Solutions

2.1

- $\begin{pmatrix} 3+(-1) \\ -2+5 \end{pmatrix} = \begin{pmatrix} \mathbf{2} \\ \mathbf{3} \end{pmatrix}$

2.2

- $\begin{pmatrix} 3 \times 3 \\ 3 \times (-2) \end{pmatrix} = \begin{pmatrix} \mathbf{9} \\ \mathbf{-6} \end{pmatrix}$

2.3

- $2\mathbf{a} = \begin{pmatrix} 6 \\ -4 \end{pmatrix}$, so $2\mathbf{a} - \mathbf{b} = \begin{pmatrix} 6-(-1) \\ -4-5 \end{pmatrix} = \begin{pmatrix} \mathbf{7} \\ \mathbf{-9} \end{pmatrix}$

2.4

- $\overrightarrow{AB} = \begin{pmatrix} 6-2 \\ 4-(-1) \end{pmatrix} = \begin{pmatrix} \mathbf{4} \\ \mathbf{5} \end{pmatrix}$
- $\overrightarrow{BA} = -\overrightarrow{AB} = \begin{pmatrix} \mathbf{-4} \\ \mathbf{-5} \end{pmatrix}$

2.5

- $\sqrt{5^2 + (-12)^2} = \sqrt{25 + 144} = \sqrt{169} = \mathbf{13}$

3.1

- it is **end minus start**: $\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$; her way gives $\overrightarrow{BA}$, the reverse direction

3.2

- image $= (4-3, 1+2) = (\mathbf{1}, \mathbf{3})$
- back to P: $\begin{pmatrix} \mathbf{3} \\ \mathbf{-2} \end{pmatrix}$

3.3

- top: $x + 2 = 7$, so $\boldsymbol{x = 5}$
- bottom: $3 + 2y = -5$, so $\boldsymbol{y = -4}$

3.4

- $\mathbf{q} = \begin{pmatrix} -3 \times 2 \\ -3 \times (-3) \end{pmatrix} = -3\mathbf{p}$, a scalar multiple, so parallel
- the scalar is negative: $\mathbf{q}$ points the **opposite way** and is 3 times as long

3.5

- in a parallelogram $\overrightarrow{DC} = \overrightarrow{AB} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$
- $C = (-1+4, 4+3) = (\mathbf{3}, \mathbf{7})$
- $\overrightarrow{AC} = \begin{pmatrix} 2 \\ 5 \end{pmatrix}$, so $AC = \sqrt{2^2 + 5^2} = \sqrt{29}$
- $AC = \mathbf{5.39}$