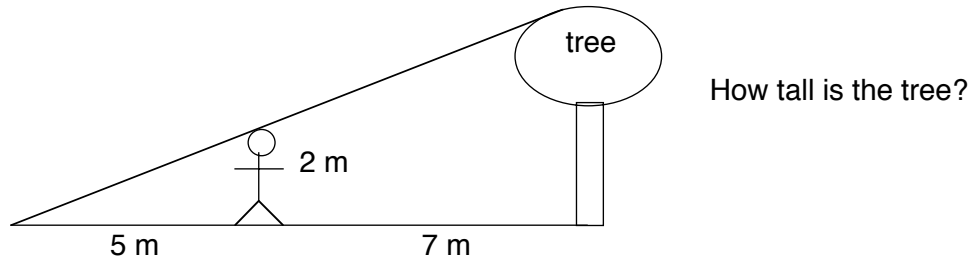
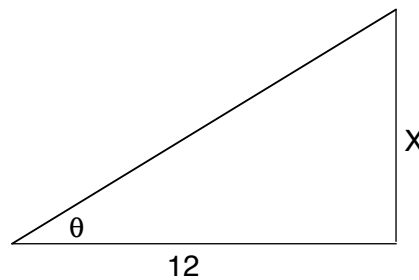
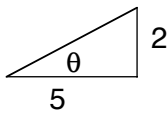


## Lesson 6 Angles of Elevation and Depression

Now we get a chance to apply all of our newly acquired skills in real life applications, otherwise known as word problems. The first section is in elevation and depression problems. I first encountered these in a Boy Scout Handbook many years ago. There was a picture of a tree, a man, and several lines.



Separating the picture into two triangles helps to clarify our ratios.



We could solve this with a proportion (two ratios) as

$$\frac{2}{5} = \frac{X}{11} \text{ and solve for } X.$$

Using our trig. abilities:

in the "man" triangle  $\tan \theta = \frac{2}{5} = .4$

We find that  $\theta = 21.8^\circ$

For the large triangle  $\tan 21.8^\circ = \frac{X}{12}$

$$(12)(.4) = X$$

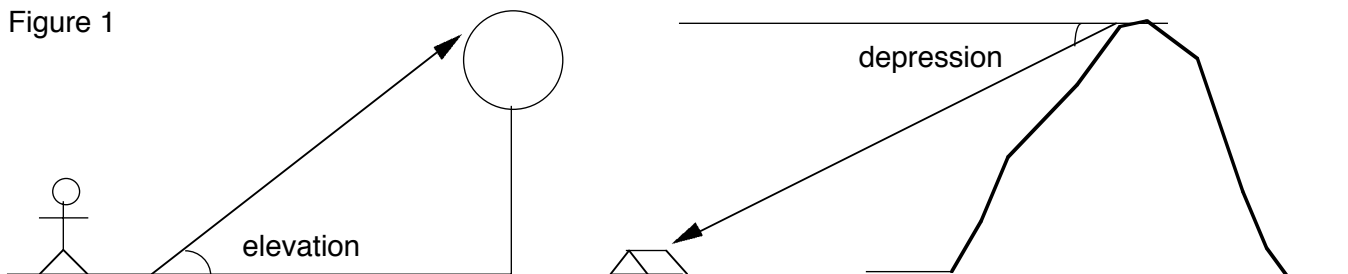
$$4.8 \text{ m} = X$$

The tree is 4.8 metres tall.

One of the key components in being a good problem solver is drawing a picture using all the data given. It turns a one dimensional group of words into a two dimensional picture.

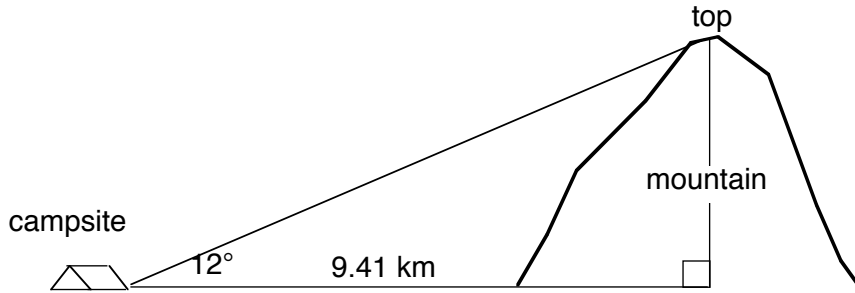
It is pretty obvious by the words themselves that an angle of elevation measures up, and an angle of depression down. Look at Figure 1.

Figure 1



We assume that the line where the angle begins is perfectly flat, or horizontal.

Example 1 A campsite is 9.41 km from a point directly below the mountain top. If the angle of elevation is  $12^\circ$  from the camp to the top of the mountain, how high is the mountain?



You can now see a right triangle, with the side adjacent to the  $12^\circ$  being 9.41 km long. To find the height of the mountain, which is the side opposite the  $12^\circ$  angle, the tangent is the best choice.

$$\tan 12^\circ = \frac{\text{height}}{9.41 \text{ km}}$$

$$(9.41)(\tan 12^\circ) = \text{height}$$

$$(9.41)(.2126) = \text{height}$$

$$2 \text{ km} = \text{height}$$

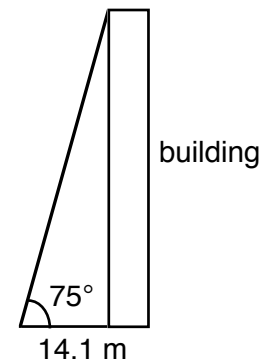
Example 2 At a point 14.1 m from the base of a building, the angle of elevation of the top is  $75^\circ$ . How tall is the building?

$$\tan 75^\circ = \frac{\text{height}}{14.1 \text{ m}}$$

$$(14.1)(\tan 75^\circ) = \text{height}$$

$$(14.1)(3.7321) = \text{height}$$

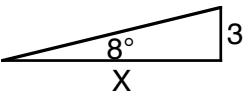
$$52.62 \text{ m} = \text{height of building}$$



### Practice Problems

- How far from the door must a ramp begin in order to rise 3 metres with an  $8^\circ$  angle of elevation?
- An A-frame cabin is 8.74 metres high at the center and the angle the floor makes with the base is  $53^\circ 15'$ . How wide is the base?

### Solutions

1) 

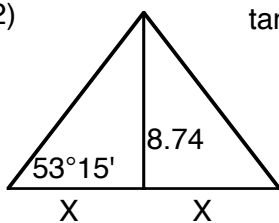
$$\tan 8^\circ = \frac{3}{X}$$

$$X \tan 8^\circ = 3$$

$$X = \frac{3}{\tan 8^\circ}$$

$$X = \frac{3}{.1405}$$

$$X = 21.35 \text{ m}$$

2) 

$$\tan 53.25^\circ = \frac{8.74}{X}$$

$$X = \frac{8.74}{\tan 53.25^\circ}$$

$$X = \frac{8.74}{1.3392}$$

$$X = 6.53 \quad 2X = 13.06 \text{ m}$$