

### Vectors 4: Intersections of lines

Name.....

- (1) Find the vector equation of the line joining  $A(2,3)$  and  $B(-5,1)$ .  
 (b) Is the point  $(16,7)$  on the line?

- (2) Two lines have vector equations:

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 2 \\ 0 \\ -1 \end{pmatrix} + \lambda \begin{pmatrix} 2 \\ 12 \\ -8 \end{pmatrix}, \quad \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 5 \\ 2 \\ -7 \end{pmatrix} + \mu \begin{pmatrix} 0 \\ -6 \\ 2 \end{pmatrix}$$

Show that the lines are skew.

- (3) Two vector equations for the motion of two drones which set off at the same time are given below.

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 5 \\ 3 \\ 1 \end{pmatrix} + t_1 \begin{pmatrix} 2 \\ 2 \\ 2 \end{pmatrix}, \quad \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} -3 \\ 4 \\ 8 \end{pmatrix} + t_2 \begin{pmatrix} 2 \\ -1 \\ -3 \end{pmatrix}$$

Show that both drones will pass through the same point and find the coordinates of intersection. Will the drones crash into each other? Explain your answer.



(4) A car starts at the origin and is traveling in the direction  $\begin{pmatrix} 6 \\ 8 \end{pmatrix}$  with speed 40 m/s. In this question time  $t$  is in seconds and distances are in metres.

(a) Give a vector equation in the form:

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} a \\ b \end{pmatrix} + t \begin{pmatrix} c \\ d \end{pmatrix}$$

(b) A second car sets off at the same time with motion given by the vector equation:

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 12 \\ 6 \end{pmatrix} + t \begin{pmatrix} 20 \\ 30 \end{pmatrix}$$

Will the two cars crash into each other? Explain your answer.

(5) Find the vector equation of the line  $L_1$  between  $A(1,5)$  and  $B(3,14)$

(b) Find the shortest distance between the line  $L_1$  and the point  $C(10, 8)$  by considering the point of intersection.

(c) Find the shortest distance between the line  $L_1$  and the point  $C(10, 8)$  by considering graphing the distance to find a minimum.