Question	Scheme	Marks	AOs
4(a)	Attempts to compare the two position vectors. Allow an attempt using two of $\overrightarrow{AO}, \overrightarrow{OB}$ or $\overrightarrow{AB}$ E.g. $(-24\mathbf{i}-10\mathbf{j}) = -2\times(12\mathbf{i}+5\mathbf{j})$	M1	1.1b
	Explains that as $\overrightarrow{AO}$ is parallel to $\overrightarrow{OB}$ (and the stone is travelling in a straight line) the stone passes through the point *O*.	A1	2.4
		(2)	
(b)	Attempts distance $AB = \sqrt{(12+24)^2+(10+5)^2}$	M1	1.1b
	Attempts speed = $\dfrac{\sqrt{(12+24)^2+(10+5)^2}}{4}$	dM1	3.1a
	Speed = 9.75 ms^{-1}	A1	3.2a
		(3)	
			(5 marks)
Alt(a)	Attempts to find the equation of the line which passes through *A* and *B* E.g. $y-5=\dfrac{5+10}{12+24}(x-12)$ $\quad\left(y=\dfrac{5}{12}x\right)$	M1	1.1b
	Shows that when $x=0,\ y=0$ and concludes the stone passes through the point *O*.	A1	2.4

Notes

(a)

M1: Attempts to compare the two position vectors. Allow an attempt using two of $\overrightarrow{AO}, \overrightarrow{OB}$ or $\overrightarrow{AB}$ either way around.

E.g. States that $(-24\mathbf{i}-10\mathbf{j}) = -2\times(12\mathbf{i}+5\mathbf{j})$

Alternatively, allow an attempt finding the gradient using any two of *AO*, *OB* or *AB*

Alternatively attempts to find the equation of the line through *A* and *B* proceeding as far as $y=...x$ Condone sign slips.

A1: States that as $\overrightarrow{AO}$ is parallel to $\overrightarrow{OB}$ or as *AO* is parallel to *OB* (and the stone is travelling in a straight line) the stone passes through the point *O*. Alternatively, shows that the point $(0,0)$ is on the line and concludes (the stone) passes through the point *O*.

(b)

M1: Attempts to find the distance *AB* using a correct method.

Condone slips but expect to see an attempt at $\sqrt{a^2+b^2}$ where *a* or *b* is correct

dM1: Dependent upon the previous mark. Look for an attempt at $\dfrac{\text{distance } AB}{4}$

A1: 9.75 ms^{-1} Requires units

Question	Scheme	Marks	AOs
3(a)	Attempts $\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA}$ or similar	M1	1.1b
	$\overrightarrow{AB} = -9\mathbf{i} + 3\mathbf{j}$	A1	1.1b
		(2)	
(b)	Finds length using 'Pythagoras' $\lvert AB\rvert = \sqrt{(-9)^2 + (3)^2}$	M1	1.1b
	$\lvert AB\rvert = 3\sqrt{10}$	A1ft	1.1b
		(2)	
			(4 marks)

Notes

(a)

M1: Attempts subtraction either way around.

This may be implied by one correct component $\overrightarrow{AB} = \pm 9\mathbf{i} \pm 3\mathbf{j}$

There must be some attempt to write in vector form.

A1: cao (allow column vector notation but not the coordinate)

Correct notation should be used. Accept $-9\text{i} + 3\text{j}$ or $\begin{pmatrix} -9 \\ 3 \end{pmatrix}$ but not $\begin{pmatrix} -9\text{i} \\ 3\text{j} \end{pmatrix}$

(b)

M1: Correct use of Pythagoras theorem or modulus formula using their answer to (a)

Note that $\lvert AB\rvert = \sqrt{(9)^2 + (3)^2}$ is also correct.

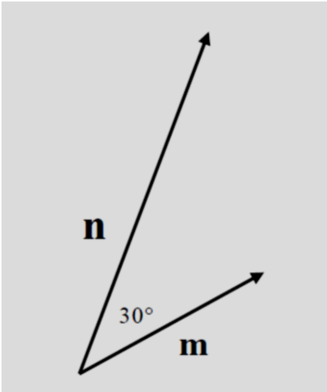
Condone missing brackets in the expression $\lvert AB\rvert = \sqrt{-9^2 + (3)^2}$

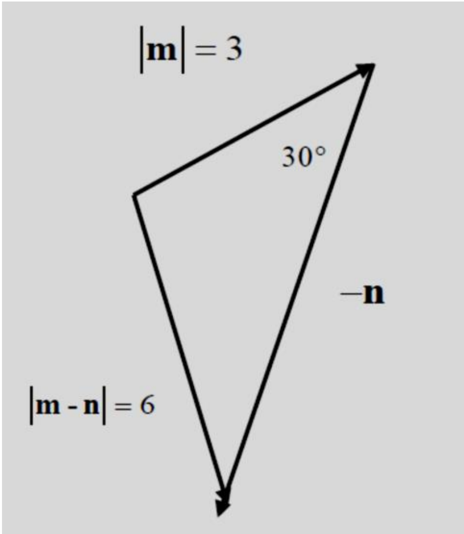
Also allow a restart usually accompanied by a diagram.

A1ft: $\lvert AB\rvert = 3\sqrt{10}$ ft from their answer to (a) as long as it has both an **i** and **j** component.

It must be simplified, if appropriate. Note that $\pm 3\sqrt{10}$ would be M1 A0

Note that, in cases where there is no working, the correct answer implies M1A1 in each part of this question

<table>
<tr><th>Question</th><th>Scheme</th><th>Marks</th><th>AOs</th></tr>
<tr><td>16(i)</td><td>Explains that a and b lie in the same direction oe</td><td>B1</td><td>2.4</td></tr>
<tr><td></td><td></td><td>(1)</td><td></td></tr>
<tr><td>(ii)</td><td>




</td><td>M1</td><td>1.1b</td></tr>
<tr><td></td><td>Attempts $\frac{\sin 30°}{6} = \frac{\sin\theta}{3}$</td><td>M1</td><td>3.1a</td></tr>
<tr><td></td><td>$\theta = \text{awrt } 14.5°$</td><td>A1</td><td>1.1b</td></tr>
<tr><td></td><td>Angle between vector $\mathbf{m}$ and vector $\mathbf{m}-\mathbf{n}$ is awrt $135.5°$</td><td>A1</td><td>3.2a</td></tr>
<tr><td></td><td></td><td>(4)</td><td></td></tr>
<tr><td colspan="4" align="right">(5 marks)</td></tr>
</table>

Notes

(i)

B1: Accept any valid response E.g The lines are collinear. Condone "They are parallel"
Mark positively. ISW after a correct answer
Do not accept "the length of line a +b is the same as the length of line a + the length of line b
Do not accept $|\mathbf{a}|$ and $|\mathbf{b}|$ are parallel.

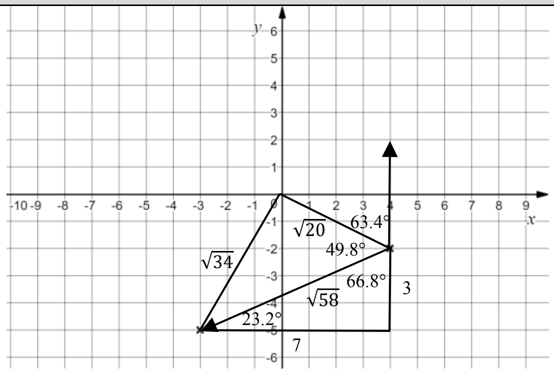
(ii)

M1: A triangle showing 3, 6 and $30°$ in the correct positions.
Look for 6' opposite $30°$ with another side of 3.
Condone the triangle not being obtuse angled and not being to scale.
Do not condone negative lengths in the tringle. This would automatically be M0

M1: Correct sine rule statement with the sides and angles in the correct positions.
If a triangle is drawn then the angles and sides must be in the correct positions.
This is not dependent so allow recovery from negative lengths in the triangle.
If the candidate has not drawn a diagram then correct sine rule would be M1 M1
Do not accept calculations where the sides have a negative length. Eg $\frac{\sin 30°}{6} = \frac{\sin\theta}{-3}$ is M0

A1: $\theta = \text{awrt } 14.5°$

A1: CSO awrt $135.5°$

Question	Scheme	Marks	AOs
2(a)			
	Attempts to find an "allowable" angle Eg $\tan\theta = \frac{7}{3}$	M1	1.1b
	A full attempt to find the bearing Eg $180° + "67°"$	dM1	3.1b
	Bearing = awrt $246.8°$	A1	1.1b
		(3)	
(b)	Attempts to find the distance travelled = $\sqrt{(4--3)^2+(-2+5)^2} = \left(\sqrt{58}\right)$	M1	1.1b
	Attempts to find the speed = $\frac{\sqrt{58}}{2.75}$	dM1	3.1b
	= awrt 2.77 km h^{-1}	A1	1.1b
		(3)	
			(6 marks)

Notes: Score these two parts together.

(a)

M1: Attempts an allowable angle. (Either the “66.8” , “23.2” or (“49.8” and “63.4”))

$\tan\theta = \pm\frac{7}{3}$, $\tan\theta = \pm\frac{3}{7}$, $\tan\theta = \pm\frac{-2--5}{4--3}$ etc

There must be an attempt to subtract the coordinates (seen or applied at least once)

If part (b) is attempted first, look for example for $\sin\theta = \pm\frac{7}{"\sqrt{58}"}$, $\cos\theta = \pm\frac{7}{"\sqrt{58}"}$, etc

They may use the cosine rule and trigonometry to find the two angles in the scheme. See above. Eg award for $\cos\theta = \frac{"58"+"20"-"34"}{2\times"\sqrt{58}"\times"\sqrt{20}"}$ **and** $\tan\theta = \pm\frac{4}{2}$ or equivalent.

dM1: A full attempt to find the bearing. $180° + \arctan\frac{7}{3}$, $270° - \arctan\frac{3}{7}$, $360° - "49.8°" - "63.4°"$. It is dependent on the previous method mark.

A1: Bearing = awrt $246.8°$ oe. Allow S $66.8°$ W

Question	Scheme	Marks	AOs
2	Attempt to differentiate	M1	1.1a
	$\frac{dy}{dx} = 4x - 12$	A1	1.1b
	Substitutes $x = 5 \Rightarrow \frac{dy}{dx} = ...$	M1	1.1b
	$\Rightarrow \frac{dy}{dx} = 8$	A1ft	1.1b
		(4 marks)	
Notes:			
M1: Differentiation implied by one correct term **A1:** Correct differentiation **M1:** Attempts to substitute $x = 5$ into their derived function **A1ft:** Substitutes $x = 5$ into **their** derived function **correctly** i.e. Correct calculation of their $f'(5)$ so follow through slips in differentiation			

Question	Scheme	Marks	AOs
3(a)	Attempts $\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA}$ or similar	M1	1.1b
	$\overrightarrow{AB} = 5\mathbf{i} + 10\mathbf{j}$	A1	1.1b
		(2)	
(b)	Finds length using 'Pythagoras' $\lvert AB \rvert = \sqrt{(5)^2 + (10)^2}$	M1	1.1b
	$\lvert AB \rvert = 5\sqrt{5}$	A1ft	1.1b
		(2)	
		(4 marks)	
Notes:			
(a) **M1:** Attempts subtraction but may omit brackets **A1:** cao (allow column vector notation)			
(b) **M1:** Correct use of Pythagoras theorem or modulus formula using their answer to (a) **A1ft:** $\lvert AB \rvert = 5\sqrt{5}$ ft from their answer to (a) *Note that the correct answer implies M1A1 in each part of this question*			