

## FUNDAMENTAL CONCEPTS (p. 26)

$$\begin{array}{ll} x = r \cos \theta & r = \sqrt{x^2 + y^2} \\ y = r \sin \theta & \theta = \tan^{-1}\left(\frac{y}{x}\right) \end{array}$$

1.

$$\begin{array}{ll} \text{(a)} & r = \sqrt{250^2 + 350^2} = 430 \text{ cm} \\ & \theta = \tan^{-1}(350/250) = 54.5^\circ \end{array} \quad \begin{array}{ll} \text{(b)} & r = \sqrt{2.00^2 + 1.000^2} = 2.24 \text{ kN} \\ & \theta = \tan^{-1}(1.000/2.00) = 26.6^\circ \end{array}$$

$$\begin{array}{ll} \text{(c)} & r = \sqrt{-10.00^2 + -20.0^2} = 22.4 \text{ m/s} \\ & \theta = \tan^{-1}(-20.0/-10.00) = -116.6^\circ \end{array} \quad \begin{array}{ll} \text{(d)} & r = \sqrt{1000^2 + 2000^2} = 2240 \text{ N} \\ & \theta = \tan^{-1}(2000/1000) = 63.4^\circ \end{array}$$

$$\begin{array}{ll} \text{(e)} & r = \sqrt{25.0^2 + (-35.0)^2} = 43.0 \text{ m/s}^2 \\ & \theta = \tan^{-1}(350/250) = -54.5^\circ \end{array} \quad \begin{array}{ll} \text{(f)} & r = \sqrt{-5.00^2 + 15.00^2} = 15.81 \text{ kN} \\ & \theta = \tan^{-1}(15.00/-5.00) = 108.4^\circ \end{array}$$

3.

$$\begin{array}{ll} \text{(a)} & x = 25.0 \cos 25.0^\circ = 22.7 \text{ m/s} \\ & y = 25.0 \sin 25.0^\circ = 10.57 \text{ m/s} \end{array} \quad \begin{array}{ll} \text{(b)} & x = 10.00 \cos 30.0^\circ = 8.66 \text{ N} \\ & y = 10.00 \sin 30.0^\circ = 5.00 \text{ N} \end{array}$$

$$\begin{array}{ll} \text{(c)} & x = 100.0 \cos -45.0^\circ = 70.7 \text{ m/s}^2 \\ & y = 100.0 \sin -45.0^\circ = -70.7 \text{ m/s}^2 \end{array} \quad \begin{array}{ll} \text{(d)} & x = 5.00 \cos(\pi/2) = 0.0 \text{ m} \\ & y = 5.00 \sin(\pi/2) = 5.00 \text{ m} \end{array}$$

$$\begin{array}{ll} \text{(e)} & x = 25.0 \cos 160.0^\circ = -23.5 \text{ N} \\ & y = 25.0 \sin 160.0^\circ = 8.55 \text{ N} \end{array} \quad \begin{array}{ll} \text{(f)} & x = 25.0 \cos(\pi/4) = 17.68 \text{ m/s} \\ & y = 25.0 \sin(\pi/4) = 17.68 \text{ m/s} \end{array}$$

5.

Sum of sides is always greater than length of hypotenuse.

7.

$$\text{(a)} \quad (30.0 - 20.0, 50.0 - 40.0) = (10.00, 10.00) \text{ cm}$$

$$\text{(b)} \quad (400 - 500, 700 - 400) = (-100.0, 300) \text{ N}$$

9.

$$\underline{\mathbf{R}} = (750, 1000) \text{ N} = 1250 \text{ N at } 53.1 \text{ deg}$$

11.

$$r = \sqrt{2.75^2 + 5.25^2} = 5.93 \text{ km}$$