1. After walking 11 km due north from camp, a hiker then walks 11 km due east.
   a) What is the total distance walked by the hiker?
   b) Determine the total displacement from the starting point.

2) Two boys push on a box. One pushes with a force of 125 N to the east. The other exerts a force of 165 N to the north. What is the size and direction of the resultant force on the box?

3) An explorer walks 13 km due east, then 18 km north, and finally 3 km west.
   a) What is the total distance walked?
   b) What is the resulting displacement of the explorer from the starting point?

4) A motorboat heads due east at 16 m/s across a river that flows due north at 9.0 m/s.
   a) What is the resultant velocity (speed and direction) of the boat?
   b) If the river is 136 m wide, how long does it take the motorboat to reach the other side?
   c) How far downstream is the boat when it reaches the other side of the river?

5) While flying due east at 120 km/h, an airplane is also carried northward at 45 km/h by the wind blowing due north. What is the plane's resultant velocity?

7) A motorboat travels at 8.5 m/s. It heads straight across a river 110 m wide.
   a) If the water flows downstream at a rate of 3.8 m/s, what is the boat's resultant velocity?
   b) How long does it take the boat to reach the opposite shore?

8) A boat heads directly across a river 41 m wide at 3.8 m/s. The current is flowing downstream at 2.2 m/s.
   a) What is the resultant velocity of the boat?
   b) How much time does it take the boat to cross the river?
   c) How far downstream is the boat when it reaches the other side?

10) A heavy box is pulled across a wooden floor with a rope. The rope makes an angle of 60° with the floor. A force of 75 N is exerted on the rope. What is the component of the force parallel to the floor?

11) An airplane flies toward 149° at 525 km/h. What is the component of the plane's velocity
   a) toward 90°?
   b) toward 180°?
12) A student exerts a force of 72 N along the handle of a lawn mower to push it across the lawn. Find the horizontal component of this force when the handle is held at an angle with the lawn of
   a) 60°.
   b) 40°.
   c) 30°.

13) A hiker walks 14.7 km at an angle of 305° from east. Find the east-west and north-south components of this walk.

15) A net force of 55 N acts due west on an object. What single force on the object produces equilibrium?

16) Two forces act on an object. One force is 6.0 N horizontally. The second force is 8.0 N vertically.
   a) Find the magnitude and direction of the resultant.
   b) If the object is in equilibrium, find the magnitude and direction of the force that produces equilibrium.

   a) Determine the resultant force.
   b) What is the magnitude and direction of the force that produces equilibrium?

18) Two forces act on an object. A 36-N force acts at 225°. A 48-N force acts at 315°. What would be the magnitude and direction of their equilibrant?
1. \[ \text{total distance} = 22 \text{ km} \]
   
   \[ 121 + 121 = c^2 \]
   
   \[ \sqrt{242} = c \]
   
   \[ 15.6 \text{ km} \]

2. \[125 \text{ N} \]

   \[105 \text{ N} \]

3. \[ \text{total distance} = 34 \text{ km} \]

4. \[ \text{a)} \quad \| \vec{P} \| = \sqrt{10^2 + 18^2} \]
   
   \[ \| \vec{P} \| = 20.6 \text{ km} \]

5. \[ \| \vec{F} \| = \sqrt{45^2 + 120^2} \]

   \[ \| \vec{F} \| = 128.2 \text{ km/h} \]
7. \quad a) \|p\| = \sqrt{3.8^2 + 8.5^2} = 9.3 \text{ m/s} \\
    b) \frac{\|p\|}{8.5} = 12.9 \text{ seconds} \\
8. \quad a) \|p\| = \sqrt{3.8^2 + 2.2^2} = 4.4 \text{ m/s} \\
    b) 10.7 \text{ seconds} \\
10. \quad \text{component means to find } \langle x, y \rangle \\
    \text{find x ble parallel to floor} \\
    \cos(\theta) = \frac{x}{75} \\
    75\cos(\theta) = x \\
    \boxed{37.5 = x} \\
11. \quad \langle x, y \rangle \\
    a) \sin(31) = \frac{y}{525} \\
    525\sin(31) = y \\
    \boxed{270.4 = y} \\
    b) x \cos(31) = \frac{x}{525} \\
    525\cos(31) = x \\
    \boxed{450 = x} \\
12. \quad \text{horizontal component is } x \\
    a) 72\cos(30) = 62.4 \text{ N} \\
    b) 72\cos(40) = 55.2 \text{ N} \\
    c) 72\cos(60) = 36.0 \text{ N}
13.

\[ \text{e/w} = x \]
\[ \text{n/s} = y \]

\[ \cos(55) = \frac{x}{14.7} \quad \text{14.7cos(55)} = \frac{8.43 \text{ km}}{y} \]

\[ \sin(55) = \frac{y}{14.7} \quad \text{14.7sin(55)} = \frac{12 \text{ km}}{y} \]

15.

55 N due east

16.

- \[ \| \mathbf{F} \| = \sqrt{8^2 + 6^2} \]
- \[ \| \mathbf{F} \| = 10 \]
- \[ \theta = \tan^{-1}\left( \frac{8}{6} \right) \]
- \[ \theta = 53.1^\circ \text{ north of east} \]

- \[ 10 \text{ N at } 63^\circ \text{ south of west} \]

17.

- \[ \theta = \text{law of sines} \]
- \[ \frac{120}{\sin(150)} = \frac{62}{\sin(\theta)} \]
- \[ 120 \sin(150) = 62 \sin(150) \]
- \[ \sin(\theta) = \frac{62 \sin(150)}{120} \]
- \[ \theta = \sin^{-1}\left( \frac{62 \sin(150)}{120} \right) \]
- \[ \theta = 15^\circ \]

Use law of cosines

\[ \| \mathbf{F} \| = \sqrt{62^2 + 62^2 - 2(62)(62)\cos(15^\circ)} \]

- \[ \| \mathbf{F} \| = 120^\circ \text{ N} \]

Equilibrium is at 125° south of west.
18.

Equilibrium is 60 N at 8° west of north.

\[ \theta = \tan^{-1}\left( \frac{48}{36} \right) \]
\[ \theta = 53.1° \]
\[ \theta = 8° \text{ east of south} \]