

## Tan Inverse

Consider the equations  $x^2 = 16$ ,  $2x = 16$  and  $x + 2 = 16$ .  
If we want to isolate  $x$  in each of these equations, we do the following

$$\begin{array}{l} \sqrt{x^2} = \sqrt{16} \\ x = 4 \end{array} \quad \text{and} \quad \begin{array}{l} \frac{2x}{2} = \frac{16}{2} \\ x = 8 \end{array} \quad \text{and} \quad \begin{array}{l} x + 2 - 2 = 16 - 2 \\ x = 14 \end{array}$$

We use opposite (or inverse) operations to isolate  $x$ .

Opposite (or inverse) operations can also be used to isolate  $\Theta$  when it is bound by a trigonometric function.

### Example 1

Suppose  $\tan \theta = 1$ . Can we solve for  $\Theta$ ? Yes!

$$\tan \theta = 1$$

Notice that when we use inverse trigonometric functions, the answer is an angle.

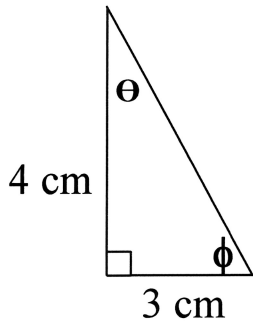
Typically, we would skip the second step above and write the solution as follows:

$$\begin{aligned} \tan \theta &= 1 \\ \theta &= \tan^{-1}(1) \\ \theta &= 45^\circ \end{aligned}$$

Remember to keep your calculator in 'degree' mode.

## Example 2

Use  $\tan^{-1}$  to find the enclosed angles

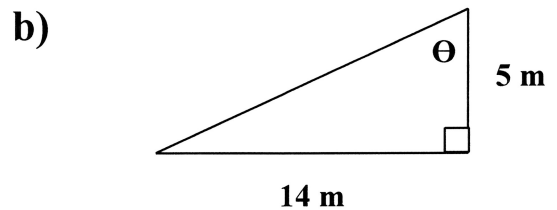
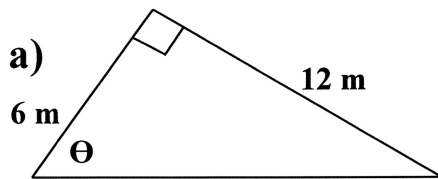


**Note:** The inverse functions can be activated on your calculator by first pressing the 2<sup>nd</sup>/shift button followed by the 'tan' button.

**Notice,** in the above example, that all of the angles in the triangle add up to  $180^\circ$  as they should by ASTT.

## Example 3

Determine the angle  $\theta$  in each diagram.



## Homework – Inverse Tangent

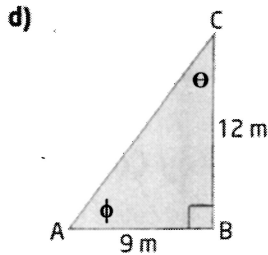
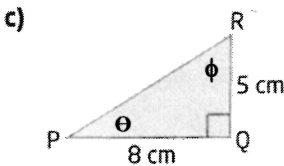
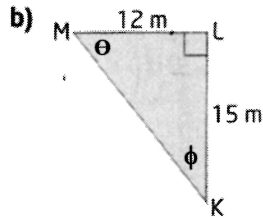
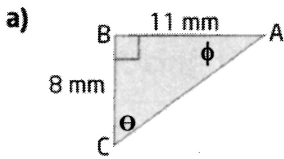
1. Find the measure of each angle, to the nearest degree.

a)  $\tan \theta = 1.5$

b)  $\tan \theta = \frac{6}{7}$

c)  $\tan \theta = \frac{15}{9}$

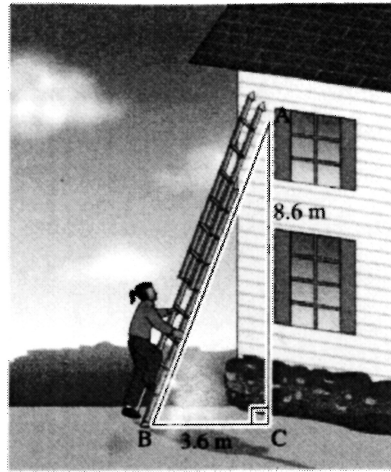
2. Find the measures of both acute angles in each triangle, to the nearest degree.



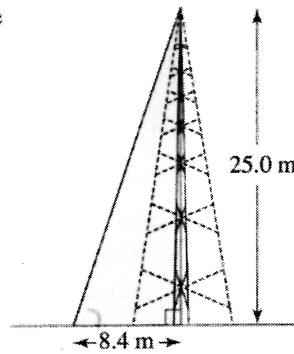
3. An extension ladder is leaning against a wall. The foot of the ladder is 3.6 m from the wall. The top of the ladder reaches 8.6 m up the wall.

a) Calculate the measure of the angle formed by the ladder and the ground.

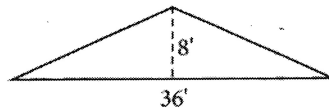
b) Calculate the length of the ladder.



4. A guy wire supports a tower. The wire is attached to the tower at a height of 25.0 m. The guy wire is attached to the ground 8.4 m from the base of the tower. Calculate the measure of the angle formed by the guy wire and the ground.



5. A roof truss spans a width of 36' and has a height of 8'. The sides that join at the top of the truss are equal in length.



- a) Find the angle formed by the two sides that join at the top of the truss.  
 b) Find the length of the equal sides.

**Answers:**

1. a)  $56^\circ$  b)  $41^\circ$  c)  $59^\circ$

2. a)  $\theta = 54^\circ$ ,  $\phi = 36^\circ$

b)  $\theta = 51^\circ$ ,  $\phi = 39^\circ$

c)  $\theta = 32^\circ$ ,  $\phi = 58^\circ$

d)  $\theta = 37^\circ$ ,  $\phi = 53^\circ$

3. a)  $67^\circ$  b) 9.3 m

4.  $71^\circ$  5. a)  $132^\circ$  b) 19.7 feet