When subtracting vectors in two dimensions, first draw the negative of the vector to be subtracted. Then add that negative vector to the other vector by using the triangle method of addition.

Multiplying or dividing vectors by scalars results in vectors

There are mathematical operations in which vectors can multiply other vectors, but they are not needed in this book. This book does, however, make use of vectors multiplied by scalars, with a vector as the result. For example, if a cab driver obeys a customer who tells him to go twice as fast, that cab's original velocity vector, $\mathbf{v}_{cab}$, is multiplied by the scalar number 2. The result, written $2\mathbf{v}_{cab}$, is a vector with a magnitude twice that of the original vector and pointing in the same direction.

On the other hand, if another cab driver is told to go twice as fast in the opposite direction, this is the same as multiplying by the scalar number −2. The result is a vector with a magnitude two times the initial velocity but pointing in the opposite direction, written as $-2\mathbf{v}_{cab}$.

SECTION REVIEW

1. Which of the following quantities are scalars, and which are vectors?
   - **a.** the acceleration of a plane as it takes off
   - **b.** the number of passengers on the plane
   - **c.** the duration of the flight
   - **d.** the displacement of the flight
   - **e.** the amount of fuel required for the flight
2. A roller coaster moves 85 m horizontally, then travels 45 m at an angle of 30.0° above the horizontal. What is its displacement from its starting point? Use graphical techniques.
3. A novice pilot sets a plane's controls, thinking the plane will fly at 2.50×10^2 km/h to the north. If the wind blows at 75 km/h toward the southeast, what is the plane's resultant velocity? Use graphical techniques.
4. While flying over the Grand Canyon, the pilot slows the plane down to one-half the velocity in item 3. If the wind's velocity is still 75 km/h toward the southeast, what will the plane's new resultant velocity be? Use graphical techniques.
5. **Critical Thinking** The water used in many fountains is recycled. For instance, a single water particle in a fountain travels through an 85 m system and then returns to the same point. What is the displacement of this water particle during one cycle?