Question	Answer	Marks	Guidance
10	$40+20\theta=65$	***M1**	
	$\theta=1.25$	**A1**	
	$\sin\left(\frac{\textit{their }\theta}{2}\right)=\frac{\frac{1}{2}AB}{20}$ $AB=23.4$ or $\frac{1}{2}AB=11.7$	**2**	**Dep M1** for an attempt to find AB or $\frac{1}{2}AB$
	Either $\tan\left(\frac{\textit{their }\theta}{2}\right)=\frac{\text{height of triangle } ACB}{\textit{their }\frac{1}{2}AB}$ Height of triangle = 8.44 Area of triangle = 98.8	**3**	**DepM1** for a correct attempt to find the height of the triangle **M1** for attempt to find the area of the triangle using *their* height and *their AB* **A1** must be at least 3 significant figures.
	Or $\cos\left(\frac{\textit{their }\theta}{2}\right)=\frac{\textit{their }\frac{1}{2}AB}{AC}$ $AC=14.4$ Area of triangle $=\frac{1}{2}\times\textit{their }AB\times\textit{their }AC\times\sin\left(\frac{\theta}{2}\right)$ Area of triangle = 98.8	**(3)**	**DepM1** for a correct attempt to find CA **M1** for attempt to find the area of the triangle using the sine rule with *their CA*. **A1** must be at least 3 significant figures.
	Area of the segment $=\frac{1}{2}\times20^2\times(1.25-\sin1.25)$ Area of the segment = 60.2	**B1**	
	Area = 38.6	**A1**	

Question	Answer	Marks	Guidance
10	**Alternative 1**		
	$40+20\theta=65$	**(*M1)**	
	$\theta=1.25$	**(A1)**	
	$\tan\left(\frac{\textit{their }\theta}{2}\right)=\frac{AC}{20}$ oe soi $AC=14.43$	**(2)**	**DepM1** for a correct attempt to find the *AC*
	Area of triangle $ACO=\frac{1}{2}\times 20\times 14.43=144.3$	**(2)**	**M1** for a correct attempt to find the area of the triangle using *their AC*
	Area of the sector = 250	**(B1)**	
	Area of half shaded region = $(144.3-125)\times 2$	**(M1)**	Dependent on a valid method for finding triangle *ACO* . Allow use of 144
	Area = 38.6	**(A1)**	
	Alternative 2		
	$40+20\theta=65$	**(*M1)**	
	$\theta=1.25$	**(A1)**	
	$\sin\left(\frac{\textit{their }\theta}{2}\right)=\frac{\frac{1}{2}AB}{20}$ $AB=23.4$	**(2)**	**Dep M1** for an attempt to find *AB* or $\frac{1}{2}AB$
	$\tan\left(\frac{\textit{their }\theta}{2}\right)=\frac{AC}{20}$ oe soi $AC=14.43$	**(2)**	**DepM1** for a correct attempt to find *AC*
	Shaded area $=14.4\times 20-\frac{1}{2}\times 20^2\times\frac{5}{4}$ Area = 38.6	**(3)**	**M1** for area of Kite **B1** for area of sector

Question	Answer	Marks	Guidance
10	**Alternative 3**		
	$40+20\theta=65$	**(*M1)**	
	$\theta=1.25$	**(A1)**	
	$\tan\left(\frac{their\ \theta}{2}\right)=\frac{AC}{20}$ oe soi AC =14.43	**(2)**	**DepM1** for a correct attempt to find AC
	Area of triangle AOB $=\frac{1}{2}\times 20^2\times\sin\ (their\ \theta)$ $=189.[7969...]$	**(M1)**	
	Area of triangle ACB $=\frac{1}{2}\times their\ AC\times their\ AB\times\sin\ \frac{\theta}{2}$ $=98.8$	**(M1)**	for a correct attempt to find the area of the triangle using *their AC* and *their AB*
	Area of the sector = 250	**(B1)**	
	Area of half shaded region = area of triangle ACB + area of triangle AOB − area of sector = 189.8 + 98.8 – 250	**(M1)**	
	Area = 38.6	**(A1)**	

Question	Answer	Marks	Guidance
10	**Alternative 4**		
	$40+20\theta=65$	**(*M1)**	
	$\theta=1.25$	**(A1)**	
	$\sin\left(\frac{their\ \theta}{2}\right)=\frac{\frac{1}{2}AB}{20}$ $AB=23.4$ or $\frac{1}{2}AB=11.7$	**(2)**	**Dep M1** for an attempt to find AB or $\frac{1}{2}AB$
	$\tan\left(\frac{their\ \theta}{2}\right)=\frac{\text{height of triangle } ACB}{their\ \frac{1}{2}AB}$ Height of triangle = 8.44	**(M1)**	**DepM1** for a correct attempt to find the height of the triangle
	Height of triangle ABO $=\sqrt{20^2-\left(\frac{1}{2}AB\right)^2}$ $=16.22$	**(M1)**	for a correct attempt to find to find the height of the triangle
	Area of the sector = 250	**(B1)**	
	Area of kite $=\frac{1}{2}\times 23.4\times(16.22+8.44)$ $=288.5$	**(M1)**	
	Area = 288.5 – 250 =38.5	**(A1)**	
11(a)	$\overrightarrow{XY}=-\overrightarrow{OX}+\mathbf{a}+\frac{1}{3}\overrightarrow{AB}$ oe soi or $\overrightarrow{XY}=\overrightarrow{XB}-\frac{2}{3}\overrightarrow{AB}$ oe soi	**M1**	
	$\overrightarrow{XY}=-\frac{4}{5}\mathbf{b}+\mathbf{a}+\frac{1}{3}(\mathbf{b}-\mathbf{a})$ oe soi or $\overrightarrow{XY}=\frac{1}{5}\mathbf{b}+\frac{2}{3}\mathbf{(a-b)}$ oe soi	**M1**	For $\pm\frac{1}{3}(\mathbf{b}-\mathbf{a})$ or $\pm\frac{4}{5}\mathbf{b}$ For $\pm\frac{1}{5}\mathbf{b}$ or $\pm\frac{2}{3}\mathbf{(a-b)}$
	$\overrightarrow{XY}=\frac{2}{3}\mathbf{a}-\frac{7}{15}\mathbf{b}$ cao	**A1**	**AG**
11(b)	$\overrightarrow{YZ}=\lambda\left(\frac{2}{3}\mathbf{a}-\frac{7}{15}\mathbf{b}\right)$ cao	**B1**	