7. Relative to a fixed origin O

- the point A has position vector $8\mathbf{i} - 3\mathbf{j} + 2\mathbf{k}$
- the point B has position vector $t\mathbf{i} + 2t\mathbf{j} + 5t\mathbf{k}$

where t is a non-zero constant.

(a) Show that $\left|\overrightarrow{AB}\right|^2 = 30t^2 - 24t + 77$

(3)

(b) Hence find

(i) the value of t when $\left|\overrightarrow{AB}\right|$ takes its minimum value,

(ii) the minimum value of $\left|\overrightarrow{AB}\right|$, giving your answer as a simplified surd.

(4)

Given that

- $\left|\overrightarrow{AB}\right|$ takes its minimum value
- the point C lies on AB such that C divides AB in the ratio $5:3$

(c) find the coordinates of C

(2)