Question Number	Scheme	Marks
8(a)	(i) $\frac{2}{3}\mathbf{b}-\mathbf{a}$	B1
	(ii) $\overrightarrow{OE}=\overrightarrow{OA}+\frac{2}{5}\overrightarrow{AD}=\mathbf{a}+\frac{2}{5}\left(\frac{2}{3}\mathbf{b}-\mathbf{a}\right)=\frac{3}{5}\mathbf{a}+\frac{4}{15}\mathbf{b}$	M1A1
	(iii) $\overrightarrow{BE}=\overrightarrow{OE}-\overrightarrow{OB}=\frac{3}{5}\mathbf{a}+\frac{4}{15}\mathbf{b}-\mathbf{b}=\frac{3}{5}\mathbf{a}-\frac{11}{15}\mathbf{b}$	M1A1 (5)
(b)	$\overrightarrow{FE}=\overrightarrow{OE}-\overrightarrow{OF}=\frac{3}{5}\mathbf{a}+\frac{4}{15}\mathbf{b}-\lambda\mathbf{a}$	M1A1
	F, E, B collinear $\frac{\frac{3}{5}-\lambda}{\frac{4}{15}}=\frac{\frac{3}{5}}{-\frac{11}{15}}$	M1A1
	$\frac{3-5\lambda}{4}=\frac{3}{-11}$	
	$\lambda=\frac{9}{11}$	A1 (5)
	ALT $\overrightarrow{OF}+\overrightarrow{FB}=\overrightarrow{OB}$	M1
	$\lambda\mathbf{a}+\mu\left(-\frac{3}{5}\mathbf{a}+\frac{11}{15}\mathbf{b}\right)=\mathbf{b}$	A1
	$\mu=\frac{15}{11}\quad\lambda=\frac{3}{5}\mu$	M1A1
	$\lambda=\frac{9}{11}$	A1 (5)
(c)	$\Delta OFB=5\text{ units}^2\Rightarrow\Delta OAB=\frac{11}{9}\times5\text{units}^2$	M1
	$\Delta OAD=\frac{2}{3}\Delta OAB=\frac{2}{3}\times\frac{55}{9}=\frac{110}{27}\text{ units}^2$	M1A1
	ALT $\frac{\text{area }\Delta OFB}{\text{area }\Delta OAD}=\frac{9/11}{2/3}=\frac{27}{22}$	M1
	$\text{area }\Delta OAD=\frac{22}{27}\times5=\frac{110}{27}$	M1A1 (3) [13]

Notes

(a) (i)

B1: for $\frac{2}{3}\mathbf{b}-\mathbf{a}$

(ii)

M1: for $\overrightarrow{OE}=\overrightarrow{OA}+\frac{2}{5}\overrightarrow{AD}$ (for the vector statement)

(or for any other valid path)

A1: $\overrightarrow{OE}=\frac{3}{5}\mathbf{a}+\frac{4}{15}\mathbf{b}$

(iii)

M1: for $\overrightarrow{BE}=\overrightarrow{OE}-\overrightarrow{OB}$ (for the vector statement)

(again for any other valid path)

A1: $\overrightarrow{BE}=\frac{3}{5}\mathbf{a}-\frac{11}{15}\mathbf{b}$

(b)

M1: for $\overrightarrow{FE}=\overrightarrow{OE}-\overrightarrow{OF}$

A1: for $\overrightarrow{FE}=\frac{3}{5}\mathbf{a}+\frac{4}{15}\mathbf{b}-\lambda\mathbf{a}$ $\left(=\mathbf{a}\left(\frac{3}{5}-\lambda\right)+\frac{4}{15}\mathbf{b}\right)$

M1: for using their $\overrightarrow{FE}$ and $\overrightarrow{BE}$ to form;

$$\frac{\frac{3}{5}-\lambda}{\frac{4}{15}}=\frac{\frac{3}{5}}{-\frac{11}{15}} \quad \text{or} \quad \frac{\frac{3}{5}-\lambda}{\frac{3}{5}}=\frac{\frac{4}{15}}{-\frac{11}{15}}$$

A1: for the correct equation in λ

A1: $\lambda=\frac{9}{11}$

ALT

M1: for $\overrightarrow{OF}+\overrightarrow{FB}=\overrightarrow{OB}$ oe

A1: for the correct expression in terms of λ and μ (or any other letter for the second constant)

M1: for comparing coefficients of λ and their μ

A1: for achieving μ and an expression for λ in terms of μ

A1: $\lambda=\frac{9}{11}$

(c)

M1: for stating and using that area of triangle $\Delta OAB = \frac{11}{9}\times$ area of $\Delta OFB \Rightarrow \Delta OAB = \frac{11}{9}\times\ 5$

Note: area of triangle *OAB* = the reciprocal of their $\lambda \times 5$

M1: for stating and using that area of $\Delta OAD = \frac{2}{3}\times$ area of ΔOAB

A1: area of triangle *OAD* = $\frac{110}{27}$

ALT 1

M1: for the ratio of areas of triangle *OFB* and triangle *OAD* as follows;

$$\frac{\text{area } \Delta OAB}{\text{area } \Delta OFB} = \frac{11}{9} \text{ and } \frac{\text{area } \Delta OAD}{\text{area } \Delta OAB} = \frac{2}{3} \Rightarrow$$

$$\frac{\text{area } \Delta OAD}{\text{area } \Delta OFB} = \frac{11}{9}\times\frac{2}{3} = \frac{22}{27}$$

M1: for $\frac{\Delta OAD}{5} = \frac{22}{27}$

A1: area of triangle *OAD* $\frac{110}{27}$

ALT 2

M1: for using $\frac{1}{2}ab\sin C$ on triangles *OAD* and *OFB*

Triangle *OFB*: $\frac{1}{2}\times\frac{9}{11}|\mathbf{a}|\times|\mathbf{b}|\times\sin\theta = 5$ **AND** Area $OAD = \frac{1}{2}\times|\mathbf{a}|\times\frac{2}{3}|\mathbf{b}|\times\sin\theta$

M1: for substituting . $\sin\theta = \frac{110}{9|\mathbf{a}||\mathbf{b}|}$ into $\Rightarrow$ Area $OAD = \frac{|\mathbf{a}||\mathbf{b}|}{3}\times\frac{110}{9|\mathbf{a}||\mathbf{b}|}\ \left(=\frac{110}{27}\right)$

A1: area of triangle *OAD* $\frac{110}{27}$