



## Foundation / Higher Tier

# Column vectors

### Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You must **show all your working.**
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- If your calculator does not have a  $\pi$  button, take the value of  $\pi$  to be 3.142 unless the question instructs otherwise.

### Information

- The marks for **each** question are shown in brackets- *use this as a guide as to how much time to spend on each question.*

### Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

1.

$$\mathbf{a} = \begin{pmatrix} 2 \\ 4 \end{pmatrix}, \mathbf{b} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$$

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

$$\begin{pmatrix} 2 \\ 4 \end{pmatrix} + \begin{pmatrix} 1 \\ 3 \end{pmatrix}$$

$$\begin{pmatrix} 3 \\ 7 \end{pmatrix}$$

.....  
(2)

b. Find  $2\mathbf{a}$

$$2 \times \begin{pmatrix} 2 \\ 4 \end{pmatrix}$$

$$\begin{pmatrix} 4 \\ 8 \end{pmatrix}$$

.....  
(2)

c. Find  $3\mathbf{a} - \mathbf{b}$

$$\begin{pmatrix} 6 \\ 12 \end{pmatrix} - \begin{pmatrix} 1 \\ 3 \end{pmatrix} = \begin{pmatrix} 5 \\ 9 \end{pmatrix}$$

$$\begin{pmatrix} 5 \\ 9 \end{pmatrix}$$

.....  
(2)

(Total for Question 1 is 6 marks)

2.  $\mathbf{a} = \begin{pmatrix} 4 \\ -6 \end{pmatrix}$ ,  $\mathbf{b} = \begin{pmatrix} 2 \\ -5 \end{pmatrix}$

a. Find  $2\mathbf{a}$

$$2 \times \begin{pmatrix} 4 \\ -6 \end{pmatrix}$$

$$\begin{pmatrix} 8 \\ -12 \end{pmatrix}$$

---

(2)

b. Find  $-\mathbf{b}$

$$-1 \times \begin{pmatrix} 2 \\ -5 \end{pmatrix}$$

$$\begin{pmatrix} -2 \\ 5 \end{pmatrix}$$

---

(2)

c. Find  $2\mathbf{a} + \mathbf{b}$

$$2 \times \begin{pmatrix} 4 \\ -6 \end{pmatrix} + \begin{pmatrix} 2 \\ -5 \end{pmatrix}$$

$$\begin{pmatrix} 8 \\ -12 \end{pmatrix} + \begin{pmatrix} 2 \\ -5 \end{pmatrix}$$

$$\begin{pmatrix} 10 \\ -17 \end{pmatrix}$$

---

(2)

(Total for Question 2 is 6 marks)

3.  $\mathbf{a} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$ ,  $\mathbf{b} = \begin{pmatrix} -2 \\ 7 \end{pmatrix}$ ,  $\mathbf{c} = \begin{pmatrix} 4 \\ -3 \end{pmatrix}$

a. Find  $\mathbf{a} + \mathbf{b} + \mathbf{c}$

$$\begin{pmatrix} 3 \\ 1 \end{pmatrix} + \begin{pmatrix} -2 \\ 7 \end{pmatrix} + \begin{pmatrix} 4 \\ -3 \end{pmatrix}$$

$$\begin{pmatrix} 5 \\ 5 \end{pmatrix}$$

---

(2)

b. Find  $2\mathbf{a} - \mathbf{c}$

$$2 \times \begin{pmatrix} 3 \\ 1 \end{pmatrix} - \begin{pmatrix} 4 \\ -3 \end{pmatrix} = \begin{pmatrix} 6 \\ 2 \end{pmatrix} - \begin{pmatrix} 4 \\ -3 \end{pmatrix}$$

$$\begin{pmatrix} 2 \\ 5 \end{pmatrix}$$

---

(2)

c. Find  $\mathbf{b} - \mathbf{a}$

$$\begin{pmatrix} -2 \\ 7 \end{pmatrix} - \begin{pmatrix} 3 \\ 1 \end{pmatrix}$$

$$\begin{pmatrix} -5 \\ 6 \end{pmatrix}$$

---

(2)

(Total for Question 3 is 6 marks)

4.

$$\mathbf{a} = \begin{pmatrix} 1 \\ -2 \end{pmatrix}, \mathbf{b} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$$

a. Find  $3\mathbf{a} - 2\mathbf{b}$

$$3 \begin{pmatrix} 1 \\ -2 \end{pmatrix} - 2 \begin{pmatrix} 4 \\ 3 \end{pmatrix} = \begin{pmatrix} 3 \\ -6 \end{pmatrix} - \begin{pmatrix} 8 \\ 6 \end{pmatrix}$$

---

$$\begin{pmatrix} -5 \\ -12 \end{pmatrix}$$

(2)

b. Find  $\mathbf{b} - 3\mathbf{a}$

$$\begin{pmatrix} 4 \\ 3 \end{pmatrix} - \begin{pmatrix} 3 \\ -6 \end{pmatrix} = \begin{pmatrix} 1 \\ 9 \end{pmatrix}$$

---

$$\begin{pmatrix} 1 \\ 9 \end{pmatrix}$$

(2)

c. Find  $2(\mathbf{a} + \mathbf{b})$

$$2 \left( \begin{pmatrix} 1 \\ -2 \end{pmatrix} + \begin{pmatrix} 4 \\ 3 \end{pmatrix} \right) = 2 \begin{pmatrix} 5 \\ 1 \end{pmatrix}$$

---

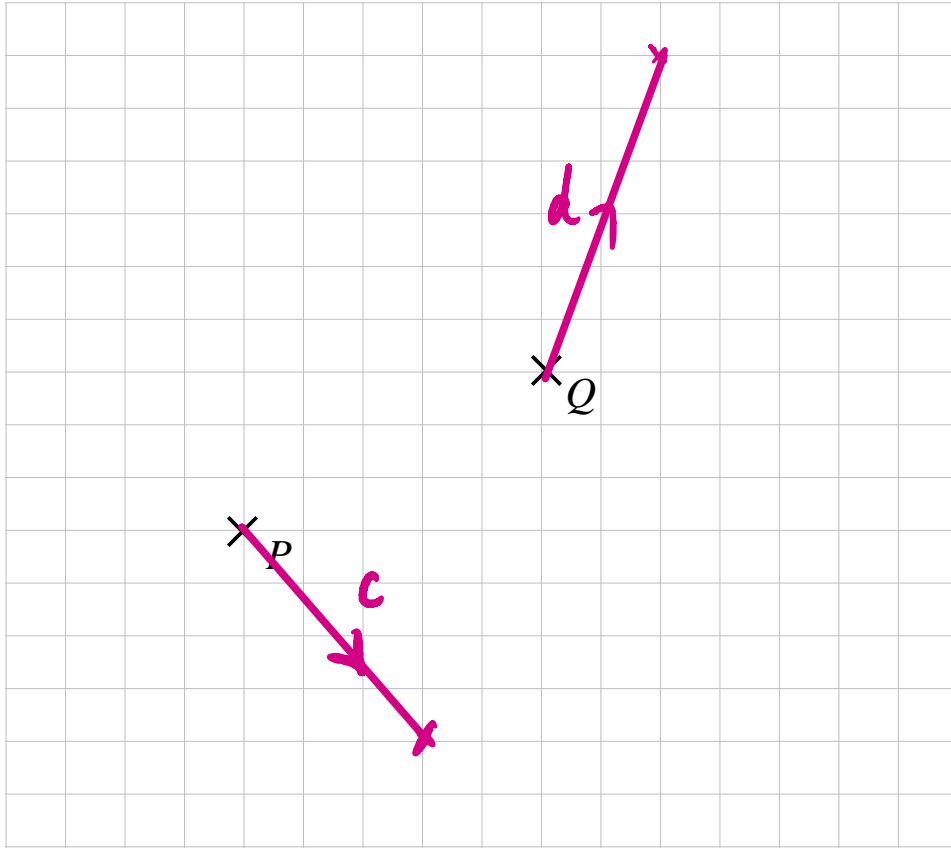
$$\begin{pmatrix} 10 \\ 2 \end{pmatrix}$$

(2)

(Total for Question 4 is 6 marks)

5.

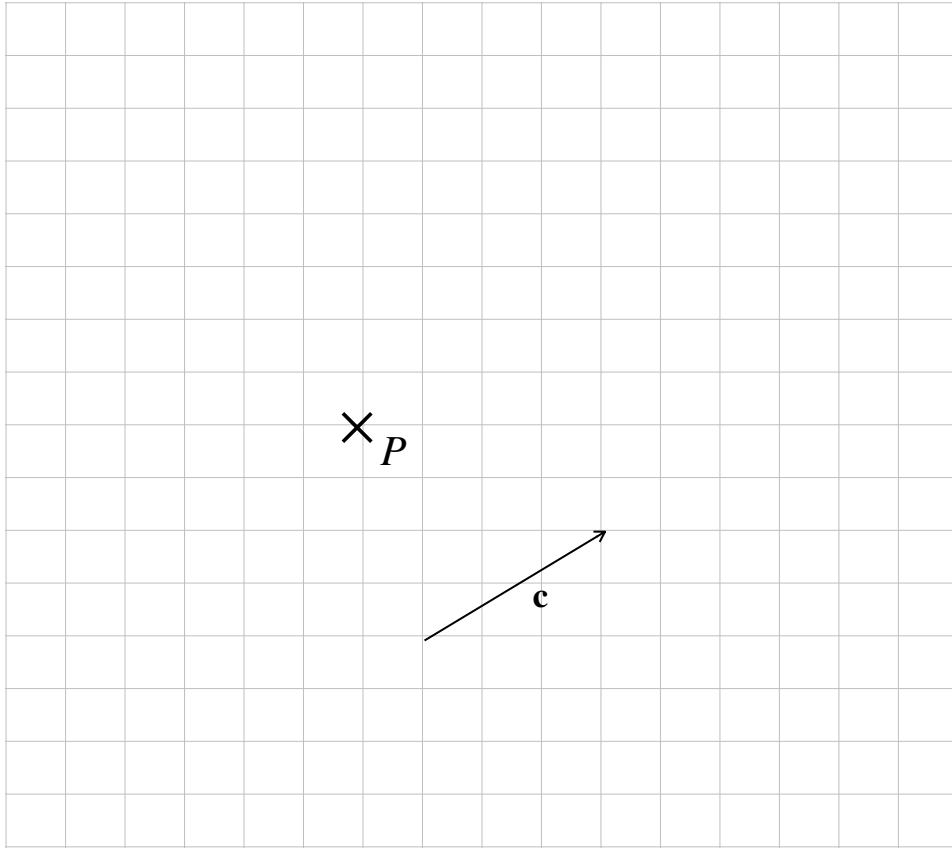
$$\mathbf{c} = \begin{pmatrix} 3 \\ -4 \end{pmatrix}, \mathbf{d} = \begin{pmatrix} 2 \\ 6 \end{pmatrix}$$



- a. From vector P, draw the vector  $\mathbf{c}$  (1)
- b. From vector Q, draw the vector  $\mathbf{d}$  (1)

(Total for Question 5 is 2 marks)

6. a. From vector P, draw the vector  $2\mathbf{c}$



(1)

b. Write down the vector  $6\mathbf{c}$

.....

(1)

(Total for Question 6 is 2 marks)