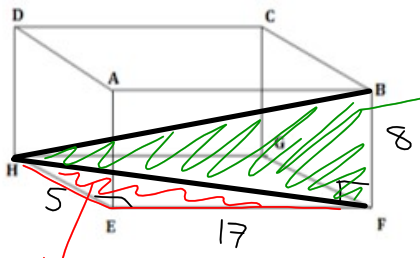


$z^2 = 19.3^2 + 24.4^2 - 2(19.3)(24.4)\cdot\cos 76^\circ$

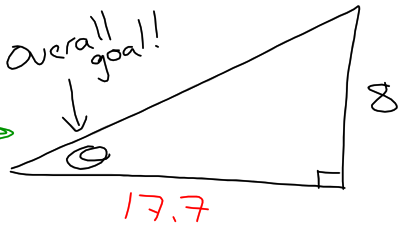
$z \doteq 27.2$

$\therefore$ The bridge is 27.2m wide

Ex. 3 A cuboid is shown below. The cuboid has a length of 17 cm, a width of 5 cm, and a height of 8 cm. Determine the size of the angle that BH makes with the plane EFGH.

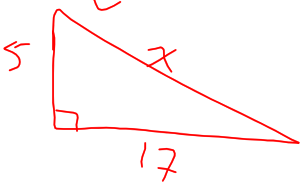


overall goal!



$\tan\theta = \frac{8}{17.7}$

$\theta \doteq 24.3°$

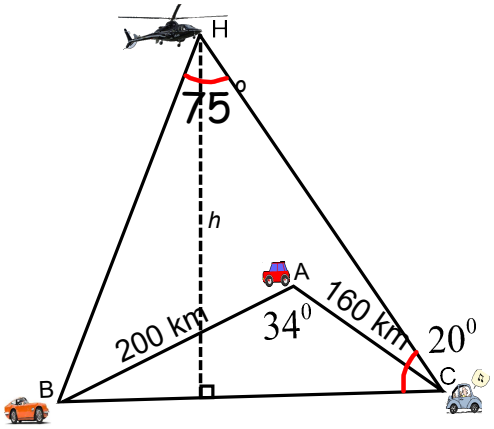


$x^2 = 5^2 + 17^2$

$x \doteq 17.7$

$\therefore$ The angle is 24.3°

Ex. 4 Determine the height of the helicopter (H).



Plan of approach

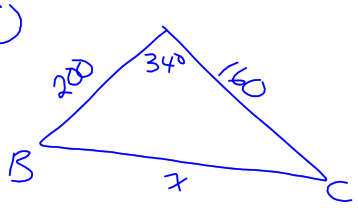
① Cosine law w/ flat △ to find BC

② Sine law w/ upright △ to find BH

③ Use interior angles to find ∠HBC

④ Use sin to solve for h

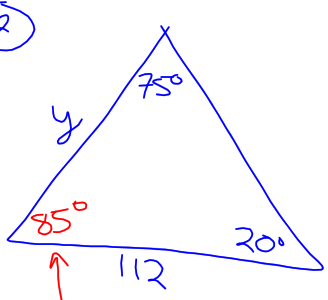
①



$x^2 = 200^2 + 160^2 - 2(200)(160)\cos 34°$

$x \doteq 112$

②



$\frac{y}{\sin 20} = \frac{112}{\sin 75°}$

$y = 39.6$

③ $\angle HBC = 180 - 75 - 20$

$= 85°$

④

$\sin 85° = \frac{h}{39.6}$

$h \doteq 39.5$

∴ The helicopter is 39.5 km high

HOMEWORK
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