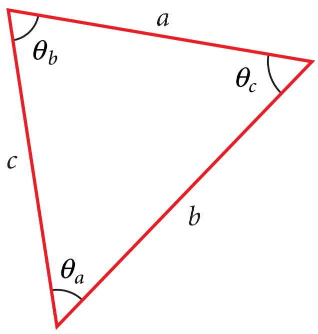

Figure 6

theorem is useful when two sides of a right triangle are known but the third side is not. For example, if $c = 2.0$ m and $a = 1.0$ m, you could find b using the Pythagorean theorem as follows:

$$b = \sqrt{c^2 - a^2} = \sqrt{(2.0\ \text{m})^2 - (1.0\ \text{m})^2}$$
$$b = \sqrt{4.0\ \text{m}^2 - 1.0\ \text{m}^2} = \sqrt{3.0\ \text{m}^2}$$
$$\boxed{b = 1.7\ \text{m}}$$

Law of sines and law of cosines The law of sines may be used to find angles of any general triangle. The law of cosines is used for calculating one side of a triangle when the angle opposite and the other two sides are known. If *a, b,* and *c* are the three sides of the triangle and θ_a, θ_b, and θ_c are the three angles opposite those sides, as shown in **Figure 6,** the following relationships hold true:

$$\frac{a}{\sin \theta_a} = \frac{b}{\sin \theta_b} = \frac{c}{\sin \theta_c}$$
$$c^2 = a^2 + b^2 - 2ab \cos \theta_c$$

Accuracy in Laboratory Calculations

Absolute error Some of the laboratory experiments in this book involve finding a value that is already known, such as free-fall acceleration. In this type of experiment, the accuracy of your measurements can be determined by comparing your results with the accepted value. The absolute value of the difference between your experimental or calculated result and the accepted value is called the *absolute error*. Thus, absolute error can be found with the following equation:

$$\text{absolute error} = \left| \text{experimental} - \text{accepted} \right|$$

Be sure not to confuse accuracy with precision. The *accuracy* of a measurement refers to how close that measurement is to the accepted value for the quantity being measured. *Precision* depends on the instruments used to measure a quantity. A meterstick that includes millimeters, for example, will give a more precise result than a meterstick whose smallest unit of measure is a centimeter. Thus, a measurement of 9.61 m/s^2 for free-fall acceleration is more precise than a measurement of 9.8 m/s^2, but 9.8 m/s^2 is more accurate than 9.61 m/s^2.

Relative error Note that a measurement that has a relatively large absolute error may be more accurate than a measurement that has a smaller absolute error if the first measurement involved much larger quantities. For this reason, the percentage error, or *relative error,* is often more meaningful than the absolute error. The relative error of a measured value can be found with the following equation:

$$\text{relative error} = \frac{(\text{experimental} - \text{accepted})}{\text{accepted}}$$