A resultant vector represents the sum of two or more vectors

When adding vectors, you must make certain that they have the same units and describe similar quantities. For example, it would be meaningless to add a velocity vector to a displacement vector because they describe different physical quantities. Similarly, it would be meaningless, as well as incorrect, to add two displacement vectors that are not expressed in the same units. For example, you cannot add meters and feet together.

Section 1 of the chapter "Motion in One Dimension" covered vector addition and subtraction in one dimension. Think back to the example of the gecko that ran up a tree from a 20 cm marker to an 80 cm marker. Then the gecko reversed direction and ran back to the 50 cm marker. Because the two parts of this displacement are opposite, they can be added together to give a total displacement of 30 cm. The answer found by adding two vectors in this way is called the **resultant.**

Did you know?

The word *vector* is also used by airline pilots and navigators. In this context, a vector is the particular path followed or to be followed, given as a compass heading.

resultant

a vector that represents the sum of two or more vectors

Vectors can be added graphically

Consider a student walking 1600 m to a friend's house and then 1600 m to school, as shown in **Figure 2.** The student's total displacement during his walk to school is in a direction from his house to the school, as shown by the dotted line. This direct path is the *vector sum* of the student's displacement from his house to his friend's house and his displacement from the friend's house to school. How can this resultant displacement be found?

One way to find the magnitude and direction of the student's total displacement is to draw the situation to scale on paper. Use a reasonable scale, such as 50 m on land equals 1 cm on paper. First draw the vector representing the student's displacement from his house to his friend's house, giving the proper direction and scaled magnitude. Then draw the vector representing his walk to the school, starting with the tail at the head of the first vector. Again give its scaled magnitude and the right direction. The magnitude of the resultant vector can then be determined by using a ruler. Measure the length of the vector pointing from the tail of the first vector to the head of the second vector. The length of that vector can then be multiplied by 50 (or whatever scale you have chosen) to get the actual magnitude of the student's total displacement in meters.

The direction of the resultant vector may be determined by using a protractor to measure the angle between the resultant and the first vector or between the resultant and any chosen reference line.

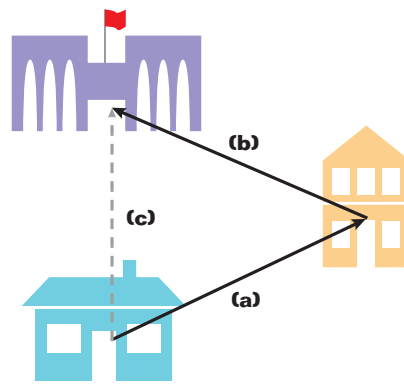

Figure 2

A student walks from his house to his friend's house **(a),** then from his friend's house to the school **(b).** The student's resultant displacement **(c)** can be found by using a ruler and a protractor.