Exercise 1. Consider the vectors $\vec{u}=\langle 1,3,4\rangle$ and $\vec{v}=-2\hat{\jmath}+3\hat{k}$. Examine the following attempt to evaluate $3\vec{v}+2\vec{u}$:

$$\begin{aligned}
3\vec{v}+2\vec{u} &= 3\langle 1,3,4\rangle+2(-2\hat{\jmath}+3\hat{k}) && (1)\\
&= (3+9+4)+2(-2\hat{\jmath}+3\hat{k}) && (2)\\
&= 16+2(-2\hat{\jmath}+3\hat{k}) && (3)\\
&= 18(-2\hat{\jmath}+3\hat{k}) && (4)\\
&= (-16\hat{\jmath}+21\hat{k}) && (5)\\
&= \langle -16,0,21\rangle && (6)
\end{aligned}$$

In the following space complete the tasks below:

- Answer: should the result of this operation be a vector or a scalar?
- Identify at least 3 mistakes in the process. Refer to the equation numbers where errors occur.

Expected Result: The result should be a vector since we are performing vector addition.
Errors Identified:

- **Line 1:** The vectors $\vec{u}$ and $\vec{v}$ are incorrectly placed.
- **Line 2:** The components of $\vec{u}$ are incorrectly added together instead of remaining as a vector.
- **Line 4:** An incorrect scalar addition is performed, it's impossible to add a scalar to a scalar multiplying a vector.
- **Line 5:** The components are added instead of multiplied by the scalar.
- **Line 6:** The y component is misplaced as the x component.

Exercise 2. Consider the following pairs of vectors:

$$\hat{\imath}+\sqrt{3}\hat{\jmath} \quad \text{and} \quad \sqrt{3}\hat{\imath}+3\hat{\jmath} \tag{1}$$

$$2\hat{\imath}+4\hat{\jmath}+6\hat{k} \quad \text{and} \quad 4\hat{\imath}+6\hat{\jmath}+8\hat{k} \tag{2}$$

$$\hat{\imath}-\sqrt{3}\hat{\jmath}+\hat{k} \quad \text{and} \quad -3\hat{\imath}+3\hat{k} \tag{3}$$

In the following space complete the tasks below:

- Define parallel and orthogonal vectors.
- Identify which pair is parallel, which is orthogonal, and which is neither.

Definitions:

- Two vectors are **parallel** if one is a scalar multiple of the other.
- Two vectors are **orthogonal** if their dot product equals zero.

Solutions:

- **First pair:** Parallel, because $\sqrt{3}\langle 1,\sqrt{3}\rangle=\langle\sqrt{3},3\rangle$.
- **Second pair:** Neither, as they are not multiples of each other and their dot product is not zero.

- **Third pair:** Orthogonal, because
$$\langle 1,-3,1\rangle \cdot \langle -3,0,3\rangle = (1)(-3)+(-3)(0)+(1)(3) = 0.$$