VECTORS   **CALCULATOR**

1) Vectors **a** and **b** have components $\mathbf{a} = \begin{pmatrix} q \\ 3 \\ -2 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} -4 \\ q \\ 9 \end{pmatrix}$. If **a** and **b** and perpendicular,

work out the value of q.

2) Show that the points A(7, 2, 7), B(−2, 5, 1) and C(10, 1, 9) are collinear and state the ratio in which A divides BC.

3) Vectors **p** and **q** are defined by $\mathbf{p} = \begin{pmatrix} -3 \\ 4 \\ 1 \end{pmatrix}$ and $\mathbf{q} = \begin{pmatrix} 5 \\ 2 \\ -3 \end{pmatrix}$. Calculate the acute angle between

p and **q**.

4) Vectors **a** and **b** are such that $\mathbf{a} = 4\mathbf{i} - 2\mathbf{j} + 5\mathbf{k}$ and $\mathbf{b} = 2\mathbf{i} + 4\mathbf{j} + q\mathbf{k}$. Express $3\mathbf{a} - \mathbf{b}$ in component form and hence find the values of q for which $|3\mathbf{a} - \mathbf{b}| = 15$

5) The diagram shows a triangular prism ABCDEF.

- $\overrightarrow{AC} = \mathbf{d}$
- $\overrightarrow{CD} = \mathbf{e}$
- $\overrightarrow{DF} = \mathbf{f}$
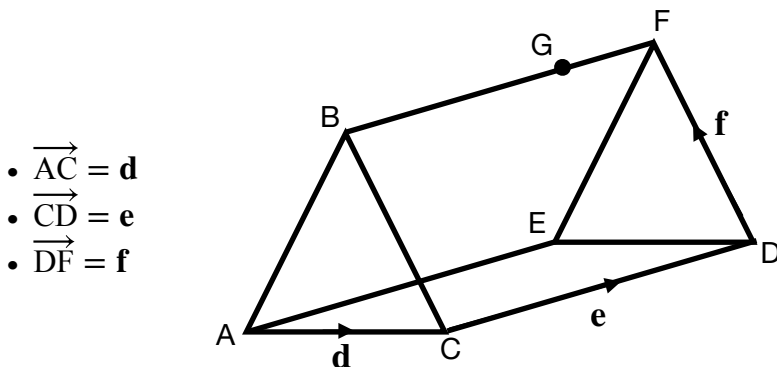
a) Express $\overrightarrow{FA}$ in terms of **d**, **e** and **f**.

b) G is $\dfrac{3}{4}$ of the way along BF. Express $\overrightarrow{CG}$ in terms of **d**, **e** and **f**.

6) Unit vectors **m** and **n** are such that $\mathbf{m} \cdot \mathbf{n} = \dfrac{1}{3}$. Determine the value of $\mathbf{m} \cdot (2\mathbf{m} - \mathbf{n})$.