Vectors As level Edexcel Maths Past Papers Answers

01.

Question	Scheme	Marks	AOs
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

02.

Question	Scheme	Marks	AOs
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 $-9\mathbf{i} + 3\mathbf{j}$ or $\begin{pmatrix} -9 \\ 3 \end{pmatrix}$ but not $\begin{pmatrix} -9\mathbf{i} \\ 3\mathbf{j} \end{pmatrix}$

(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 $\lvert AB \rvert = \sqrt{-9^2 + (3)^2}$

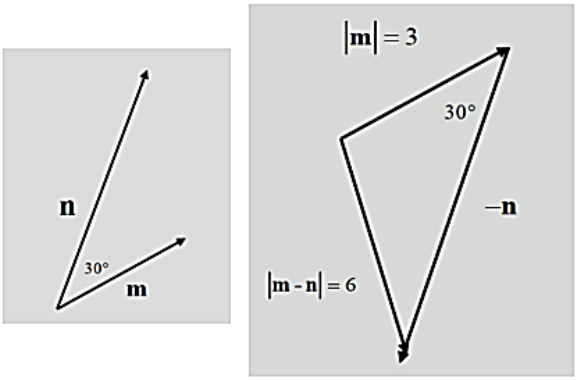
Also allow a restart usually accompanied by a diagram.

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

03.

Question	Scheme	Marks	AOs
(i)	Explains that **a** and **b** lie in the same direction oe	B1	2.4
		(1)	
(ii)		M1	1.1b
	Attempts $\frac{\sin 30°}{6} = \frac{\sin\theta}{3}$	M1	3.1a
	$\theta =$ awrt 14.5°	A1	1.1b
	Angle between vector **m** and vector **m** − **n** is awrt 135.5°	A1	3.2a
		(4)	
			(5 marks)
			(5 marks)

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)

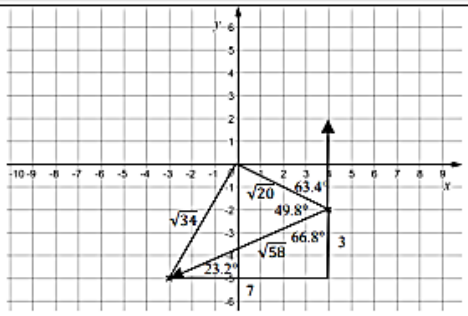
M1: A triangle showing 3, 6 and 30° in the correct positions.
Look for 6' opposite 30° with another side of 3.
Condone the triangle not being obtuse angled and not being to scale.
Do not condone negative lengths in the tringle. This would automatically be M0

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: $\theta =$ awrt 14.5°

A1: CSO awrt 135.5°

04.

Question	Scheme	Marks	AOs
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 = $\sqrt{(4--3)^2+(-2+5)^2} = (\sqrt{58})$	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

(b)

M1: Attempts to find the distance travelled. Allow for $d^2 = (4--3)^2 + (-2+5)^2$

You may see this on a diagram and allow if they attempt to find the magnitude from their "resultant vector" found in part (a).

dM1: Attempts to find the speed. There must have been an attempt to find the distance using the coordinates and then divide it by 2.75. Alternatively they could find the speed in km min^{-1} and then multiply by 60

A1: awrt 2.77 km h^{-1}

05.

Question	Scheme	Marks	AOs
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 $=9.75\ \text{ms}^{-1}$	A1	3.2a
		(3)	
			(5 marks)
Alt(a)	Attempts to find the equation of the line which passes through A and B E.g. $y-5=\dfrac{5+10}{12+24}(x-12)$ $\quad(y=\dfrac{5}{12}x)$	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: $9.75\ \text{ms}^{-1}$ Requires units

06.

Question	Scheme	Marks	AOs
a	$\overrightarrow{QR}=\overrightarrow{PR}-\overrightarrow{PQ}=13\mathbf{i}-15\mathbf{j}-(3\mathbf{i}+5\mathbf{j})$	M1	1.1a
	$=10\mathbf{i}-20\mathbf{j}$	A1	1.1b
		(2)	
(b)	$\left\lvert\overrightarrow{QR}\right\rvert=\sqrt{"10"^2+"(-20)"^2}$	M1	2.5
	$=10\sqrt{5}$	A1ft	1.1b
		(2)	
(c)	$\overrightarrow{PS}=\overrightarrow{PQ}+\frac{3}{5}\overrightarrow{QR}=3\mathbf{i}+5\mathbf{j}+\frac{3}{5}("10\mathbf{i}-20\mathbf{j}")=...$ or $\overrightarrow{PS}=\overrightarrow{PR}+\frac{2}{5}\overrightarrow{RQ}=13\mathbf{i}-15\mathbf{j}+\frac{2}{5}("-10\mathbf{i}+20\mathbf{j}")=...$	M1	3.1a
	$=9\mathbf{i}-7\mathbf{j}$	A1	1.1b
		(2)	
			(6 marks)

Notes

(a)

M1: Attempts subtraction either way round. This cannot be awarded for adding the two vectors. If no method shown it may be implied by one correct component.
eg $10\mathbf{i}-10\mathbf{j}$ on its own can score M1.

A1: Correct answer. Allow $10\mathbf{i}-20\mathbf{j}$ and $\begin{pmatrix}10\\-20\end{pmatrix}$ but not $\begin{pmatrix}10\mathbf{i}\\-20\mathbf{j}\end{pmatrix}$

(b)

M1: Correct use of Pythagoras. Attempts to "square and add" before square rooting. The embedded values are sufficient. Follow through on their $\overrightarrow{QR}$

A1ft: $10\sqrt{5}$ following (a) of the form $\pm10\mathbf{i}\pm20\mathbf{j}$

(c)

M1: Full attempt at finding a $\overrightarrow{PS}$. They must be attempting $\overrightarrow{PQ}\pm\frac{3}{5}\overrightarrow{QR}$ or $\overrightarrow{PS}=\overrightarrow{PR}\pm\frac{2}{5}\overrightarrow{RQ}$ but condone arithmetical slips after that.

Cannot be scored for just stating eg $\overrightarrow{PQ}\pm\frac{3}{5}\overrightarrow{QR}$

Follow through on their $\overrightarrow{QR}$. Terms do not need to be collected for this mark. If no method shown it may be implied by one correct component following through on their $\overrightarrow{QR}$

A1: Correct vector as shown. Allow $9\mathbf{i}-7\mathbf{j}$ and $\begin{pmatrix}9\\-7\end{pmatrix}$.

Only withhold the mark for $\begin{pmatrix}9\mathbf{i}\\-7\mathbf{j}\end{pmatrix}$ if the mark has not already been withheld in (a) for $\begin{pmatrix}10\mathbf{i}\\-20\mathbf{j}\end{pmatrix}$

Alt (c) (Expressing $\overrightarrow{PS}$ in terms of the given vectors) They must be attempting $\frac{2}{5}\overrightarrow{PQ}+\frac{3}{5}\overrightarrow{PR}$

M1: $(\overrightarrow{PS}=\overrightarrow{PQ}+\frac{3}{5}\overrightarrow{QR}=\overrightarrow{PQ}+\frac{3}{5}(\overrightarrow{PR}-\overrightarrow{PQ}))$

$\Rightarrow \frac{2}{5}\overrightarrow{PQ}+\frac{3}{5}\overrightarrow{PR}=\frac{2}{5}(3\mathbf{i}+5\mathbf{j})+\frac{3}{5}(13\mathbf{i}-15\mathbf{j})=\ldots$

A1: Correct vector as shown. Allow $9\mathbf{i}-7\mathbf{j}$ and $\begin{pmatrix}9\\-7\end{pmatrix}$.

Only withhold the mark for $\begin{pmatrix}9\mathbf{i}\\-7\mathbf{j}\end{pmatrix}$ if the mark has not already been withheld in (a) for $\begin{pmatrix}10\mathbf{i}\\-20\mathbf{j}\end{pmatrix}$

07.

Question	Scheme	Marks	AOs
a	$\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA} = (-8\mathbf{i}+9\mathbf{j}) - (10\mathbf{i}-3\mathbf{j})$	M1	1.1b
	$= -18\mathbf{i}+12\mathbf{j}$	A1	1.1b
		(2)	
(b)	$\left\|\overrightarrow{AB}\right\| = \sqrt{"18"^2+"12"^2}\ \{=\sqrt{468}\}$	M1	1.1b
	$= 6\sqrt{13}$	A1	1.1b
		(2)	
(c)	For the key step in using the fact that *BCA* forms a straight line in an attempt to find "p" $\overrightarrow{AB} = \lambda\overrightarrow{BC} \Rightarrow -18\mathbf{i}+12\mathbf{j} = 6\lambda\mathbf{i}+\lambda(p-9)\mathbf{j}$ with components equated leading to a value for λ and to $p = \ldots$	M1	2.1
	(i) $p = 5$	A1	1.1b
	(ii) ratio = 2: 3	B1 (A1 on EPEN)	2.2a
		(3)	
			(7 marks)

Notes:

(a) **Must be seen in (a)**

M1: Attempts subtraction either way round. This cannot be awarded for adding the two vectors.
If no method shown it may be implied by one correct component.
Allow as coordinates for this mark. Condone missing brackets, e.g., $-8\mathbf{i}+9\mathbf{j}-10\mathbf{i}-3\mathbf{j}$

A1: cao $-18\mathbf{i}+12\mathbf{j}$ o.e. $\begin{pmatrix}-18\\12\end{pmatrix}$ Condone $\begin{matrix}-18\\12\end{matrix}$

Do not allow $\begin{pmatrix}-18\mathbf{i}\\12\mathbf{j}\end{pmatrix}$ or $(-18,\ 12)$ or $\left(\frac{-18}{12}\right)$ for the A1.

(b)

M1: Attempts to use Pythagoras' theorem on their vector from part (a). Allow restarts.
$\left\|\overrightarrow{AB}\right\| = \sqrt{"18"^2+"12"^2}\ \{=\sqrt{468}\}$ Note that -18 will commonly be squared as 18
May be implied by awrt 21.6 This will need checking if (a) is incorrect.

A1: cao $6\sqrt{13}$ May come from $\begin{pmatrix}\pm18\\\pm12\end{pmatrix}$

(c)

M1: For the key step in using the fact that *BCA* forms a straight line in an attempt to find "p"
Condone sign slips. Award, for example, for $\pm\frac{p-9}{6} = \pm\frac{2}{3}$ leading to $p = \ldots$
It is implied by $p = 5$ unless it comes directly from work that is clearly incorrect.

e.g., award for an attempt to use

- $\overrightarrow{AB}=\alpha\overrightarrow{AC}\Rightarrow -18\mathbf{i}+12\mathbf{j}=-12\alpha\mathbf{i}+\alpha(p+3)\mathbf{j}$ with components equated leading to a value for α and to $p = \ldots$
- gradient BC = gradient $BA = -\frac{2}{3}$ e.g., $\frac{p-9}{6}=\frac{9--3}{-8-10}$ leading to $p=\ldots$
- triangles BCM and BAN are similar with lengths in a ratio 1:3. e.g., $p=9-\frac{1}{3}\times 12$ **or** $p=-3+\frac{2}{3}\times 12$
- attempt to find the equation of line AB using both points (FYI line AB has equation $y=-\frac{2}{3}x+\frac{11}{3}$) and then sub in $x=-2$ leading to $p=\ldots$
- $\frac{p+3}{12}=\frac{2}{3}$ **or** $\frac{p+3}{2}=9-p$ leading to $p=\ldots$

A1: $p = 5$ Correct answer implies both marks, unless it comes directly from work that is clearly incorrect.

B1: States ratio = 2: 3 or equivalent such as 1: 1.5 or 22:33
Note that 3:2 is incorrect but condone {Area}AOB : {Area}AOC = 3: 2
This might follow incorrect work or even incorrect p
For reference, area AOC = 22, area AOB = 33 and area BOC = 11