

## Chapter 5

## Exercise 5A

$$1 \text{ (i) a } \begin{pmatrix} -3 \\ 6 \\ 5 \end{pmatrix} \quad \text{b } \begin{pmatrix} 0 \\ 4 \\ -5 \end{pmatrix} \quad \text{c } \begin{pmatrix} 12 \\ 18 \\ 4 \end{pmatrix}$$

$$\text{(ii) a } \sqrt{70} \quad \text{b } \sqrt{41} \quad \text{c } \sqrt{34}$$

$$2 \text{ a } 3\tilde{i} + 5\tilde{j}$$

$$\text{b } 7\tilde{i} - 9\tilde{j}$$

$$\text{c } 3\tilde{i} - 2\tilde{j} - 6\tilde{k}$$

$$\text{d } 1\tilde{i} + 0\tilde{j} - 4\tilde{k}$$

$$\text{e } 8\tilde{i} + 2\tilde{j} - 1\tilde{k}$$

$$3 \text{ a } \begin{pmatrix} 2 \\ 5 \\ -1 \end{pmatrix} \quad \text{b } \begin{pmatrix} 7 \\ -3 \\ 9 \end{pmatrix} \quad \text{c } \begin{pmatrix} 6 \\ 0 \\ -5 \end{pmatrix} \quad \text{d } \begin{pmatrix} 0 \\ 8 \\ 5 \end{pmatrix}$$

$$4 \text{ (i) a } 4\tilde{i} - 4\tilde{j} + 11\tilde{k}$$

$$\text{b } -10\tilde{i} + 5\tilde{j} + 16\tilde{k}$$

$$\text{c } -9\tilde{i} + 7\tilde{j} + 10\tilde{k}$$

$$\text{(ii) a } 3\sqrt{17}$$

$$\text{b } \sqrt{381}$$

$$\text{c } \sqrt{230}$$

$$5 \quad x = 5$$

$$y = 2$$

$$6 \quad x = 3$$

$$\text{b } y = -5$$

$$7 \quad x = 4$$

$$y = 3$$

$$z = 2$$

$$8 \quad x = -4$$

$$y = 4$$

$$z = -2$$

$$9 \quad x = 3$$

$$y = -2$$

$$z = 6$$

$$10 \text{ a } \begin{pmatrix} \frac{4}{5} \\ \frac{3}{5} \end{pmatrix} \quad \text{b } \begin{pmatrix} -\frac{3}{5} \\ \frac{4}{5} \end{pmatrix} \quad \text{c } \begin{pmatrix} \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{pmatrix}$$

$$11 \begin{pmatrix} \frac{3}{\sqrt{14}} \\ -\frac{1}{\sqrt{14}} \\ \sqrt{\frac{2}{7}} \end{pmatrix}$$

$$\begin{pmatrix} -\frac{3}{\sqrt{14}} \\ \frac{1}{\sqrt{14}} \\ -\sqrt{\frac{2}{7}} \end{pmatrix}$$

$$12 \quad z = \frac{\sqrt{3}}{4}$$

$$13 \quad y = -\frac{\sqrt{23}}{6}$$

$$y = \frac{\sqrt{23}}{6}$$

$$14 \quad a = -\sqrt{14}$$

$$a = \sqrt{14}$$

## Exercise 5B

$$1 \text{ a } CB = \begin{pmatrix} 2 \\ 5 \end{pmatrix}$$

$$AB = \begin{pmatrix} 5 \\ -1 \end{pmatrix}$$

$$AC = \begin{pmatrix} 3 \\ -6 \end{pmatrix}$$

$$\text{b } \sqrt{29}$$

$$\sqrt{26}$$

$$3\sqrt{5}$$

$$2 \quad -3\tilde{i} - 5\tilde{j}$$

$$-2\tilde{i} - 7\tilde{j}$$

$$5\tilde{i} + 12\tilde{j}$$

$$3 \quad 5\tilde{i} - 1\tilde{j} - 4\tilde{k}$$

$$-2\tilde{i} - 8\tilde{j} - 10\tilde{k}$$

$$-3\tilde{i} + 9\tilde{j} - 6\tilde{k}$$

$$\sqrt{42}$$

$$2\sqrt{42}$$

$$3\sqrt{14}$$

$$4 \quad -8\tilde{i} + 2\tilde{j} - 5\tilde{k}$$

$$9\tilde{i} - 5\tilde{j} + 3\tilde{k}$$

$$-1\tilde{i} + 3\tilde{j} + 2\tilde{k}$$

● ANSWERS

- 5 **a**  $(-4, 9)$   
**b**  $(-1, 3)$   
**c**  $(-4, 0, 12)$   
**d**  $(-1, 3, 5)$   
**e**  $(9, 2, 7)$
- 6  $(4, 2)$
- 7  $(-2, 4, 4)$
- 8  $Q(2, 0, 0)$   
 $R(12, 0, 0)$

**Exercise 5C**

- 1  $B(4, 0, 2)$
- 2  $Q(2, 3, 13)$
- 3  $(-4, -1, 0)$
- 4  $D(9, -3, 2)$
- 5  $B(1, 1, -3)$
- 6  $B(2, 2, -2)$   
 $D(0, -4, -14)$
- 7  $Q(4, 2, -1)$   
 $S(8, -4, -5)$   
 $T(10, -7, -7)$
- 8  $C(-2, 7, 10)$
- 9  $A(-2, 24, -20)$

**Exercise 5D**

- 1 **a**  $\vec{RP}$   
**b**  $\vec{QS}$   
**c**  $0$
- 2 **a**  $\vec{AD}$   
**b**  $\vec{AD}$   
**c**  $\vec{EC}$   
**d**  $\vec{AD}$
- 3 **a**  $\underline{a} + \underline{b} + \underline{c}$   
**b**  $\underline{a} + \underline{b}$   
**c**  $\underline{b} + \underline{c}$   
**d**  $\underline{a} - \underline{b} - \underline{c}$

- e**  $-\underline{a} - \underline{c}$   
**f**  $-\underline{a} - \underline{c}$

4 **a**  $\begin{pmatrix} 5 \\ 7 \\ 7 \end{pmatrix}$     **b**  $\begin{pmatrix} -1 \\ 5 \\ 7 \end{pmatrix}$     **c**  $\begin{pmatrix} 3 \\ -3 \\ 1 \end{pmatrix}$

5  $\vec{EA} = \begin{pmatrix} 3 \\ -5 \\ -6 \end{pmatrix}$      $\vec{BE} = \begin{pmatrix} -5 \\ -1 \\ 4 \end{pmatrix}$

6 **a**  $\vec{OQ} = \begin{pmatrix} 2 \\ 3 \\ 4 \end{pmatrix}$

$Q(2, 3, 4)$

**b**  $\vec{OP} = \begin{pmatrix} 6 \\ \frac{3}{2} \\ 2 \end{pmatrix}$

$P(6, \frac{3}{2}, 2)$

- 7 Typo in X position – should say X is mid-point of HG not HC.

- a**  $9\underline{i} + 9\underline{j} + 6\underline{k}$   
**b**  $6\underline{i} + 8\underline{j} + 5\underline{k}$   
**c**  $8\underline{i} + 8\underline{j} + 3\underline{k}$   
**d**  $0\underline{i} + 6\underline{j} + 3\underline{k}$   
**e**  $2\underline{i} + 0\underline{j} - 2\underline{k}$

8 **a**  $\vec{PA} = \begin{pmatrix} 9 \\ 2 \\ 4 \end{pmatrix}$

**b**  $\vec{PB} = \begin{pmatrix} 5 \\ -5 \\ \frac{15}{4} \end{pmatrix}$

**c**  $\vec{QV} = \begin{pmatrix} 2 \\ -8 \\ 10 \end{pmatrix}$

$$\mathbf{d} \quad \vec{PV} = \begin{pmatrix} 10 \\ -4 \\ 13 \end{pmatrix}$$

$$\mathbf{e} \quad \vec{AB} = \begin{pmatrix} -4 \\ -7 \\ -\frac{1}{4} \end{pmatrix}$$

- 9** Wording very poor and also incorrect according to diagram: it should be "A lies three quarters along WV and B lies two thirds along UV."

$$\vec{PA} = \begin{pmatrix} -\frac{31}{4} \\ -\frac{11}{2} \\ \frac{129}{4} \end{pmatrix}$$

$$\vec{PB} = \begin{pmatrix} -\frac{17}{3} \\ -\frac{14}{3} \\ 33 \end{pmatrix}$$

### Exercise 5E

**1 a**  $t = 10$

**b**  $t = 4$

**2**  $h = -2$

$k = 8$

**3**  $c = 7$

$d = -5$

**4 a** first = 3 (second)

**b** second = 2 (first)

**c** second = 2.5 (first)

**d** second =  $-\frac{2}{3}$  (first)

First = multiple (second)  $\Rightarrow$  parallel

**5** D(23, -2, -7)

**6 a** collinear

**b** not collinear

**c** not collinear

**d** collinear

**7 a**  $AB = \left(\frac{1}{3}\right) AC$  so A, B, C collinear

**b** ratio is 1:2

**8 a**  $PQ = \left(\frac{1}{4}\right) PR$  so PQR collinear

**b** ratio is 1:3

**9 a**  $MN = \left(\frac{2}{3}\right) MP$  so MNP collinear

**b** ratio is 2:1

**10 a**  $AB = \left(\frac{2}{5}\right) AC$  so ABC collinear

**b** ratio is 2:3

**11** EF is not multiple of EG so EFG not collinear

**12 a**  $PQ = \left(\frac{1}{3}\right) PR$  so collinear

**b** S(10, 5, -1)

**13 a**  $PA = \left(\frac{1}{4}\right) PB$  so PAB collinear

**b** 14:45

**14**  $AB = \left(\frac{3}{5}\right) AC$  so collinear

**15 a** C(9, -41, 32)

**b** not collinear so no.