✓ **Congratulations! You passed!**

TO PASS 80% or higher

Keep Lear

Vector operations assessment

LATEST SUBMISSION GRADE

100%

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?

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

✓ **Correct**

This is the vector projection of the velocity of the ship onto the velocity of the current.

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?

- $-\frac{2}{5}$
- $\frac{5}{2}$
- $-\frac{5}{2}$
- $\frac{2}{5}$

✓ **Correct**

This is the scalar projection of the velocity of the ball onto the velocity of the wind.

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.

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

✓ **Correct**

This is a change of basis in 3 dimensions.

4. Are the following vectors linearly independent?

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

- ○ Yes
- ◉ No

✓ **Correct**

One can be written as a linear combination of the other two.

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?

- ○ $\begin{bmatrix} -1 \\ -6 \\ 2 \end{bmatrix}$
- ○ $\begin{bmatrix} 2 \\ 4 \\ 1 \end{bmatrix}$
- ◉ $\begin{bmatrix} 1 \\ 6 \\ -2 \end{bmatrix}$
- ○ $\begin{bmatrix} -2 \\ 4 \\ -1 \end{bmatrix}$

✓ **Correct**

This takes the idea of vectors in the context of a moving body.