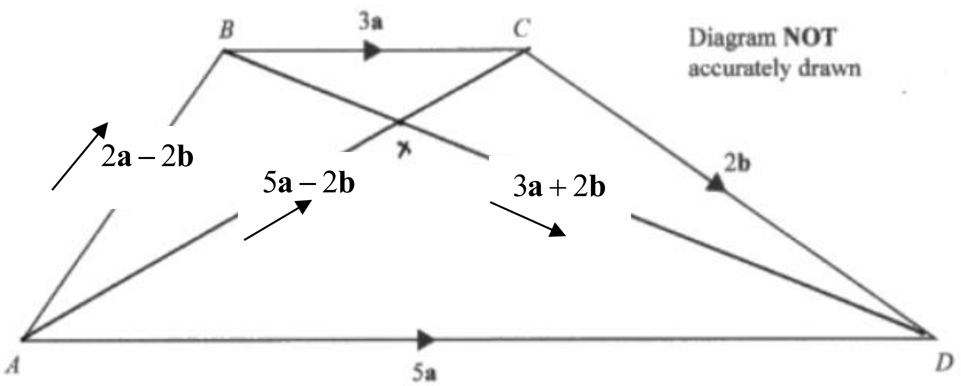
Question	Scheme	Marks
8(a)	$\overrightarrow{AB} = \overrightarrow{AD} + \overrightarrow{DC} + \overrightarrow{CB} = 5\mathbf{a} - 2\mathbf{b} - 3\mathbf{a} = 2\mathbf{a} - 2\mathbf{b}$	B1 [1]
(b)	$\overrightarrow{BX} = k\,\overrightarrow{BD} = k(3\mathbf{a} + 2\mathbf{b})$	M1
	$\overrightarrow{BX} = \overrightarrow{BA} + \lambda\,\overrightarrow{AC} = -2\mathbf{a} + 2\mathbf{b} + \lambda(5\mathbf{a} - 2\mathbf{b})$	M1
	$\Rightarrow k(3\mathbf{a} + 2\mathbf{b}) = -2\mathbf{a} + 2\mathbf{b} + \lambda(5\mathbf{a} - 2\mathbf{b})$	
	$\Rightarrow 3k\mathbf{a} + 2k\mathbf{b} = (5\lambda - 2)\mathbf{a} + (2 - 2\lambda)\mathbf{b}$	M1
	$\Rightarrow 3k = 5\lambda - 2 \quad 2k = 2 - 2\lambda$	
	$\Rightarrow k = \frac{3}{8} \qquad \left[\lambda = \frac{5}{8}\right]$	M1A1 [5]
(c)	$\Delta CXD = \frac{5}{8}\Delta BCD$	M1
	$\Delta BCD = \frac{3}{8}ABCD$	M1
	$\frac{\Delta CXD}{ABCD} = \frac{\frac{5}{8}}{\frac{8}{3}} = \frac{15}{64}$	M1
	Ratio of area of triangle CXD : Trapezium $ABCD$ $= 15:64$	A1
		[4]
		Total 10 marks

Useful sketch



<table>
<tr><th>Part</th><th>Mark</th><th>Notes</th></tr>
<tr><td>(a)</td><td>B1</td><td>For the correct vector for $\overrightarrow{AB}$</td></tr>
<tr><td rowspan="6">(b)</td><td colspan="2">Note carefully.
For the first two marks in part (b) you must follow through their working using their $\overrightarrow{AB}$ or $\overrightarrow{AC}$ or $\overrightarrow{BD}$</td></tr>
<tr><td>M1</td><td>For one correct vector statement for $\overrightarrow{BX}$</td></tr>
<tr><td>M1</td><td>For a second correct and different vector statement for $\overrightarrow{BX}$
For example:
$\overrightarrow{BX} = \overrightarrow{BA} + \lambda\overrightarrow{AC} = -2\mathbf{a} + 2\mathbf{b} + \lambda(5\mathbf{a} - 2\mathbf{b})$
OR
$\overrightarrow{BX} = \overrightarrow{BC} + \lambda\overrightarrow{AC} = 3\mathbf{a} - \lambda(5\mathbf{a} - 2\mathbf{b})$</td></tr>
<tr><td>ddM1</td><td>For equating coefficients of a and b and forming two equations in k and another parameter. This must be correct
Dependent on first two M marks</td></tr>
<tr><td>dddM1</td><td>For solving their simultaneous equations to find k
Allow one arithmetical error in processing.
Dependent on all three previous M marks</td></tr>
<tr><td>A1</td><td>For $k = \frac{3}{8}$</td></tr>
<tr><td rowspan="5">(c)</td><td>M1</td><td>For using their k to find the ratio of the areas of for example,
$CXD : CAD \Rightarrow \frac{CXD}{CAD} = \frac{3}{8}$ or $\frac{CXD}{CAD} = \frac{\frac{1}{2}\times\frac{3}{8}\times 2b\times\sin ACD}{\frac{1}{2}\times\frac{8}{8}\times 2b\times\sin ACD} = \frac{3}{8}$
OR
$CXD : BCD \Rightarrow \frac{CXD}{BCD} = \frac{5}{8}$ or $\frac{CXD}{CAD} = \frac{\frac{1}{2}\times\frac{5}{8}\times 2b\times\sin BDC}{\frac{1}{2}\times\frac{8}{8}\times 2b\times\sin BDC} = \frac{5}{8}$</td></tr>
<tr><td>M1</td><td>For using the given lengths of BC and AD [3 and 5],to find the ratio of the area of triangle ACD : trapezium $ABCD$
$\frac{CAD}{ABCD} = \frac{\frac{1}{2}\times h\times 5}{\frac{1}{2}\times h\times(5+3)} = \frac{5}{8}$ OR $\frac{BCD}{ABCD} = \frac{\frac{1}{2}\times h\times 3}{\frac{1}{2}\times h\times(5+3)} = \frac{3}{8}$</td></tr>
<tr><td colspan="2">Note carefully.
You must ft their ratios above and check to see if they are being combined correctly for the final M mark here.</td></tr>
<tr><td>M1</td><td>Combines the areas above to obtain:
$\frac{CXD}{CAD}\times\frac{CAD}{ABCD} = \frac{3}{8}\times\frac{5}{8} = \left(\frac{15}{64}\right)$ OR $\frac{CXD}{BCD}\times\frac{BCD}{ABCD} = \frac{5}{8}\times\frac{3}{8} = \left(\frac{15}{64}\right)$</td></tr>
<tr><td>A1</td><td>For the correct ratio $15:64$</td></tr>
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