

## Tangent's Friend the Sine and Cosine Ratio

Thus far, the only trigonometric equation that we have been using is the *tangent ratio*. This equation is limited since it only makes use of the opposite and adjacent; the hypotenuse is not part of the tangent ratio.

There are two other trigonometric ratios that can be used,

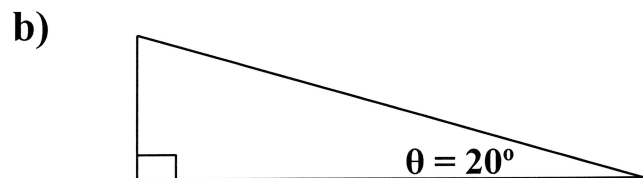
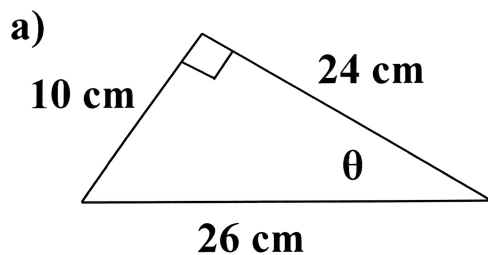
$$\sin \theta = \frac{\textit{opposite}}{\textit{hypotenuse}} \qquad \cos \theta = \frac{\textit{adjacent}}{\textit{hypotenuse}} \qquad \tan \theta = \frac{\textit{opposite}}{\textit{adjacent}}$$

All three ratios can be memorized using the following acronym:

SOH CAH TOA

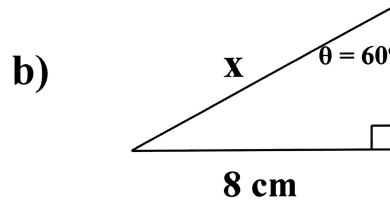
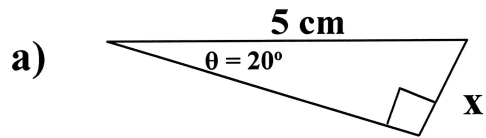
### Example 1:

For the following triangles, label the sides opposite, adjacent and hypotenuse. Calculate  $\sin \theta$ ,  $\cos \theta$ , and  $\tan \theta$ .



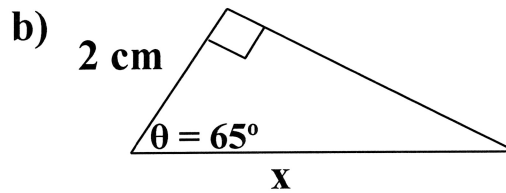
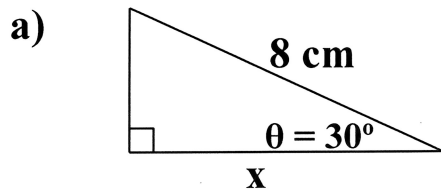
**Example 2:**

Determine the length by using the sine equation (to 1 decimal place).



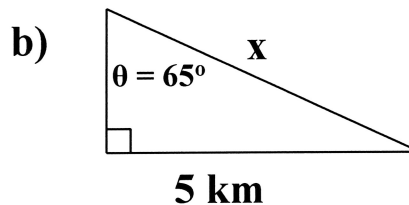
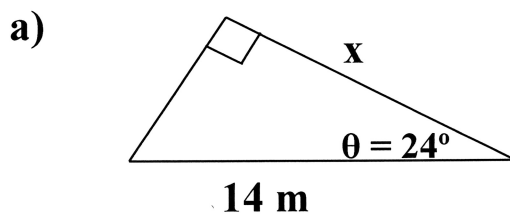
**Example 3:**

Determine the length  $x$  by using the cosine equation (to 1 decimal place).



**Example 4:**

Determine the length  $x$  using a trigonometric ratio.

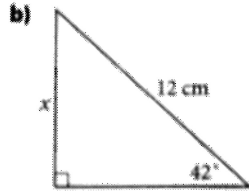
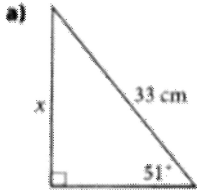


## Practice - Introduction to Sine and Cosine Ratio

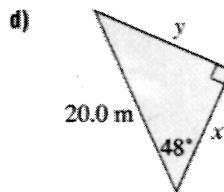
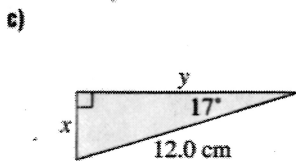
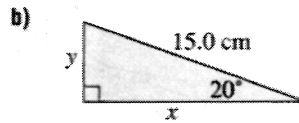
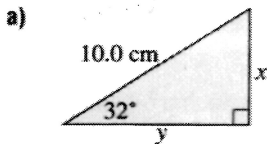
1. Use a scientific calculator to find each value to four decimal places.

- |                    |                    |                    |
|--------------------|--------------------|--------------------|
| a) $\sin 42^\circ$ | b) $\sin 33^\circ$ | c) $\cos 19^\circ$ |
| d) $\sin 88^\circ$ | e) $\cos 74^\circ$ | f) $\cos 38^\circ$ |
| g) $\sin 45^\circ$ | h) $\cos 42^\circ$ |                    |

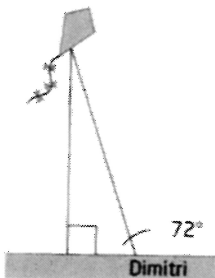
2. Find  $x$  to the nearest tenth of a centimetre.



3. Determine each value of  $x$ . Use the Pythagorean Theorem to determine each value of  $y$ .

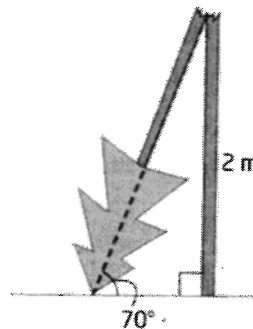


4. Dmitri has let out 40 m of his kite string, which makes an angle of  $72^\circ$  with the horizontal ground.



- a) Find the height of the kite, to the nearest metre.
- b) Suppose the Sun is shining directly above the kite. How far is the kite's shadow from Dimitri, to the nearest metre?

5. A tree is splintered by lightning 2 m up its trunk, so that the top part of the tree touches the ground. The angle the top of the tree forms with the ground is  $70^\circ$ . Before it was splintered, how tall was the tree, to the nearest tenth of a metre?



Answers: 1.a) 0.6691 b) 0.5446 c) 0.9455 d) 0.9994 e) 0.2756 f) 0.7880 g) 0.7071

h) 0.7431 2. a) 25.6 cm b) 8.0 cm 3. a)  $x = 5.3$  cm,  $y = 8.5$  cm b)  $x = 14.1$  cm,  $y = 5.1$  cm

c)  $x = 3.5$  cm,  $y = 11.5$  cm d)  $x = 13.4$  m,  $y = 14.9$  m 4. a) 38.0 m b) 12.4 m 5. 4.13 m