Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

2.1

$\begin{pmatrix} 0-3 \\ 1+2 \\ 6-0 \end{pmatrix} = \begin{pmatrix} -3 \\ 3 \\ 6 \end{pmatrix}$

2.2

$\overrightarrow{AB} \times \overrightarrow{AC} = \begin{pmatrix} 0 \\ -8 \\ 6 \end{pmatrix}$; area $= \frac{1}{2}(10) = \mathbf{5}$

2.3

$2x - y + 3z = d$; $d = 2 - 2 - 3$; $\mathbf{2x - y + 3z = -3}$

3.1

(a) $\begin{pmatrix} 2 \\ 1 \\ -2 \end{pmatrix}$; $\begin{pmatrix} 1 \\ -1 \\ -1 \end{pmatrix}$

(b) $\begin{pmatrix} -1-2 \\ -2+2 \\ -2-1 \end{pmatrix} = \begin{pmatrix} -3 \\ 0 \\ -3 \end{pmatrix}$

(c) normal $\begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix}$, $x + z = 1 + 2$; $\mathbf{x + z = 3}$

(d) $\frac{1}{2}\sqrt{9+0+9} = \mathbf{2.12}$

(e) $\lambda + \lambda = 3$, $\lambda = 1.5$; $(\mathbf{1.5}, \mathbf{1.5}, \mathbf{1.5})$

3.2

(a) $\mathbf{b} \cdot \mathbf{n} = 2 + 2 - 1 = 3$; $\sin\theta = \dfrac{3}{\sqrt{6}\sqrt{6}}$; $\theta = \mathbf{30}^\circ$

(b) $(1 + 2t) + 2(-1 + t) - (2 + t) = 7$; $t = \frac{10}{3}$; $\left(\frac{\mathbf{23}}{\mathbf{3}}, \frac{\mathbf{7}}{\mathbf{3}}, \frac{\mathbf{16}}{\mathbf{3}}\right)$

(c) direction $\begin{pmatrix} 1 \\ 2 \\ -1 \end{pmatrix} \times \begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ -2 \\ -3 \end{pmatrix}$; with $z = 0$: $x + 2y = 7$, $x - y = 2$, point $\left(\frac{11}{3}, \frac{5}{3}, 0\right)$; $\mathbf{r} = \begin{pmatrix} 11/3 \\ 5/3 \\ 0 \end{pmatrix} + s\begin{pmatrix} 1 \\ -2 \\ -3 \end{pmatrix}$