

Vectors: arrows, lists of numbers, and why both views matter

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Practice problems

1. A vector v starts at the origin and has a length of 5, pointing exactly along the negative x -axis. Write v as a component list.
2. Find the length of the vector $w = \begin{bmatrix} 8 \\ 6 \end{bmatrix}$.
3. A vector u has components $\begin{bmatrix} 2 \\ 2 \end{bmatrix}$. If we double the length of the vector while keeping the direction the same, what are the new components?

Solutions

1. A vector v starts at the origin and has a length of 5, pointing exactly along the negative x -axis. Write v as a component list.

- The vector points along the x -axis, so the y -component must be 0.
- The vector points in the negative direction, so the x -component must be negative.
- Since the length is 5, the x -component must be -5 .
- The resulting column vector is $\begin{bmatrix} -5 \\ 0 \end{bmatrix}$.

Answer: $v = \begin{bmatrix} -5 \\ 0 \end{bmatrix}$

2. Find the length of the vector $w = \begin{bmatrix} 8 \\ 6 \end{bmatrix}$.

- Identify the components: $x = 8$ and $y = 6$.
- Apply the length formula: $\sqrt{8^2 + 6^2}$.
- Calculate the squares: $64 + 36 = 100$.
- Take the square root: $\sqrt{100} = 10$.

Answer: 10

3. A vector u has components $\begin{bmatrix} 2 \\ 2 \end{bmatrix}$. If we double the length of the vector while keeping the direction the same, what are the new components?

- The original length is $\sqrt{2^2 + 2^2} = \sqrt{8}$.
- To double the length while keeping the direction, we must multiply each component by 2.
- The new x -component is $2 \times 2 = 4$.
- The new y -component is $2 \times 2 = 4$.
- The new vector is $\begin{bmatrix} 4 \\ 4 \end{bmatrix}$.

Answer: $u_{\text{new}} = \begin{bmatrix} 4 \\ 4 \end{bmatrix}$