1) Find the cross product of the unit vectors.

a) $\mathbf{j}\times\mathbf{i}$ $\boxed{-\mathbf{k}}$

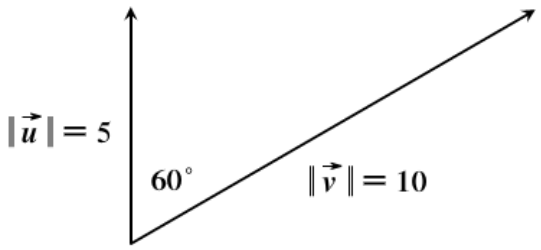
b) $\mathbf{i}\times\mathbf{j}$ $\boxed{\mathbf{k}}$

c) $\mathbf{k}\times\mathbf{i}$ $\boxed{\mathbf{j}}$

d) $\mathbf{i}\times\mathbf{k}$ $\boxed{-\mathbf{j}}$

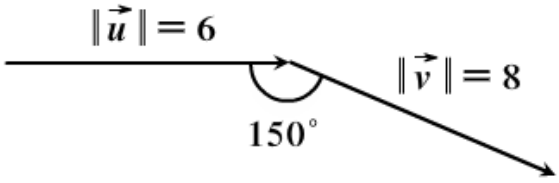
2) Find $\|\vec{u}\times\vec{v}\|$ and determine whether $\vec{u}\times\vec{v}$ is directed into the page or out of the page.

a)



$\boxed{25\sqrt{3} \text{ into the page.}}$

b)



$\boxed{24 \text{ into the page.}}$

3) Given $\vec{u} = \langle 7,3,2\rangle$ and $\vec{v} = \langle 1,-1,5\rangle$ find the following:

a) $\vec{u}\times\vec{v}$ $\boxed{\langle 17,-33,-10\rangle}$

b) $\vec{v}\times\vec{u}$ $\boxed{\langle -17,33,10\rangle}$

c) $\vec{v}\times\vec{v}$ $\boxed{\langle 0,0,0\rangle}$

4) Given the following vectors find $\vec{w} = \vec{u} \times \vec{v}$ and show that it is orthogonal to both $\vec{u}$ and $\vec{v}$.

a) $\vec{u} = 2\mathbf{i} - 3\mathbf{j} + \mathbf{k}$, $\vec{v} = \mathbf{i} - 2\mathbf{j} + \mathbf{k}$

b) $\vec{u} = \mathbf{i} + e^t\mathbf{j} + e^{-t}\mathbf{k}$, $\vec{v} = 2\mathbf{i} + e^t\mathbf{j} - e^{-t}\mathbf{k}$

c) $\vec{u} = \langle t, t^2, t^3 \rangle$, $\vec{v} = \langle 1, 2t, 3t^2 \rangle$

a) $\boxed{\vec{w} = \langle -1, -1, -1 \rangle, \text{ Use Dot Product to show that they are orthogonal.}}$

b) $\boxed{\vec{w} = \langle -2, 3e^{-t}, -e^t \rangle, \text{ Use Dot Product to show that they are orthogonal.}}$

c) $\boxed{\vec{w} = \langle t^4, -2t^3, t^2 \rangle, \text{ Use Dot Product to show that they are orthogonal.}}$

5) Find two unit vectors orthogonal to both $\langle 1, -1, 1 \rangle$ and $\langle 0, 4, 4 \rangle$.

$$\boxed{\left\langle -\frac{2}{\sqrt{6}}, -\frac{1}{\sqrt{6}}, \frac{1}{\sqrt{6}} \right\rangle \text{ and } \left\langle \frac{2}{\sqrt{6}}, \frac{1}{\sqrt{6}}, -\frac{1}{\sqrt{6}} \right\rangle}$$

6) Find the area of the parallelogram that has the given vectors as adjacent sides:

a) $\vec{u} = \mathbf{j}$, $\vec{v} = \mathbf{j} + \mathbf{k}$

b) $\vec{u} = \langle 3, 2, -1 \rangle$, $\vec{v} = \langle 1, 2, 3 \rangle$

a) $\boxed{1}$

b) $\boxed{6\sqrt{5}}$

7) Show that $(\vec{u}\times\vec{v})\cdot\vec{v}=0$ for all vectors $\vec{u}$ and $\vec{v}$.

Show by using $\vec{u}=\langle u_1,u_2,u_3\rangle$ and $\vec{v}=\langle v_1,v_2,v_3\rangle$

8) The vertices of a triangle are: $(2,1,5)$, $(-1,3,4)$, and $(3,0,6)$, find the following:

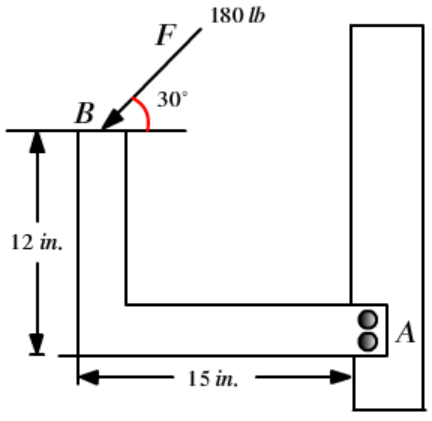
a) A vector orthogonal to the plane of the triangle.

b) The area of the triangle.

a) $\langle 1,2,1\rangle$ or any scalar multiple of this vector.

b) $\frac{\sqrt{6}}{2}$

9) A force of 180 pounds acts on the bracket shown below, determine the magnitude of the moment about A by evaluating $\left\|\overrightarrow{AB}\times\vec{F}\right\|$.



$\approx 268.38\ in\cdot lbs$

10) Find the volume of the parallelepiped with the given vertices: $(0,0,0)$, $(3,0,0)$, $(0,5,1)$, $(2,0,5)$, $(3,5,1)$, $(5,0,5)$, $(2,5,6)$, $(5,5,6)$.

$\boxed{75}$

11) Use the scalar triple product to determine whether the points: $(1,0,1)$, $(2,4,6)$, $(3,-1,2)$, and $(6,2,8)$ lie in the same plane.

$\boxed{\text{Yes}}$

12) A wrench 30 cm long lies along the positive $y-axis$ and grips a bolt at the origin. A force is applied in the direction $\langle 0,3,-4 \rangle$ at the end of the wrench. Find the magnitude of the force needed to supply 100 J of torque to the bolt.

$\boxed{\approx 417\ N}$