Outcome 3 – Using Vector Components

Bronze examples

Examples...

Vector $\mathbf{a} = \begin{pmatrix} 2 \\ 5 \end{pmatrix}$ and vector $\mathbf{b} = \begin{pmatrix} 8 \\ -3 \end{pmatrix}$.

Calculate $\mathbf{a} + \mathbf{b}$.

$\mathbf{a} + \mathbf{b} = \begin{pmatrix} 2 \\ 5 \end{pmatrix} + \begin{pmatrix} 8 \\ -3 \end{pmatrix} = \begin{pmatrix} 10 \\ 2 \end{pmatrix}$

Vector $\mathbf{p} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}$ and vector $\mathbf{q} = \begin{pmatrix} 3 \\ -1 \end{pmatrix}$.

Calculate $5\mathbf{p} - 3\mathbf{q}$.

$5\mathbf{p} - 3\mathbf{q} = \begin{pmatrix} 20 \\ 10 \end{pmatrix} - \begin{pmatrix} 9 \\ -3 \end{pmatrix} = \begin{pmatrix} 11 \\ 13 \end{pmatrix}$

Silver examples

Examples...

Vector $\mathbf{a} = \begin{pmatrix} 7 \\ 0 \\ 5 \end{pmatrix}$ and vector $\mathbf{b} = \begin{pmatrix} 2 \\ 3 \\ -9 \end{pmatrix}$.

Calculate $\mathbf{a} + \mathbf{b}$.

$\mathbf{a} + \mathbf{b} = \begin{pmatrix} 7 \\ 0 \\ 5 \end{pmatrix} + \begin{pmatrix} 2 \\ 3 \\ -9 \end{pmatrix} = \begin{pmatrix} 9 \\ 3 \\ -4 \end{pmatrix}$

Vector $\mathbf{p} = \begin{pmatrix} 9 \\ 8 \\ -2 \end{pmatrix}$ and vector $\mathbf{q} = \begin{pmatrix} 4 \\ -7 \\ 0 \end{pmatrix}$.

Calculate $2\mathbf{p} - 3\mathbf{q}$.

$2\mathbf{p} - 3\mathbf{q} = \begin{pmatrix} 18 \\ 16 \\ -4 \end{pmatrix} - \begin{pmatrix} 12 \\ -21 \\ 0 \end{pmatrix} = \begin{pmatrix} 6 \\ 37 \\ -4 \end{pmatrix}$

Gold example

Examples...

Given that...

$\mathbf{a} = \begin{pmatrix} 5 \\ 0 \\ 1 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 2 \\ 4 \\ -6 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} -8 \\ 12 \\ 4 \end{pmatrix}$,

Express $2\mathbf{a} - \mathbf{b} + \frac{1}{4}\mathbf{c}$ in component form.

$2\mathbf{a} - \mathbf{b} + \frac{1}{4}\mathbf{c} = \begin{pmatrix} 10 \\ 0 \\ 5 \end{pmatrix} - \begin{pmatrix} 2 \\ 4 \\ -6 \end{pmatrix} + \begin{pmatrix} -2 \\ 3 \\ 1 \end{pmatrix}$

$= \begin{pmatrix} 6 \\ -1 \\ 12 \end{pmatrix}$

Bronze Questions

Complete the following vector component calculations...

1. Vector $\mathbf{m} = \begin{pmatrix} 4 \\ 1 \end{pmatrix}$ and vector $\mathbf{n} = \begin{pmatrix} -5 \\ 7 \end{pmatrix}$.

   Calculate $\mathbf{m} + \mathbf{n}$.

2. Vector $\mathbf{r} = \begin{pmatrix} 6 \\ 8 \end{pmatrix}$ and vector $\mathbf{s} = \begin{pmatrix} 4 \\ 9 \end{pmatrix}$.

   Calculate $\mathbf{r} - \mathbf{s}$.

3. Vector $\mathbf{g} = \begin{pmatrix} 5 \\ 2 \end{pmatrix}$ and vector $\mathbf{h} = \begin{pmatrix} 8 \\ -1 \end{pmatrix}$.

   Calculate $8\mathbf{g} + 5\mathbf{h}$.

4. Vector $\mathbf{c} = \begin{pmatrix} 9 \\ 4 \end{pmatrix}$ and vector $\mathbf{d} = \begin{pmatrix} 7 \\ -2 \end{pmatrix}$.

   Calculate $4\mathbf{c} - 3\mathbf{d}$.

Silver Questions

Complete the following vector component calculations...

1. Vector $\mathbf{m} = \begin{pmatrix} 4 \\ -3 \\ 5 \end{pmatrix}$ and vector $\mathbf{n} = \begin{pmatrix} 8 \\ 0 \\ -2 \end{pmatrix}$.

   Calculate $\mathbf{m} + \mathbf{n}$.

2. Vector $\mathbf{r} = \begin{pmatrix} 3 \\ 2 \\ -7 \end{pmatrix}$ and vector $\mathbf{s} = \begin{pmatrix} 4 \\ 6 \\ -5 \end{pmatrix}$.

   Calculate $\mathbf{r} - \mathbf{s}$.

3. Vector $\mathbf{g} = \begin{pmatrix} 1 \\ 6 \\ 2 \end{pmatrix}$ and vector $\mathbf{h} = \begin{pmatrix} 0 \\ -5 \\ 7 \end{pmatrix}$.

   Calculate $5\mathbf{g} + 2\mathbf{h}$.

4. Vector $\mathbf{c} = \begin{pmatrix} 8 \\ 4 \\ -2 \end{pmatrix}$ and vector $\mathbf{d} = \begin{pmatrix} 3 \\ 0 \\ 1 \end{pmatrix}$.

   Calculate $4\mathbf{c} - 5\mathbf{d}$.

Gold Questions

Complete the following vector component calculations...

1. Given that $\mathbf{a} = \begin{pmatrix} 2 \\ 4 \\ 7 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 5 \\ 9 \\ -1 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} -6 \\ 18 \\ 3 \end{pmatrix}$,

   Express $4\mathbf{a} + \mathbf{b} + \frac{1}{3}\mathbf{c}$ in component form.

2. Given that $\mathbf{a} = \begin{pmatrix} 8 \\ 0 \\ 2 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 7 \\ 3 \\ -5 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} 8 \\ 14 \\ -4 \end{pmatrix}$,

   Express $3\mathbf{a} - \mathbf{b} + \frac{1}{2}\mathbf{c}$ in component form.

3. Given that $\mathbf{a} = \begin{pmatrix} 1 \\ 6 \\ 4 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 2 \\ 4 \\ -3 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} -6 \\ 0 \\ 12 \end{pmatrix}$,

   Express $2\mathbf{a} - 5\mathbf{b} - \frac{1}{6}\mathbf{c}$ in component form.

Bronze Answers

1. $\begin{pmatrix} -1 \\ 8 \end{pmatrix}$ 2. $\begin{pmatrix} 2 \\ -1 \end{pmatrix}$

3. $\begin{pmatrix} 80 \\ 11 \end{pmatrix}$ 4. $\begin{pmatrix} 15 \\ 22 \end{pmatrix}$

Silver Answers

1. $\begin{pmatrix} 12 \\ -3 \\ 3 \end{pmatrix}$ 2. $\begin{pmatrix} -1 \\ -4 \\ -2 \end{pmatrix}$

3. $\begin{pmatrix} 5 \\ 20 \\ 24 \end{pmatrix}$ 4. $\begin{pmatrix} 17 \\ 16 \\ -13 \end{pmatrix}$

Gold Answers

1. $\begin{pmatrix} 11 \\ 31 \\ 28 \end{pmatrix}$ 2. $\begin{pmatrix} 21 \\ 4 \\ 9 \end{pmatrix}$ 3. $\begin{pmatrix} -7 \\ -8 \\ 21 \end{pmatrix}$