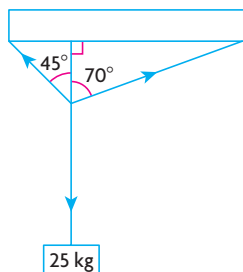


Chapter 7 Test

- Given the vectors $\vec{a} = (-1, 1, 1)$, $\vec{b} = (2, 1, -3)$, and $\vec{c} = (5, 1, -7)$, calculate the value of each of the following:
 - $\vec{a} \times \vec{b}$
 - $\vec{b} \times \vec{c}$
 - $\vec{a} \cdot (\vec{b} \times \vec{c})$
 - $(\vec{a} \times \vec{b}) \times (\vec{b} \times \vec{c})$
- Given the vectors $\vec{a} = \vec{i} - \vec{j} + \vec{k}$ and $\vec{b} = 2\vec{i} - \vec{j} - 2\vec{k}$, determine the following:
 - the scalar projection and vector projection of \vec{a} on \vec{b}
 - the angle that \vec{b} makes with each of the coordinate axes
 - the area of the parallelogram formed by the vectors \vec{a} and \vec{b}
- Two forces of 40 N and 50 N act at an angle of 60° to each other. Determine the resultant and equilibrant of these forces.
- An airplane is heading due north at 1000 km/h when it encounters a wind from the east at 100 km/h. Determine the resultant velocity of the airplane.
- A canoeist wishes to cross a 200 m river to get to a campsite directly across from the starting point. The canoeist can paddle at 2.5 m/s in still water, and the current has a speed of 1.2 m/s.
 - How far downstream would the canoeist land if headed directly across the river?
 - In what direction should the canoeist head in order to arrive directly across from the starting point?
- Calculate the area of a triangle with vertices $A(-1, 3, 5)$, $B(2, 1, 3)$, and $C(-1, 1, 4)$.
- A 25 kg mass is suspended from a ceiling by two cords. The cords make angles of 45° and 70° with a perpendicular drawn to the ceiling, as shown. Determine the tension in each cord.



- Using the vectors $\vec{x} = (3, 3, 1)$ and $\vec{y} = (-1, 2, -3)$, verify that the following formula is true: $\vec{x} \cdot \vec{y} = \frac{1}{4}|\vec{x} + \vec{y}|^2 - \frac{1}{4}|\vec{x} - \vec{y}|^2$
 - Prove that this formula is true for any two vectors.