## REVIEW SET 15B (MATRICES)

**1** Given P(2, −5, 6) and Q(−1, 7, 9), find:

**a** the position vector of Q from P **b** the distance from P to Q

**c** the distance from P to the $x$-axis.

**2** For $\mathbf{m} = \begin{bmatrix} 6 \\ -3 \\ 1 \end{bmatrix}$, $\mathbf{n} = \begin{bmatrix} 2 \\ 3 \\ -4 \end{bmatrix}$ and $\mathbf{p} = \begin{bmatrix} -1 \\ 3 \\ 6 \end{bmatrix}$, find:

**a** $\mathbf{m} - \mathbf{n} + \mathbf{p}$ **b** $2\mathbf{n} - 3\mathbf{p}$ **c** $|\mathbf{m} + \mathbf{p}|$

**3** If $\overrightarrow{AB} = \begin{bmatrix} 2 \\ -7 \\ 4 \end{bmatrix}$ and $\overrightarrow{AC} = \begin{bmatrix} -6 \\ 1 \\ -3 \end{bmatrix}$, find $\overrightarrow{CB}$.

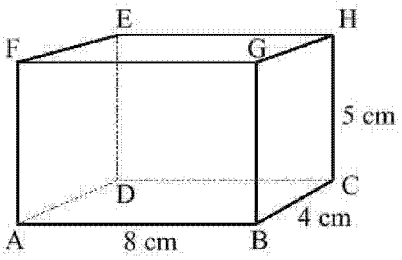
**4** Find $m$ and $n$ if $\begin{bmatrix} 3 \\ m \\ n \end{bmatrix}$ and $\begin{bmatrix} -12 \\ -20 \\ 2 \end{bmatrix}$ are parallel vectors.

**5** Prove that P(−6, 8, 2), Q(4, 6, 8) and R(19, 3, 17) are collinear. Hence find the ratio in which Q divides PR.

**6** Find $t$ if $\begin{bmatrix} -4 \\ t+2 \\ t \end{bmatrix}$ and $\begin{bmatrix} t \\ 1+t \\ -3 \end{bmatrix}$ are perpendicular vectors.

**7** Determine the angle between $\begin{bmatrix} 2 \\ -4 \\ 3 \end{bmatrix}$ and $\begin{bmatrix} -1 \\ 1 \\ 3 \end{bmatrix}$.

**8** Find the measure of angle GAC in the rectangular box alongside. Use vector methods.




**9** For P(2, 3, −1) and Q(−4, 4, 2) find:

**a** $\overrightarrow{PQ}$ **b** the distance between P and Q **c** the midpoint of PQ.

**10** For $\mathbf{p} = \begin{bmatrix} -1 \\ 2 \\ 1 \end{bmatrix}$, $\mathbf{q} = \begin{bmatrix} 3 \\ -1 \\ 4 \end{bmatrix}$ and $\mathbf{r} = \begin{bmatrix} 1 \\ 1 \\ 2 \end{bmatrix}$ find:

**a** $\mathbf{p} \bullet \mathbf{q}$ **b** $\mathbf{p} + 2\mathbf{q} - \mathbf{r}$ **c** the angle between $\mathbf{p}$ and $\mathbf{r}$.

**11** Find all angles of the triangle with vertices K(3, 1, 4), L(−2, 1, 3) and M(4, 1, 3).

**12** Find the angle between $\begin{bmatrix} 3 \\ 1 \\ -2 \end{bmatrix}$ and $\begin{bmatrix} 2 \\ 5 \\ 1 \end{bmatrix}$.

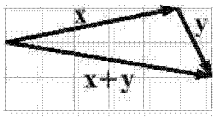
**13** If A(4, 2, −1), B(−1, 5, 2), C(3, −3, $c$) and triangle ABC is right angled at B, find possible values of $c$.

**14** Explain why:

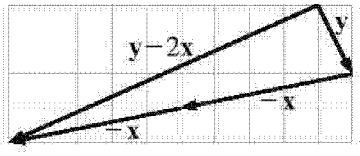
**a** $\mathbf{a} \bullet \mathbf{b} \bullet \mathbf{c}$ is meaningless **b** you do not need a bracket for $\mathbf{a} \bullet \mathbf{b} \times \mathbf{c}$.

**15** Find $k$ if the following are unit vectors: **a** $\begin{bmatrix} \frac{4}{7} \\ \frac{1}{k} \end{bmatrix}$ **b** $\begin{bmatrix} k \\ k \end{bmatrix}$

**2** **a**




**b**



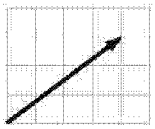

**3** **a** $\overrightarrow{PQ}$ **b** $\overrightarrow{PR}$ **4** 4.845 km, 208° **5** **a** $\overrightarrow{AC}$ **b** $\overrightarrow{AD}$

**6** **a** $AB = \frac{1}{2}CD$, $AB \parallel CD$ **b** C is midpoint AB

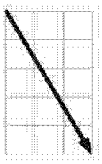
**7** **a** $\mathbf{p} + \mathbf{r} = \mathbf{q}$ **b** $\mathbf{l} + \mathbf{m} = \mathbf{k} - \mathbf{j} + \mathbf{n}$

**8** **a** $\mathbf{r} + \mathbf{q}$ **b** $-\mathbf{p} + \mathbf{r} + \mathbf{q}$ **c** $\mathbf{r} + \frac{1}{2}\mathbf{q}$ **d** $-\frac{1}{2}\mathbf{p} + \frac{1}{2}\mathbf{r}$

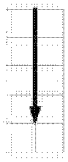
**9** **a** $\begin{bmatrix} 4 \\ 3 \end{bmatrix}$



**b** $\begin{bmatrix} 3 \\ -5 \end{bmatrix}$



**c** $\begin{bmatrix} 0 \\ -4 \end{bmatrix}$



**10** **a** $\begin{bmatrix} -4 \\ -2 \end{bmatrix}$ **b** $\begin{bmatrix} -1 \\ -13 \end{bmatrix}$ **c** $\begin{bmatrix} -4 \\ 8 \end{bmatrix}$ **11** $\begin{bmatrix} 1 \\ 4 \end{bmatrix}$

**12** **a** $\sqrt{17}$ units **b** $\sqrt{13}$ units **c** $\sqrt{10}$ units **d** $\sqrt{109}$ units

**13** **a** $\mathbf{p} + \mathbf{q}$ **b** $\frac{3}{2}\mathbf{p} + \frac{1}{2}\mathbf{q}$

**14** **a** $\mathbf{x} = \begin{bmatrix} -1 \\ \frac{1}{3} \end{bmatrix}$ **b** $\mathbf{x} = \begin{bmatrix} 1 \\ -10 \end{bmatrix}$ **16** $r = 4,\ s = 7$

**17** **a** $\mathbf{q} + \mathbf{r}$ **b** $\mathbf{r} + \mathbf{q}$, $DB = AC$, $DB \parallel AC$

## REVIEW SET 15B

**1** **a** $\overrightarrow{PQ} = \begin{bmatrix} -3 \\ 12 \\ 3 \end{bmatrix}$ **b** $\sqrt{162}$ units **c** $\sqrt{61}$ units

**2** **a** $\begin{bmatrix} 3 \\ -3 \\ 11 \end{bmatrix}$ **b** $\begin{bmatrix} 7 \\ -3 \\ -26 \end{bmatrix}$ **c** $\sqrt{74}$ units **3** $\begin{bmatrix} 8 \\ -8 \\ 7 \end{bmatrix}$

**4** $m = 5,\ n = -\frac{1}{2}$ **5** 2 : 3 **6** $t = 2 \pm \sqrt{2}$ **7** 80.3°

**8** 40.7° **9** **a** $\begin{bmatrix} -6 \\ 1 \\ 3 \end{bmatrix}$ **b** $\sqrt{46}$ units **c** $(-1, 3\frac{1}{2}, \frac{1}{2})$

**10** **a** $-1$ **b** $\begin{bmatrix} 4 \\ -1 \\ 7 \end{bmatrix}$ **c** 60°

**11** $\angle K \doteq 123.7°$, $\angle L \doteq 11.3°$, $\angle M \doteq 45.0°$

**12** 63.95° **13** $c = \frac{50}{3}$

**14** **a** $\mathbf{a} \bullet \mathbf{b}$ is a scalar, so $\mathbf{a} \bullet \mathbf{b} \bullet \mathbf{c}$ is a scalar dotted with a vector, which is meaningless.

**b** $\mathbf{b} \times \mathbf{c}$ must be done first otherwise we have a scalar crossed with a vector which is meaningless.

**15** **a** $k = \pm\frac{7}{\sqrt{33}}$ **b** $k = \pm\frac{1}{\sqrt{2}}$

## REVIEW SET 15C

**1** **a** $-13$ **b** $-36$ **3** $t = \frac{2}{3}$ or $-3$ **4** $k = 6$

**5** $k\begin{bmatrix} 5 \\ 4 \end{bmatrix}$, $k \neq 0$ **6** $\angle K = 64.44°$, $\angle L = 56.89°$, $\angle M = 58.67°$

**7** 72.35° or 107.65°

**8** **a** **i** **(1)** $\mathbf{p} + \mathbf{q}$ **(2)** $\frac{1}{2}\mathbf{p} + \frac{1}{2}\mathbf{q}$

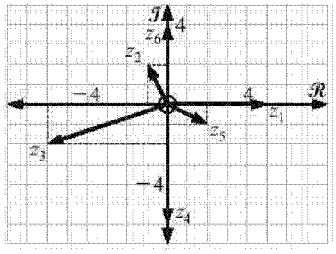
**b** **i** $\overrightarrow{AC} = -\mathbf{p} + \mathbf{r}$, $\overrightarrow{BC} = -\mathbf{q} + \mathbf{r}$

**9** **a** $\begin{bmatrix} 7 \\ -12 \\ -7 \end{bmatrix}$ **b** $\begin{bmatrix} 1 \\ -\frac{5}{3} \\ -\frac{2}{3} \end{bmatrix}$ **c** $\begin{bmatrix} \frac{5}{14} \\ -\frac{5}{7} \\ -\frac{15}{14} \end{bmatrix}$

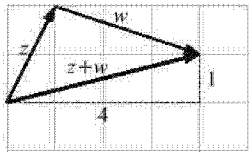
**10** **a** $\pm 7$ **b** $\frac{\sqrt{14}}{2}$ units$^2$ **c** $\frac{7}{6}$ units$^3$

## EXERCISE 16A.1

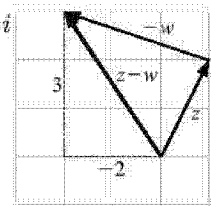
**1**



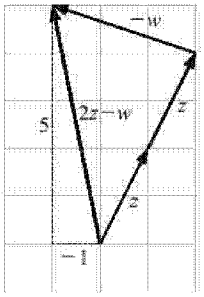

**2** **a** $4 + i$



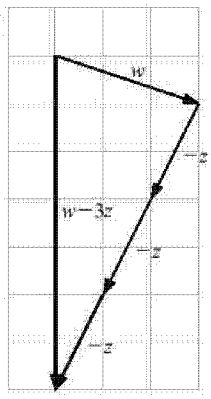

**b** $-2 + 3i$



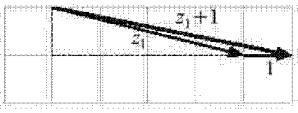

**c** $-1 + 5i$



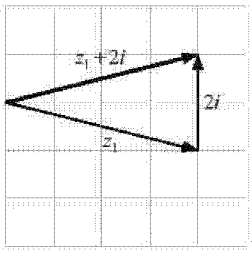

**d** $-7i$



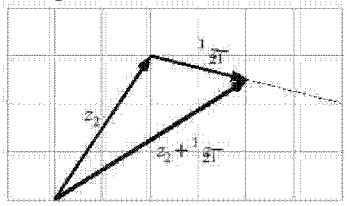

**3** **a** $5 - i$



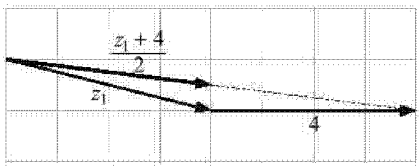

**b** $4 + i$



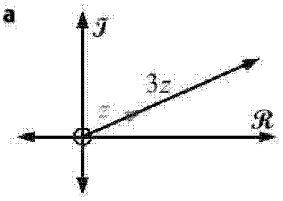

**c** $4 + \frac{5}{2}i$



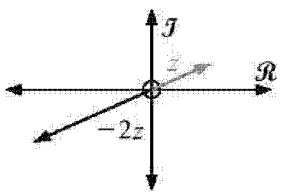

**d** $4 - \frac{1}{2}i$



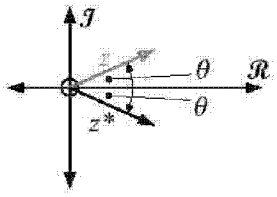

**4** **a**




**b**




**c**




**d**