# Quiz 1, Calculus III

Dr. Graham-Squire, Fall 2013

**Name:** _____

1. (3 points)

    State if each of the following are True or False. In either case, give a brief explanation for why (using either words or a calculation).

    (a) If $\mathbf{u}$ is orthogonal to $\mathbf{w}$, and $\mathbf{v}$ is orthogonal to $\mathbf{w}$, is $\mathbf{u}+\mathbf{v}$ orthogonal to $\mathbf{w}$?

    (b) If $\mathbf{u}$ and $\mathbf{v}$ are two nonzero vectors that are not parallel, then $\mathbf{u} \times \mathbf{v} = \mathbf{v} \times \mathbf{u}$.

2. (3 points)

    For each of the following, state if the expression gives a vector, a scalar, or does not exist. Assume that $\mathbf{u}$, $\mathbf{v}$, and $\mathbf{w}$ are all nonzero vectors, and $c$ is a scalar.

    (i) $(\mathbf{u} \cdot \mathbf{v})\mathbf{w}$

    (ii) $c(\mathbf{u} \times \mathbf{v})$

    (iii) $(\mathbf{u} \cdot \mathbf{v}) \times \mathbf{w}$

    (iv) $(\mathbf{u} \times \mathbf{v}) \cdot \mathbf{w}$

    (v) $c \times (\mathbf{u} \times \mathbf{v})$

3. (4 points) The following lines in space intersect at a certain point.

$$x = 1 + 2t, y = 2, z = 5 - 3t \qquad \text{and} \qquad x = 2 - t, y = -2 - 4t, z = 3 + t$$

Find the direction vectors of each line, and use them to answer the following:

(a) What is the angle between the two lines?

(b) There is a plane that is defined by the two lines. Find a vector normal to that plane.