1 A, B and C are three points such that

$\overrightarrow{AB} = 3\mathbf{a} + 4\mathbf{b}$

$\overrightarrow{AC} = 15\mathbf{a} + 20\mathbf{b}$

(a) Prove that A, B and C lie on a straight line.

factor and common point

$\overrightarrow{AB} = 3a + 4b$

$\overrightarrow{AC} = 5(3a + 4b)$ ✓(1)

• $\overrightarrow{AC}$ is a multiple of $\overrightarrow{AB}$ and they share point A ✓(1)

(2)

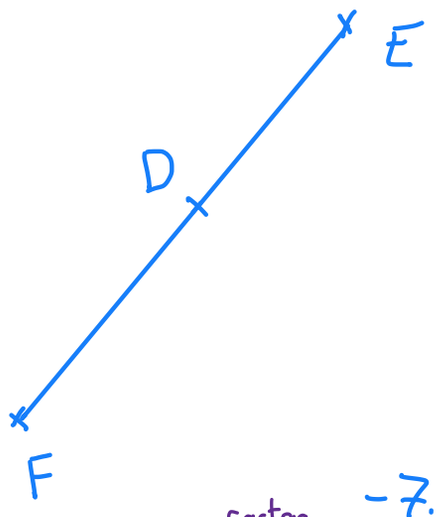
D, E and F are three points on a straight line such that

$\overrightarrow{DE} = 3\mathbf{e} + 6\mathbf{f}$

$\overrightarrow{EF} = -10.5\mathbf{e} - 21\mathbf{f}$

(b) Find the ratio

length of DF : length of DE



$\overrightarrow{DF} = \overrightarrow{DE} + \overrightarrow{EF}$

$= 3e + 6f + -10.5e + -21f$

collect e and f

$= -7.5e - 15f$ ✓(1)

$\overrightarrow{DF} : \overrightarrow{DE}$

$-7.5e - 15f : 3e + 6f$

factor out ↓

$-2.5(3e + 6f) : 3e + 6f$

$\div 3e + 6f$ $\quad$ $\div 3e + 6f$

$-2.5 : 1$ ✓(1)

negative answer just means opposite direction → $-5 : 2$

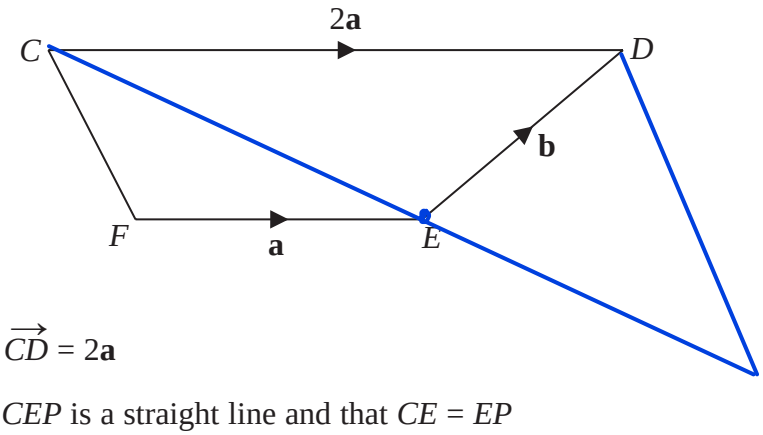
✓(1)

$5 : 2$

(3)

(Total for Question 1 is 5 marks)

2 *CDEF* is a quadrilateral.



$\overrightarrow{FE} = \mathbf{a}$ $\overrightarrow{ED} = \mathbf{b}$ $\overrightarrow{CD} = 2\mathbf{a}$

The point *P* is such that *CEP* is a straight line and that *CE* = *EP*

Use a vector method to prove that *CF* is parallel to *DP*.

$\overrightarrow{CF} = \overrightarrow{CD} + \overrightarrow{DE} + \overrightarrow{EF}$
$= 2\underline{a} - \underline{b} - \underline{a}$
$= \underline{a} - \underline{b}$ (1)

$\overrightarrow{CE} = \overrightarrow{CD} + \overrightarrow{DE}$
$= 2\underline{a} - \underline{b}$ (1)

$\therefore \overrightarrow{EP} = 2\underline{a} - \underline{b}$ (1)

$\overrightarrow{DP} = \overrightarrow{DE} + \overrightarrow{EP}$
$= -\underline{b} + (2\underline{a} - \underline{b})$
$= 2\underline{a} - 2\underline{b}$
$= 2(\underline{a} - \underline{b})$ (1)
$= 2\overrightarrow{CF}$
$\therefore$ they are parallel

Method: find $\overrightarrow{CF}$ and $\overrightarrow{DP}$ and show that one is a multiple of the other.

(Total for Question 2 is 4 marks)