1. Find a vector $\mathbf{a}$ with representation given by a directed line segment $\overrightarrow{AB}$, where $A(2,1)$ and $B(3,-1)$.
   (a) Draw the vector $\overrightarrow{AB}$.
   (b) Draw the equivalent representation for $\mathbf{a}$ that starts at the origin.
   (c) Draw the equivalent representation starting at the point $P(1,2)$.
2. For the vectors $\mathbf{a} = 3\mathbf{i} - 4\mathbf{j}$, $\mathbf{b} = \mathbf{i} + 3\mathbf{j}$, $\mathbf{c} = 2\mathbf{i} + \mathbf{j}$, find:
   (a) $|-4\mathbf{a} + 3\mathbf{b}|$
   (b) a unit vector in the direction opposite to $\mathbf{c}$
   (c) a vector of length 3 in the direction of $\mathbf{b}$
   (d) constants s and t such that $\mathbf{c} = s\mathbf{a} + t\mathbf{b}$
3. Suppose that a wind is blowing in the direction S45°E at a speed of 60 km/h. A pilot is steering a plane in the direction N60°E at an airspeed (speed in still air) of 100 km/h. The *true course*, or *track*, of the plane is the direction of the resultant of the velocity vectors of the plane and the wind. The *ground speed* of the plane is the magnitude of the resultant. Find the true course and the ground speed of the plane.
4. Ropes 3 m and 5 m in length are fastened to a holiday decoration that is suspended over a town square. The decoration has a mass of 5 kg. The ropes, fastened at different heights, make angles of 52° and 40° with the horizontal. Find the magnitude of the tension in each wire.
5. Find $\mathbf{a} \cdot \mathbf{b}$
   (a) $|\mathbf{a}| = 2$, $|\mathbf{b}| = 5$ and the angle between $\mathbf{a}$ and $\mathbf{b}$ is 150°
   (b) $\mathbf{a} = -3\mathbf{i} + \mathbf{j}$, $\mathbf{b} = 2\mathbf{i} + 4\vec{\mathbf{j}}$
6. A boat sails south with the help of a wind blowing in the direction S36°E with magnitude 400 lb. Find the work done by the wind as the boat moves 110 ft. (Round your answer to the nearest whole number.)
7. Find, correct to the nearest degree, the angle B of the triangle with the vertices $A(1,0)$, $B(4,5)$, $C(-1,2)$
8. Find a unit vector orthogonal to the vector $< -2, 4 >$.
9. Find the value(s) of x such that the vectors $x\mathbf{i} + 3x\mathbf{j}$ and $x\mathbf{i} - 4\mathbf{j}$ are orthogonal.