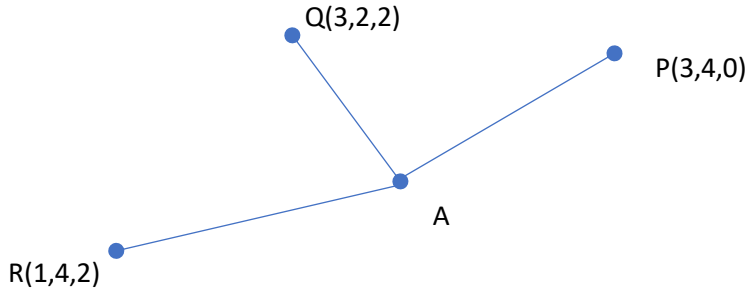
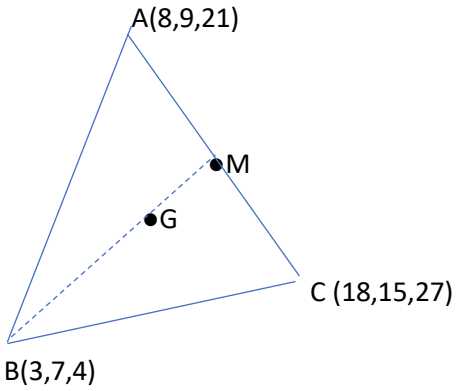
	Vectors	
1	A triangle ABC has vertices A (2,-1,3), B(3,6,5) and C(6,6,-2) Calculate the size of angle BAC	7
2	Three oxygen atoms P, Q and R round the carbon Atom A have the coordinates shown below  Calculate the size of angle PQR	5
3	The point Q divides the line joining P (-1,-1,0) to R(5,2,-3) in the ratio 2:1. Find the coordinates of Q	3
4	(a) Show that the points L(-5,6,-5), M(7,-2,-1) and N(10,-4,0) are collinear (b) Hence find the ratio in which M divides LN	4 1
5	Triangle ABC is as shown below  (a) M is the midpoint of AC, find the coordinates of M (b) G divides BM in the ratio 3:2, find the coordinates of G (c) Hence calculate the size of the angle GMC	1 3 5

	Vectors - Answers	
1	Know how to rearrange scalar product $\cos BAC = \dfrac{\vec{AB} \bullet \vec{AC}}{\lvert \vec{AB} \rVert \vec{AC} \rvert}$, Find vectors and magnitude $\vec{AB} = \begin{pmatrix} 1 \\ 7 \\ 2 \end{pmatrix}$, $\vec{AC} = \begin{pmatrix} 4 \\ 7 \\ -5 \end{pmatrix}$ $\lvert \vec{AB} \rvert = \sqrt{54}$ $\lvert \vec{AC} \rvert = \sqrt{90}$ Evaluate scalar product $\vec{AB} \bullet \vec{AC} = 1 \times 4 + 7 \times 7 + 2 \times -5 = 43$ Substitute and find the angle $\cos BAC = \dfrac{43}{\sqrt{54}\sqrt{90}}$, **angle BAC is 51.9 °**	
2	Know how to rearrange scalar product $\cos PQR = \dfrac{\vec{QP} \bullet \vec{QR}}{\lvert \vec{QP} \rVert \vec{QR} \rvert}$, Find vectors and magnitude $\vec{QP} = \begin{pmatrix} 0 \\ 2 \\ -2 \end{pmatrix}$, $\vec{QR} = \begin{pmatrix} -2 \\ 2 \\ 0 \end{pmatrix}$ $\lvert \vec{QP} \rvert = \sqrt{8}$ $\lvert \vec{QR} \rvert = \sqrt{8}$ Evaluate scalar product $\vec{QP} \bullet \vec{QR} = 0 \times -2 + 2 \times 2 + -2 \times 0 = 4$ Substitute and find the angle $\cos BAC = \dfrac{4}{\sqrt{8}\sqrt{8}}$, **angle BAC is 60°**	
3	**q** = **p** + ⅔ $\vec{PR}$ → **q** = $\begin{pmatrix} -1 \\ -1 \\ 0 \end{pmatrix} + \dfrac{2}{3}\begin{pmatrix} 6 \\ 3 \\ -3 \end{pmatrix} = \begin{pmatrix} 3 \\ 1 \\ -2 \end{pmatrix}$ → D = (3,1,-2)	
4 (a)	Express both vectors in component form $\vec{LM} = \begin{pmatrix} 12 \\ -8 \\ 4 \end{pmatrix}$, $\vec{MN} = \begin{pmatrix} 3 \\ -2 \\ 1 \end{pmatrix}$ can use equivalent combinations Show that vectors are parallel $\vec{LM} = 4\vec{MN}$, $\Rightarrow$ $\vec{LM} \parallel \vec{MN}$ State final justification LM || MN and as M is a common point, L, M and N are collinear (b) State Ratio 4:1	
5a	M is the point (13,12,24)	

(b)	**g** = **b** + 3/5 $\vec{BM}$ → **g** = $\begin{pmatrix}3\\7\\4\end{pmatrix},+\frac{3}{5}\begin{pmatrix}10\\5\\20\end{pmatrix}=\begin{pmatrix}9\\10\\16\end{pmatrix}$ → G = (9,10,16)	
(c)	Know how to rearrange scalar product $\cos GMC=\frac{\vec{MG}\bullet\vec{MC}}{\lvert\vec{MG}\rvert\lvert\vec{MC}\rvert}$,	
	Find vectors and magnitude $\vec{MG}=\begin{pmatrix}-4\\-2\\-8\end{pmatrix}$, $\vec{MC}=\begin{pmatrix}5\\3\\3\end{pmatrix}$ $\lvert\vec{MG}\rvert=\sqrt{84}$ $\lvert\vec{MC}\rvert=\sqrt{43}$	
	Evaluate scalar product $\vec{MG}\bullet\vec{MC}=-4\times5+-2\times3+-8\times3=-50$	
	Substitute and find the angle $\cos GMC=\frac{-50}{\sqrt{84}\sqrt{43}}$, **angle BAC is 146°**	