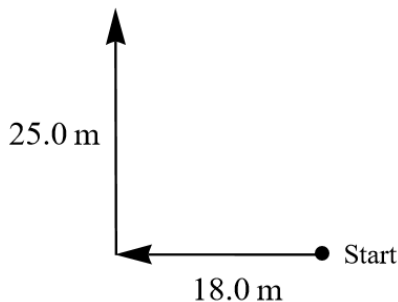


## Problem 27

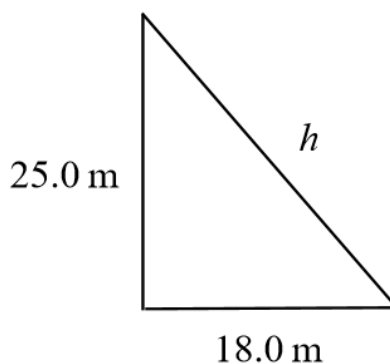
Suppose you walk 18.0 m straight west and then 25.0 m straight north. How far are you from your starting point and what is the compass direction of a line connecting your starting point to your final position? Use a graphical method.

### Solution

Draw a schematic of the path.



Notice that it forms two sides of a right triangle, and the distance between the start and finish points is the length of the hypotenuse.



The Pythagorean theorem relates the sides of a right triangle.

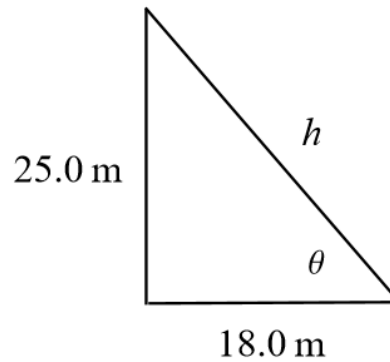
$$h^2 = (18.0 \text{ m})^2 + (25.0 \text{ m})^2$$

$$h = \sqrt{18.0^2 + 25.0^2} \text{ m}$$

$$\approx 30.8 \text{ m}$$

This is how far you are from the starting point.

To find the direction of the line going from start to finish, calculate the angle  $\theta$  it makes with the horizontal.



This is a right triangle, so the trigonometric functions apply here. The one which relates the opposite and adjacent sides is the tangent function.

$$\tan \theta = \frac{\text{opposite}}{\text{adjacent}} = \frac{25.0 \text{ m}}{18.0 \text{ m}} \rightarrow \theta = \tan^{-1} \left( \frac{25}{18} \right) \approx 54.2^\circ$$

Therefore, the compass direction of the line connecting your starting and finishing points is  $54.2^\circ$  north of west.