	Vectors Mark Scheme	
1(a)	$2\boldsymbol{a}+\boldsymbol{b}$	[1] Vector representing M to L
1(b)	$\frac{1}{2}(2\boldsymbol{a}+\boldsymbol{b})=\boldsymbol{a}+\frac{\boldsymbol{b}}{2}$	[1] Vector representing M to P
1(c)	$4\begin{bmatrix}\boldsymbol{a}\\ \boldsymbol{b}/2\end{bmatrix}=\begin{bmatrix}\boldsymbol{4a}\\ 2\boldsymbol{b}\end{bmatrix}=2\begin{bmatrix}2\boldsymbol{a}\\ \boldsymbol{b}\end{bmatrix}=2\,\overrightarrow{ML}$	[1] Vector representing M to N
2	$\overrightarrow{GF}=3\boldsymbol{a}-\boldsymbol{a}+5\boldsymbol{b}+4\boldsymbol{b}$	[1] Vector representing G to F which is the sum of G to E and E to F
	$\overrightarrow{GF}=2\boldsymbol{a}+9\boldsymbol{b}$	[1] Vector representing G to F
	$\overrightarrow{GH}=3(2\boldsymbol{a}+9\boldsymbol{b})=6\boldsymbol{a}+27\boldsymbol{b}$	[1] Vector representing G to H which is 3 times G to F
3	$\overrightarrow{FC}=\frac{\boldsymbol{a}}{2}$	[1] Vector representing F to C
	$\overrightarrow{BE}=\frac{3}{4}\boldsymbol{a}$	[1] Vector representing B to E
	$\overrightarrow{FE}=\frac{5}{4}\boldsymbol{a}-\boldsymbol{b}$	[1] $\overrightarrow{FE}=\overrightarrow{FC}+\overrightarrow{CB}+\overrightarrow{BE}$
4(a)	$\overrightarrow{LM}=-\boldsymbol{2a}$, $\overrightarrow{MN}=2\boldsymbol{a}+\boldsymbol{2b}$, $\overrightarrow{NK}=3\boldsymbol{a}+\boldsymbol{b}$.	[1] $\overrightarrow{LK}=\overrightarrow{LM}+\overrightarrow{MN}+\overrightarrow{NK}$
	$\overrightarrow{LK}=-2\boldsymbol{a}+2\boldsymbol{a}+2\boldsymbol{b}+3\boldsymbol{a}+\boldsymbol{b}$ $\overrightarrow{LK}=3\boldsymbol{a}+3\boldsymbol{b}$	[1] Vector representing L to K in its simplest form
4(b)	$\overrightarrow{LP}=\frac{1}{3}(3\boldsymbol{a}+3\boldsymbol{b})$	[1] Vector representing L to P
	$\overrightarrow{LP}=\boldsymbol{a}+\boldsymbol{b}$	[1] Simplifying
	$\overrightarrow{MP}=\overrightarrow{ML}+\overrightarrow{LP}=2\boldsymbol{a}+\boldsymbol{a}+\boldsymbol{b}$	[1] Vector representing M to P
	$\overrightarrow{MP}=3\boldsymbol{a}+\boldsymbol{b}=\overrightarrow{NK}$	[1] Showing M to P is the same as N to K
5(a)	$-a+b$	[1] Vector representing B to C
5(b)	$-2a$	[1] Vector representing D to E
5(c)	$-2a\ +\ b$	[1] Vector representing D to E
5(d)	$a+b$	[1] Vector representing D to E

Turn over ►

6	$\overrightarrow{DA} = 4\boldsymbol{b}$	[1] Magnitude of 4
	$\overrightarrow{BE} = 2\boldsymbol{a}$	[1] Vector representing B to E
	$\therefore \overrightarrow{AE} = 5\boldsymbol{a}$	[1] Vector representing A to E
	$\overrightarrow{DE} = 4\boldsymbol{b} + 5\boldsymbol{a}$	[1] Vector representing D to E
7(a)	$-a + b$	[1] Vector representing B to C
7(b)	$\overrightarrow{(AC)} = \overrightarrow{(CE)} = b$	[1] Vector representing C to E
	$\overrightarrow{(DE)} = \frac{1}{4}\overrightarrow{(CE)} = \frac{1}{4}\ b$	[1] Vector representing D to E
	$\overrightarrow{(CD)} = \overrightarrow{(CE)} - \overrightarrow{(DE)} = b - \frac{1}{4}\ b = \frac{3}{4}\ b$	[1] Vector representing C to D
	$\overrightarrow{(DB)} = \overrightarrow{(DC)} + \overrightarrow{(CB)} = -\frac{3}{4}\ b - b + a = -\frac{7}{4}\ b + a$	[1] Vector representing D to B
8	$\overrightarrow{BC} = -2\boldsymbol{a} + \boldsymbol{3b}$	[1] Vector representing B to C
	$\overrightarrow{BD} = -\frac{\boldsymbol{a}}{2} + \frac{3}{4}\boldsymbol{b}$	[1] Vector representing B to D
	$\overrightarrow{AD} = 2\boldsymbol{a} - \frac{\boldsymbol{a}}{2} + \frac{3}{4}\boldsymbol{b} = \frac{3}{2}\boldsymbol{a} + \frac{3}{4}\boldsymbol{b}$	[1] Vector representing A to D
	$\overrightarrow{AE} = \frac{1}{2}(\frac{3}{2}\boldsymbol{a} + \frac{3}{4}\boldsymbol{b})$	[1] Vector representing A to E
	$= \frac{3}{4}\boldsymbol{a} + \frac{3}{8}\boldsymbol{b} = \frac{3}{4}(\boldsymbol{a} + \frac{\boldsymbol{b}}{2})$	[1] Simplification not required

9(a)	$2a - 3b$	[1] $\overrightarrow{DC} = \overrightarrow{DA} + \overrightarrow{AC}$
9(b)	$AD: BE: CF = 3: 2: 2$ $AD: BE: CF = 3b: 2b: 2b$ $CF = 2b$	[1] Ratio finds $\overrightarrow{FC}$
	$\overrightarrow{(FD)} = \overrightarrow{(FC)} + \overrightarrow{(CB)} + \overrightarrow{(BA)} + \overrightarrow{(AD)}$ $= -2b - a - a + 3b$ $= -2a + b$	[1] Final answer
9(c)	$\overrightarrow{(DE)} = -3b + a + 2b$ $= a - b$	[1] Vector representing D to E
	$\overrightarrow{(EX)} = x\overrightarrow{(DE)}$ $Need\ 1\ lot\ of\ \overrightarrow{(EX)}\ to\ reach\ CF, and\ gives:$ $\overrightarrow{(CX)} = \overrightarrow{(XF)} = b$	[1] Comparison
	$CX: XF = 1: 1$	[1] Correct Ratio
10	$\overrightarrow{(AD)}: \overrightarrow{(DY)}: \overrightarrow{(YC)} = 1: 1: 1$ $\overrightarrow{(AD)} = \overrightarrow{(DY)} = \overrightarrow{(YC)} = a$ $\overrightarrow{(BC)} = \overrightarrow{(BD)} + \overrightarrow{(DY)} + \overrightarrow{(YC)}$ $= -(3b - a) + a + a$ $= a - 3b + a + a$ $= 3a - 3b$ $= 3(a - b)$	[1] Find vector B to C
	$\overrightarrow{(AB)} = \overrightarrow{(AD)} + \overrightarrow{(DB)}$ $= a + 3b - a$ $= 3b$ $\overrightarrow{(AX)}: \overrightarrow{(XB)} = 2: 1$ $\overrightarrow{(AX)} = 2b$	[1] Find vector A to X
	$\overrightarrow{(XY)} = \overrightarrow{(XA)} + \overrightarrow{(AD)} + \overrightarrow{(DY)} = -2b + a + a$ $= 2a - 2b$ $= 2(a - b)$ $BC\ is\ a\ multiply\ of\ XY, so\ they\ are\ going\ in\ the\ same\ direction$	[1] Find vector X to Y

END