Quiz 2

Name: _____ Section and/or TA: _____

Answer all questions in a clear and concise manner. Unsupported answers will receive *no credit*.

1. (2 points) Consider the vector $\mathbf{a}=\langle 4,5,-2\rangle$ and $\mathbf{b}=\langle 3,-1,5\rangle$.
   (a) (1 point) Determine whether **a** and **b** are orthogonal, parallel, or neither.

> **Solution:** $cos(\theta) = \frac{\mathbf{a}\cdot\mathbf{b}}{|\mathbf{a}||\mathbf{b}|} = \frac{12-5-10}{\sqrt{45}\sqrt{35}} = \frac{-1}{5\sqrt{7}}$, neither.
> Alternatively, the dot product non zero tells us they are not orthogonal, the cross product non zero (or they are not proportional) tells us they are not parallel.

   (b) (1 point) What is the angle between **a** and **b**? (It is sufficient to leave your answer in the form of *arccos* or cos^{-1}).

> **Solution:** Continue from above, $\theta = cos^{-1}(\frac{-1}{5\sqrt{7}})$.

2. (2 points) Consider the same vectors **a** and **b** as in the previous question, find a vector that is orthogonal to both **a** and **b**.

> **Solution:** (Using dot prod) Let (x,y,z) be the vector we want. Then we have $4x+5y-2z=0$ and $3x-y+5z=0$ as a system, and one solution is $(23,-26,-19)$.
> (Using cross prod) The vector we are looking for is
>
> $$(\begin{vmatrix} 5 & -2 \\ -1 & 5 \end{vmatrix}, -\begin{vmatrix} 4 & -2 \\ 3 & 5 \end{vmatrix}, \begin{vmatrix} 4 & 5 \\ 3 & -1 \end{vmatrix}) = (23,-26,-19)$$