Vector operations assessment

TOTAL POINTS 5

1. In this assessment, you will be tested on all of the different topics you have in covered this module. Good luck!

   A ship travels with velocity given by $\begin{bmatrix} 1 \\ 2 \end{bmatrix}$, with current flowing in the direction given by $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$ with respect to some co-ordinate axes.

   What is the velocity of the ship in the direction of the current?

   ○ $\begin{bmatrix} 2/3 \\ 3/2 \end{bmatrix}$

   ○ $\begin{bmatrix} 3/2 \\ 2/3 \end{bmatrix}$

   ○ $\begin{bmatrix} 2/3 \\ 2/3 \end{bmatrix}$

   ◉ $\begin{bmatrix} 3/2 \\ 3/2 \end{bmatrix}$

2. A ball travels with velocity given by $\begin{bmatrix} 2 \\ 1 \end{bmatrix}$, with wind blowing in the direction given by $\begin{bmatrix} 3 \\ -4 \end{bmatrix}$ with respect to some co-ordinate axes.

   What is the size of the velocity of the ball in the direction of the wind?

   ○ $-\frac{5}{2}$

   ○ $-\frac{2}{5}$

   ◉ $\frac{2}{5}$

   ○ $\frac{5}{2}$

3. Given vectors $\mathbf{v} = \begin{bmatrix} -4 \\ -3 \\ 8 \end{bmatrix}$, $\mathbf{b_1} = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$, $\mathbf{b_2} = \begin{bmatrix} -2 \\ 1 \\ 0 \end{bmatrix}$ and $\mathbf{b_3} = \begin{bmatrix} -3 \\ -6 \\ 5 \end{bmatrix}$ all written in the standard basis,

   what is $\mathbf{v}$ in the basis defined by $\mathbf{b_1}$, $\mathbf{b_2}$ and $\mathbf{b_3}$? You are given that $\mathbf{b_1}$, $\mathbf{b_2}$ and $\mathbf{b_3}$ are all pairwise orthogonal to each other.

   ◉ $\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$

   ○ $\begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}$

   ○ $\begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$

   ○ $\begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$

4. Are the following vectors linearly independent?

   $\mathbf{a} = \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix}$, $\mathbf{b} = \begin{bmatrix} 3 \\ -4 \\ 5 \end{bmatrix}$ and $\mathbf{c} = \begin{bmatrix} 1 \\ -8 \\ 7 \end{bmatrix}$.

   ○ Yes

   ◉ No

5. At 12:00 pm, a spaceship is at position $\begin{bmatrix} 3 \\ 2 \\ 4 \end{bmatrix}$ km away from the origin with respect to some 3 dimensional

   co ordinate system. The ship is travelling with velocity $\begin{bmatrix} -1 \\ 2 \\ -3 \end{bmatrix}$ km/h What is the location of the spaceship after 2 hours have passed?

   ○ $\begin{bmatrix} -2 \\ 4 \\ -1 \end{bmatrix}$

   ○ $\begin{bmatrix} 2 \\ 4 \\ 1 \end{bmatrix}$

   ◉ $\begin{bmatrix} 1 \\ 6 \\ -2 \end{bmatrix}$

   ○ $\begin{bmatrix} -1 \\ -6 \\ 2 \end{bmatrix}$