

Author: Brunelle Ndongala

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11.2 Representing Vectors

$$1. \quad a = -7i + 3j \\ b = 2i - 5j$$

$$a) \quad 3a = 3(-7i + 3j) \\ = -21i + 9j$$

$$b) \quad a - 2b = -7i + 3j - 2(2i - 5j) \\ = -7i + 3j - 4i + 10j \\ = -11i + 13j$$

$$c) \quad 3b - a = 3(2i - 5j) - (-7i + 3j) \\ = 6i - 15j + 7i - 3j \\ = 13i - 18j$$

$$2. \quad a = \begin{pmatrix} -2 \\ 4 \end{pmatrix} \quad b = \begin{pmatrix} 6 \\ -1 \end{pmatrix} \quad c = \begin{pmatrix} -3 \\ -5 \end{pmatrix}$$

$$a) \quad \frac{1}{2}a = \frac{1}{2} \begin{pmatrix} -2 \\ 4 \end{pmatrix} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$$

$$b) \quad a + b + c = \begin{pmatrix} -2 \\ 4 \end{pmatrix} + \begin{pmatrix} 6 \\ -1 \end{pmatrix} + \begin{pmatrix} -3 \\ -5 \end{pmatrix} \\ = \begin{pmatrix} 1 \\ -2 \end{pmatrix}$$

$$c) \quad c + 2b - \frac{3}{2}a = \begin{pmatrix} -3 \\ -5 \end{pmatrix} + 2 \begin{pmatrix} 6 \\ -1 \end{pmatrix} - \frac{3}{2} \begin{pmatrix} -2 \\ 4 \end{pmatrix} \\ = \begin{pmatrix} -3 \\ -5 \end{pmatrix} + \begin{pmatrix} 12 \\ -2 \end{pmatrix} - \begin{pmatrix} -3 \\ 6 \end{pmatrix} \\ = \begin{pmatrix} 12 \\ -13 \end{pmatrix}$$

3.

$$a = -6i + 7j$$

$$b = 3i - 5j$$

$$\begin{aligned}\text{Resultant} &= -6i + 7j + 3i - 5j \\ &= -3i + 2j\end{aligned}$$

4. $\vec{AB} = -8i + 7j$

$$\vec{AC} = 11i - j$$

$$\begin{aligned}\vec{BC} &= \vec{BA} + \vec{AC} \\ &= 8i - 7j + 11i - j \\ &= 19i - 8j\end{aligned}$$

5. $a = \begin{pmatrix} 2 \\ p \end{pmatrix}$ $b = \begin{pmatrix} -3 \\ -4 \end{pmatrix}$ $c = \begin{pmatrix} q \\ 11 \end{pmatrix}$

$$2b - c = a$$

$$2 \begin{pmatrix} -3 \\ -4 \end{pmatrix} - \begin{pmatrix} q \\ 11 \end{pmatrix} = \begin{pmatrix} 2 \\ p \end{pmatrix}$$

$$\begin{pmatrix} -6 \\ -8 \end{pmatrix} - \begin{pmatrix} q \\ 11 \end{pmatrix} = \begin{pmatrix} 2 \\ p \end{pmatrix}$$

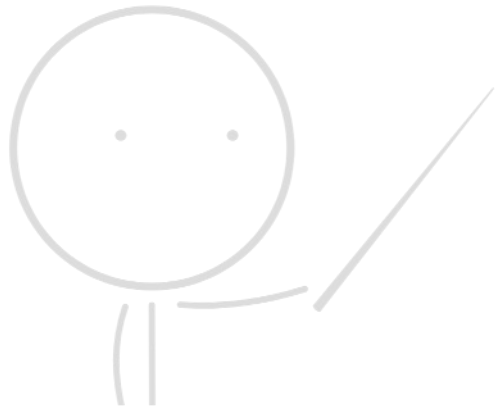
$$-6 - q = 2$$

$$q = -8$$

$$-8 - 11 = p$$

$$-19 = p$$

$$p = -19, \quad q = -8$$



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$$\begin{aligned}
 6. \quad a &= -2i + 7j \\
 b &= 3i - 2j \\
 c &= -i - 6j \\
 d &= 2i - 2j
 \end{aligned}$$

$$\begin{aligned}
 2a + 5b &= 2(-2i + 7j) + 5(3i - 2j) \\
 &= -4i + 14j + 15i - 10j \\
 &= 11i + 4j
 \end{aligned}$$

$$\begin{aligned}
 2d - c &= 2(2i - 2j) - (-i - 6j) \\
 &= 4i - 4j + i + 6j \\
 &= 5i + 2j
 \end{aligned}$$

$11i + 4j$ and $5i + 2j$ are not multiples of each other
 \therefore the vectors are not parallel

$$\begin{aligned}
 7. \quad a &= 2pi + 3qj \\
 b &= -4qi + pj
 \end{aligned}$$

$$b - a = -10i + 10j$$

$$-4qi + pj - 2pi + 3qj = -10i + 10j$$

$$\begin{pmatrix} -4q \\ p \end{pmatrix} - \begin{pmatrix} 2p \\ 3q \end{pmatrix} = \begin{pmatrix} -10 \\ 10 \end{pmatrix}$$

$$\begin{aligned}
 -4q - 2p &= -10 \\
 p - 3q &= 10
 \end{aligned}$$

Simultaneous equations

$$\begin{aligned}
 -4q - 2p &= -10 & q &= -1 \\
 -3q + p &= 10 & p &= 7
 \end{aligned}$$