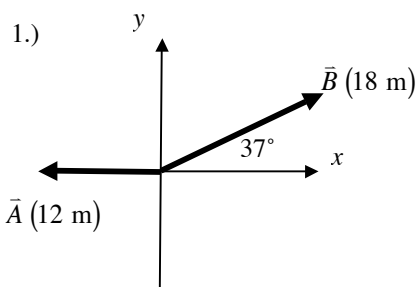


HO 25.2 Solutions

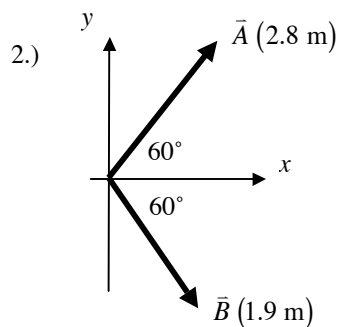


$$\vec{A} = (-12 \text{ m})\hat{i} \text{ and } \hat{a} = -\hat{i} \text{ (by inspection)}$$

$$B_x = B\cos\theta = (18 \text{ m})\cos 37^\circ = 14.4 \text{ m and } B_y = B\sin\theta = (18 \text{ m})\sin 37^\circ = 10.8 \text{ m}$$

$$\vec{B} = (14.4 \text{ m})\hat{i} + (10.8 \text{ m})\hat{j}$$

$$\hat{b} = \frac{\vec{B}}{B} = \frac{(14.4 \text{ m})\hat{i} + (10.8 \text{ m})\hat{j}}{18 \text{ m}} = 0.8\hat{i} + 0.6\hat{j}$$



$$A_x = A\cos\theta = (2.8 \text{ m})\cos 60^\circ = 1.4 \text{ m and } A_y = A\sin\theta = (2.8 \text{ m})\sin 60^\circ = 2.42 \text{ m}$$

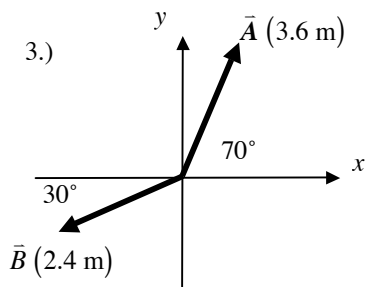
$$\vec{A} = (1.4 \text{ m})\hat{i} + (2.42 \text{ m})\hat{j}$$

$$\hat{a} = \frac{\vec{A}}{A} = \frac{(1.4 \text{ m})\hat{i} + (2.42 \text{ m})\hat{j}}{2.8 \text{ m}} = 0.5\hat{i} + 0.86\hat{j}$$

$$B_x = B\cos\theta = (1.9 \text{ m})\cos(-60^\circ) = 0.95 \text{ m and } B_y = B\sin\theta = (1.9 \text{ m})\sin(-60^\circ) = -1.65 \text{ m}$$

$$\vec{B} = (0.95 \text{ m})\hat{i} + (-1.65 \text{ m})\hat{j}$$

$$\hat{b} = \frac{\vec{B}}{B} = \frac{(0.95 \text{ m})\hat{i} + (-1.65 \text{ m})\hat{j}}{1.9 \text{ m}} = 0.5\hat{i} - 0.87\hat{j}$$



$$A_x = A\cos\theta = (3.6 \text{ m})\cos 70^\circ = 1.23 \text{ m and } A_y = A\sin\theta = (3.6 \text{ m})\sin 70^\circ = 3.38 \text{ m}$$

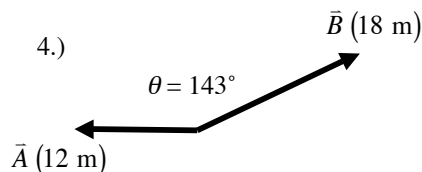
$$\vec{A} = (1.23 \text{ m})\hat{i} + (3.38 \text{ m})\hat{j}$$

$$\hat{a} = \frac{\vec{A}}{A} = \frac{(1.23 \text{ m})\hat{i} + (3.38 \text{ m})\hat{j}}{3.6 \text{ m}} = 0.34\hat{i} + 0.94\hat{j}$$

$$B_x = B\cos\theta = (2.4 \text{ m})\cos(210^\circ) = -2.08 \text{ m and } B_y = B\sin\theta = (2.4 \text{ m})\sin(210^\circ) = -1.2 \text{ m}$$

$$\vec{B} = (-2.08 \text{ m})\hat{i} + (-1.2 \text{ m})\hat{j}$$

$$\hat{b} = \frac{\vec{B}}{B} = \frac{(-2.08 \text{ m})\hat{i} + (-1.2 \text{ m})\hat{j}}{2.4 \text{ m}} = -0.867\hat{i} - 0.5\hat{j}$$



$$\vec{A} \cdot \vec{B} = AB\cos\theta = (12 \text{ m})(18 \text{ m})\cos 143^\circ = -173 \text{ m}^2$$

$$\vec{A} \cdot \vec{B} = ((-12 \text{ m})\hat{i}) \cdot ((14.4 \text{ m})\hat{i} + (10.8 \text{ m})\hat{j})$$

$$\vec{A} \cdot \vec{B} = (-12 \text{ m})(14.4 \text{ m})(\hat{i} \cdot \hat{i}) + (-12 \text{ m})(10.8 \text{ m})(\hat{i} \cdot \hat{j})$$

$$\vec{A} \cdot \vec{B} = (-173 \text{ m}^2)(1) + (-129.6 \text{ m}^2)(0) = -173 \text{ m}^2$$

5.)  \vec{A} (2.8 m)

$$\vec{A} \cdot \vec{B} = AB \cos \theta = (2.8 \text{ m})(1.9 \text{ m}) \cos 120^\circ = \boxed{-2.66 \text{ m}^2}$$

$$\vec{A} \cdot \vec{B} = ((1.4 \text{ m})\hat{i} + (2.42 \text{ m})\hat{j}) \cdot ((0.95 \text{ m})\hat{i} + (-1.65 \text{ m})\hat{j})$$

$$\vec{A} \cdot \vec{B} = (1.4 \text{ m})(0.95 \text{ m})(\hat{i} \cdot \hat{i}) + (1.4 \text{ m})(-1.65 \text{ m})(\hat{i} \cdot \hat{j}) + (2.42 \text{ m})(0.95 \text{ m})(\hat{j} \cdot \hat{i}) + (2.42 \text{ m})(-1.65 \text{ m})(\hat{j} \cdot \hat{j})$$

$$\vec{B}$$
 (1.9 m) $\vec{A} \cdot \vec{B} = (1.33 \text{ m}^2)(1) + (-2.31 \text{ m}^2)(0) + (2.30 \text{ m}^2)(0) + (-3.99 \text{ m}^2)(1) = \boxed{-2.66 \text{ m}^2}$

6.)  \vec{A} (3.6 m)

$$\vec{A} \cdot \vec{B} = AB \cos \theta = (3.6 \text{ m})(2.4 \text{ m}) \cos 140^\circ = \boxed{-6.62 \text{ m}^2}$$

$$\vec{A} \cdot \vec{B} = ((1.23 \text{ m})\hat{i} + (3.38 \text{ m})\hat{j}) \cdot ((-2.08 \text{ m})\hat{i} + (-1.2 \text{ m})\hat{j})$$

$$\vec{B}$$
 (2.4 m) $\vec{A} \cdot \vec{B} = (1.23 \text{ m})(-2.08 \text{ m})(\hat{i} \cdot \hat{i}) + (1.23 \text{ m})(-1.2 \text{ m})(\hat{i} \cdot \hat{j}) + (3.38 \text{ m})(-2.08 \text{ m})(\hat{j} \cdot \hat{i}) + (3.38 \text{ m})(-1.2 \text{ m})(\hat{j} \cdot \hat{j})$

$$\vec{A} \cdot \vec{B} = (-2.56 \text{ m}^2)(1) + (-1.48 \text{ m}^2)(0) + (-7.03 \text{ m}^2)(0) + (-4.06 \text{ m}^2)(1) = \boxed{-6.62 \text{ m}^2}$$

7.)  \vec{B} (18 m)

$$\vec{A} \times \vec{B} = AB \sin \theta = (12 \text{ m})(18 \text{ m}) \sin(-143^\circ) = \boxed{(-130 \text{ m}^2)\hat{k}}$$

$$\vec{A} \times \vec{B} = ((-12 \text{ m})\hat{i}) \times ((14.4 \text{ m})\hat{i} + (10.8 \text{ m})\hat{j})$$

$$\vec{A} \times \vec{B} = (-12 \text{ m})(14.4 \text{ m})(\hat{i} \times \hat{i}) + (-12 \text{ m})(10.8 \text{ m})(\hat{i} \times \hat{j})$$

$$\vec{A} \times \vec{B} = (-173 \text{ m}^2)(0) + (-129.6 \text{ m}^2)\hat{k} = \boxed{(-130 \text{ m}^2)\hat{k}}$$

8.)  \vec{A} (2.8 m)

$$\vec{A} \times \vec{B} = AB \sin \theta = (2.8 \text{ m})(1.9 \text{ m}) \sin(-120^\circ) = \boxed{(-4.61 \text{ m}^2)\hat{k}}$$

$$\vec{A} \times \vec{B} = ((1.4 \text{ m})\hat{i} + (2.42 \text{ m})\hat{j}) \times ((0.95 \text{ m})\hat{i} + (-1.65 \text{ m})\hat{j})$$

$$\vec{A} \times \vec{B} = (1.4 \text{ m})(0.95 \text{ m})(\hat{i} \times \hat{i}) + (1.4 \text{ m})(-1.65 \text{ m})(\hat{i} \times \hat{j}) + (2.42 \text{ m})(0.95 \text{ m})(\hat{j} \times \hat{i}) + (2.42 \text{ m})(-1.65 \text{ m})(\hat{j} \times \hat{j})$$

$$\vec{B}$$
 (1.9 m) $\vec{A} \times \vec{B} = (1.33 \text{ m}^2)(0) + (-2.31 \text{ m}^2)\hat{k} + (2.30 \text{ m}^2)(-\hat{k}) + (-3.99 \text{ m}^2)(0) = \boxed{(-4.62 \text{ m}^2)\hat{k}}$

9.)  \vec{A} (3.6 m)

$$\vec{A} \times \vec{B} = AB \sin \theta = (3.6 \text{ m})(2.4 \text{ m}) \sin 140^\circ = \boxed{(5.55 \text{ m}^2)\hat{k}}$$

$$\vec{A} \times \vec{B} = ((1.23 \text{ m})\hat{i} + (3.38 \text{ m})\hat{j}) \times ((-2.08 \text{ m})\hat{i} + (-1.2 \text{ m})\hat{j})$$

$$\vec{B}$$
 (2.4 m) $\vec{A} \times \vec{B} = (1.23 \text{ m})(-2.08 \text{ m})(\hat{i} \times \hat{i}) + (1.23 \text{ m})(-1.2 \text{ m})(\hat{i} \times \hat{j}) + (3.38 \text{ m})(-2.08 \text{ m})(\hat{j} \times \hat{i}) + (3.38 \text{ m})(-1.2 \text{ m})(\hat{j} \times \hat{j})$

$$\vec{A} \times \vec{B} = (-2.56 \text{ m}^2)(0) + (-1.48 \text{ m}^2)\hat{k} + (-7.03 \text{ m}^2)(-\hat{k}) + (-4.06 \text{ m}^2)(0) = \boxed{(5.55 \text{ m}^2)\hat{k}}$$

10.)

$$\vec{A} \cdot \vec{B} = AB \cos \theta \text{ so } \theta = \cos^{-1} \left(\frac{\vec{A} \cdot \vec{B}}{AB} \right)$$

a.) $\vec{A} = -1.0\hat{i} + 6.0\hat{j}$ and $\vec{B} = 3.0\hat{i} - 2.0\hat{j}$

$$A = \sqrt{(-1.0)^2 + (6.0)^2} = 6.08 \text{ and } B = \sqrt{(3.0)^2 + (-2.0)^2} = 3.61$$

$$\vec{A} \cdot \vec{B} = (-1.0\hat{i} + 6.0\hat{j}) \cdot (3.0\hat{i} - 2.0\hat{j}) = (-1.0)(3.0)(\hat{i} \cdot \hat{i}) + (-1.0)(-2.0)(\hat{i} \cdot \hat{j}) + (6.0)(3.0)(\hat{j} \cdot \hat{i}) + (6.0)(-2.0)(\hat{j} \cdot \hat{j})$$

$$\vec{A} \cdot \vec{B} = (-3.0)(1) + (2.0)(0) + (18.0)(0) + (-12.0)(1) = -15$$

$$\theta = \cos^{-1} \left(\frac{-15}{(6.08)(3.61)} \right) = \boxed{133^\circ}$$

b.) $\vec{A} = 3.0\hat{i} + 5.0\hat{j}$ and $\vec{B} = 10\hat{i} + 6.0\hat{j}$

$$A = \sqrt{(3.0)^2 + (5.0)^2} = 5.83 \text{ and } B = \sqrt{(10)^2 + (6.0)^2} = 11.66$$

$$\vec{A} \cdot \vec{B} = (3.0\hat{i} + 5.0\hat{j}) \cdot (10\hat{i} + 6.0\hat{j}) = (3.0)(10)(\hat{i} \cdot \hat{i}) + (3.0)(6.0)(\hat{i} \cdot \hat{j}) + (5.0)(10)(\hat{j} \cdot \hat{i}) + (5.0)(6.0)(\hat{j} \cdot \hat{j})$$

$$\vec{A} \cdot \vec{B} = (30)(1) + (18)(0) + (50)(0) + (30)(1) = 60$$

$$\theta = \cos^{-1} \left(\frac{60}{(5.83)(11.66)} \right) = \boxed{28.1^\circ}$$

c.) $\vec{A} = -4.0\hat{i} + 2.0\hat{j}$ and $\vec{B} = 7.0\hat{i} - 14\hat{j}$

$$A = \sqrt{(-4.0)^2 + (2.0)^2} = 4.47 \text{ and } B = \sqrt{(7.0)^2 + (-14)^2} = 15.65$$

$$\vec{A} \cdot \vec{B} = (-4.0\hat{i} + 2.0\hat{j}) \cdot (7.0\hat{i} - 14\hat{j}) = (-4.0)(7.0)(\hat{i} \cdot \hat{i}) + (-4.0)(-14)(\hat{i} \cdot \hat{j}) + (2.0)(7.0)(\hat{j} \cdot \hat{i}) + (2.0)(-14)(\hat{j} \cdot \hat{j})$$

$$\vec{A} \cdot \vec{B} = (-28)(1) + (56)(0) + (14)(0) + (-28)(1) = -56$$

$$\theta = \cos^{-1} \left(\frac{-56}{(4.47)(15.65)} \right) = \boxed{143^\circ}$$