12C Modelling with Vectors

1. A, B, C and D are the points $(2, -5, -8)$, $(1, -7, -3)$, $(0{,}15, -10)$ and $(2{,}19, -20)$ respectively.

a) Find $\overrightarrow{AB}$ and $\overrightarrow{DC}$, giving your answers in the form $p\boldsymbol{i} + q\boldsymbol{j} + r\boldsymbol{k}$

b) Show that the lines AB and DC are parallel and that $\overrightarrow{AB} = 2\overrightarrow{DC}$

c) Hence, describe the quadrilateral $ABCD$

2. P, Q and R are the points $(4, -9, -3)$, $(7, \ -7, \ -7)$ and $(8, -2, 0)$ respectively. Find the coordinates of a point S such that $PQRS$ forms a parallelogram.

3. Given that:

$$3\boldsymbol{i} + (p+2)\boldsymbol{j} + 120\boldsymbol{k} = p\boldsymbol{i} - q\boldsymbol{j} + 4pqr\boldsymbol{k}$$

Find the values of p, q and r.

4. The diagram shows a cuboid whose vertices are O, A, B, C, D, E, F and G. Vectors $\boldsymbol{a}$, $\boldsymbol{b}$ and $\boldsymbol{c}$ are the position vectors of the vertices A, B and C respectively. Prove that diagonals OE and BG bisect each other.