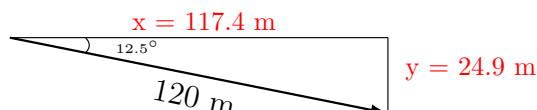


Position and Displacement 1

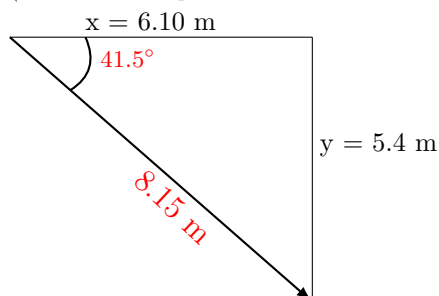
1. A submarine dives 120.0 m at an angle of 12.0° below the horizontal. What are the horizontal and vertical components of the submarine's displacement? Draw a diagram.



$$\begin{aligned}\cos(12.5^\circ) &= \frac{x}{120} \\ x &= \cos(12.5^\circ) \times 120 \\ x &= 117.4 \text{ m}\end{aligned}$$

$$\begin{aligned}\sin(12.5^\circ) &= \frac{y}{120} \\ y &= \sin(12.5^\circ) \times 120 \\ y &= 24.9 \text{ m}\end{aligned}$$

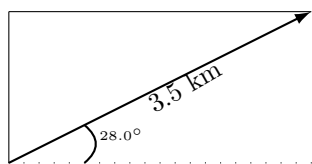
2. A golfer takes two putts to sink his ball in the hole once he is on the green. The first putt displaces the ball 6.10 m east, and the second putt displaces it 5.40 m south. What displacement would put the ball in the hole in one putt? (reminder: displacement is a vector, so therefore you must find a magnitude and direction)



$$\begin{aligned}6.1^2 + 5.4^2 &= c^2 \\ 66.37 &= c^2 \\ 8.15 &= c\end{aligned}$$

$$\begin{aligned}\tan \theta &= \frac{5.4}{6.10} \\ \tan \theta &= .885 \\ \tan^{-1}(.885) &= 41.5^\circ\end{aligned}$$

3. A person walks 28.0° north of east for 3.50 km. How far would another person walk due north and due east to arrive at the same location?



$$6.1^2 + 5.4^2 = c^2$$

$$66.37 = c^2$$

$$8.15 = c$$

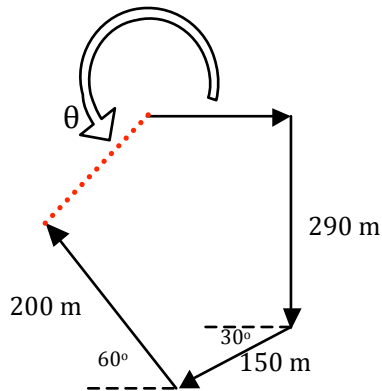
$$\tan \theta = \frac{5.4}{6.10}$$

$$\tan \theta = .885$$

$$\tan^{-1}(.885) = 41.5^\circ$$

4. A roller coaster travels 38.1 m at an angle of 46.0° above the horizontal. How far does it move horizontally? How far does it move vertically?

5. A person walks the path shown in the figure below. The total trip consists of four straight-line paths. At the end of the walk, what is the person's resultant displacement measured from the starting point? Find the distance, and the direction, measured counterclockwise from the $+x$ direction.



6. The eye of a hurricane passes over Grand Bahama Island. It is moving in a direction 60.0° north of west with a speed of $v_1 = 36.0$ km/h. Exactly three hours later, the course of the hurricane shifts due north, and its speed slows to $v_2 = 27.0$ km/h, as shown in Figure 3-30. How far from Grand Bahama, in kilometers, is the hurricane 4.50 h after it passes over the island?

