

Show all work. Incomplete answers may receive little or no credit. You need not simplify your answers. All numerical answers should be exact, with no decimal approximations.

1. Consider the vectors  $\mathbf{u} = \langle 4, 1, 3 \rangle$  and  $\mathbf{v} = \langle -2, 3, 4 \rangle$

(a) Find  $\mathbf{u} \cdot \mathbf{v}$

(b) Find  $\theta$ , the angle between the two vectors.

2. Are the vectors  $\mathbf{a} = \langle 1, 2, -3 \rangle$  and  $\mathbf{b} = \langle -4, 5, 2 \rangle$  orthogonal? Show why or why not.

3. Write down a nonzero vector that is orthogonal to  $\mathbf{v} = \langle 2, -1, 5 \rangle$ . Hint: There are infinitely many correct answers.