1. Consider the vectors $\vec{u} = \langle 1, -2, -1 \rangle$ and $\vec{v} = \langle -6, 2, -3 \rangle$.

   a) Determine the dot product of $\vec{u}$ and $\vec{v}$.

   b) Determine the angle between $\vec{u}$ and $\vec{v}$.

   c) Determine the projection of $\vec{u}$ onto $\vec{v}$

2. Determine the work done by the force $\vec{F} = \langle 3, -1, 2 \rangle$ on a particle moving from $(0, 4, 4)$ to $(-2, 5, -1)$. Assume force is in lbs and position in feet.

Answers:

1.

    a) $\vec{u} \cdot \vec{v} = \langle 1, -2, -1 \rangle \cdot \langle -6, 2, -3 \rangle = -6 - 4 + 3 = -7$

    b) Using the equation $\vec{u} \cdot \vec{v} = |\vec{u}||\vec{v}| \cos\theta$, we get $\theta = \cos^{-1}\left(\frac{\vec{u} \cdot \vec{v}}{|\vec{u}||\vec{v}|}\right) = \cos^{-1}\left(\frac{-7}{\sqrt{6}*7}\right) = 114.09° = 1.99$ rad

    c) $\text{proj}_{\vec{v}}\vec{u} = \frac{\vec{u} \cdot \vec{v}}{|\vec{v}|}\left(\frac{\vec{v}}{|\vec{v}|}\right) = \frac{-7}{7}\left(\frac{\langle -6,2,-3 \rangle}{7}\right) = -\frac{1}{7}\langle -6,2,-3 \rangle$

2. $W = \vec{F} \cdot \vec{d} = \langle 3, -1, 2 \rangle \cdot \langle -2 - 0, 5 - 4, -1 - 4 \rangle = \langle 3, -1, 2 \rangle \cdot \langle -2, 1, -5 \rangle = -6 - 1 - 10 = -17$ ft-lb