EXERCISES #3

DOT PRODUCT

Exercise 1. What is the angle between $\vec{i} + \sqrt{3}\vec{j}$ and the positive x-direction?

Exercise 2. Find $\vec{u} \cdot \vec{v}$ for the following.

- (1) $\vec{u} = \langle 1, 3, -5 \rangle, \vec{v} = \langle 4, 3, 19 \rangle$
- (2) $\vec{u} = \langle 0, 4 \rangle, \vec{v} = \langle 8, -6 \rangle$
- (3) $\vec{u} = \langle 7, 11 \rangle, \vec{v} = \langle 9, 2 \rangle$ (4) $\vec{u} = 2\vec{i} + \vec{k}, \vec{v} = \vec{i} 6\vec{j}$

Exercise 3. Show that $\vec{i} \cdot \vec{j} = \vec{j} \cdot \vec{k} = \vec{k} \cdot \vec{i} = 0$ and $\vec{i} \cdot \vec{i} = \vec{j} \cdot \vec{j} = \vec{k} \cdot \vec{k} = 1$.

Exercise 4. What is the angle between $\vec{u} = \langle 5, 1 \rangle$ and $\vec{v} = \langle 3, 2 \rangle$?

Exercise 5. What is the angle between $\vec{u} = \vec{i} - 4\vec{j} + \vec{k}$ and $\vec{v} = -3\vec{i} + \vec{j} + 5\vec{k}$?

Exercise 6. Determine whether the triangle with vertices P = (1, -3, -2), Q = (2, 0, -4),R = (6, -2, -5) is right-angled.

Exercise 7. Find the values of x such that the angle between the vectors (2, 1, -1) and (1, x, 0)is $\frac{\pi}{4} = 45^{\circ}$.

Exercise 8. Find the \vec{v} -direction component of \vec{u} , where $\vec{u} = \langle 3, -1, 1 \rangle$ and $\vec{v} = \langle 4, 7, -4 \rangle$.

Exercise 9. Find the projection of $\vec{u} = 5\vec{j} - \vec{k}$ to $\vec{v} = 2\vec{i} + \vec{j} + 3\vec{k}$.

Exercise 10. Show that, for any vectors \vec{u} and \vec{v} (in either 2D or 3D), $\vec{v} - \text{proj}_{\vec{u}} \vec{v}$ is orthogonal to \vec{u} .