

Vector addition and scalar multiplication — geometrically

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Practice problems

1. Given $u = \begin{bmatrix} 4 \\ -1 \end{bmatrix}$ and $v = \begin{bmatrix} -2 \\ 3 \end{bmatrix}$, compute $u + v$.
2. Given $v = \begin{bmatrix} 3 \\ -5 \end{bmatrix}$, compute $-3v$.
3. Given $a = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$ and $b = \begin{bmatrix} 0 \\ 4 \end{bmatrix}$, compute $2a - b$.

Solutions

1. Given $u = \begin{bmatrix} 4 \\ -1 \end{bmatrix}$ and $v = \begin{bmatrix} -2 \\ 3 \end{bmatrix}$, compute $u + v$.

- Add the first components: $4 + (-2) = 2$.
- Add the second components: $-1 + 3 = 2$.

Answer: $\begin{bmatrix} 2 \\ 2 \end{bmatrix}$

2. Given $v = \begin{bmatrix} 3 \\ -5 \end{bmatrix}$, compute $-3v$.

- Multiply the first component by -3 : $-3 \cdot 3 = -9$.
- Multiply the second component by -3 : $-3 \cdot (-5) = 15$.

Answer: $\begin{bmatrix} -9 \\ 15 \end{bmatrix}$

3. Given $a = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$ and $b = \begin{bmatrix} 0 \\ 4 \end{bmatrix}$, compute $2a - b$.

- First, scale a by 2: $2 \cdot \begin{bmatrix} 1 \\ 2 \end{bmatrix} = \begin{bmatrix} 2 \\ 4 \end{bmatrix}$.
- Subtract b from the result: $\begin{bmatrix} 2 \\ 4 \end{bmatrix} - \begin{bmatrix} 0 \\ 4 \end{bmatrix} = \begin{bmatrix} 2 - 0 \\ 4 - 4 \end{bmatrix} = \begin{bmatrix} 2 \\ 0 \end{bmatrix}$.

Answer: $\begin{bmatrix} 2 \\ 0 \end{bmatrix}$