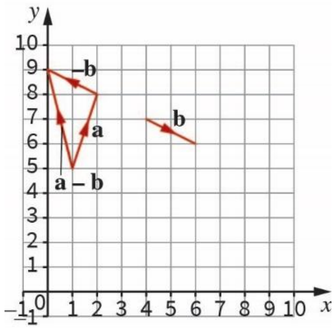
Oxford Revise | AQA GCSE Maths Higher | Answers

Chapter 27 Vectors

Question	Answer	Extra information	Marks
27.1 (a)		Correct vector drawn Arrow pointing in the correct direction	1 1
27.1 (b)	$2\mathbf{b}+3\mathbf{a}=2\begin{pmatrix}2\\-1\end{pmatrix}+3\begin{pmatrix}1\\3\end{pmatrix}$ $=\begin{pmatrix}4\\-2\end{pmatrix}+\begin{pmatrix}3\\9\end{pmatrix}$ $=\begin{pmatrix}7\\7\end{pmatrix}$	2**b** and 3**a** both correct Correct vector	1 1
27.2 (a)	$\overrightarrow{OT}=\overrightarrow{QO}=-\mathbf{a}$		1
27.2 (b)	$\overrightarrow{PQ}=-\mathbf{b}+\mathbf{a}$		1

Question	Answer	Extra information	Marks
27.2 (c)	$\overrightarrow{OU} = \mathbf{b} - \mathbf{a}$		1
27.2 (d)	$\overrightarrow{UQ} = \overrightarrow{UO} + \overrightarrow{OQ}$ $= \mathbf{a} - \mathbf{b} + \mathbf{a}$ $= 2\mathbf{a} - \mathbf{b}$		1
27.3	Let **q** be the vector $\mathbf{q} = \begin{pmatrix} x \\ y \end{pmatrix}$ $2\mathbf{q} - 5\mathbf{p} = 2\begin{pmatrix} x \\ y \end{pmatrix} - 5\begin{pmatrix} 4 \\ -1 \end{pmatrix}$ $= \begin{pmatrix} 2x - 20 \\ 2y + 5 \end{pmatrix}$ Therefore $2x - 20 = -26 \Rightarrow x = -3$ and $2y + 5 = 15 \Rightarrow y = 5$ $\mathbf{q} = \begin{pmatrix} -3 \\ 5 \end{pmatrix}$	Letting $\mathbf{q} = \begin{pmatrix} x \\ y \end{pmatrix}$ and writing $2\mathbf{q} - 5\mathbf{p} = 2\begin{pmatrix} x \\ y \end{pmatrix} - 5\begin{pmatrix} 4 \\ -1 \end{pmatrix}$ Equating the vector components and attempting to solve for x and y. Correct answer	1 1 1
27.4	$\overrightarrow{OC} = \begin{pmatrix} 3 \\ 3 \end{pmatrix}$	C correctly plotted Correct column vector	1 1

Question	Answer	Extra information	Marks
27.5	$\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB} = \mathbf{b} - \mathbf{a}$ $\overrightarrow{MN} = \overrightarrow{MA} + \overrightarrow{AN} = \frac{1}{2}\overrightarrow{OA} + \frac{4}{5}\overrightarrow{AB}$ $= \frac{1}{2}\mathbf{a} + \frac{4}{5}(\mathbf{b} - \mathbf{a})$ $= \frac{4}{5}\mathbf{b} - \frac{3}{10}\mathbf{a}$	1 mark for each line	4
27.6	$\overrightarrow{PQ} = \overrightarrow{PO} + \overrightarrow{OQ} = \mathbf{q} - \mathbf{p}$ $PQ : QR = 2:3, \overrightarrow{PR} = \frac{5}{2}\overrightarrow{PQ} = \frac{5}{2}(\mathbf{q} - \mathbf{p})$ $\overrightarrow{OR} = \overrightarrow{OP} + \overrightarrow{PR} = p + \frac{5}{2}(\mathbf{q} - \mathbf{p}) = \frac{5}{2}\mathbf{q} - \frac{3}{2}\mathbf{p}$ $= \frac{1}{2}(5\mathbf{q} - 3\mathbf{p})$ This is a multiple of $5\mathbf{q} - 3\mathbf{p}$, so it is parallel	1 mark for each line	5

Question	Answer	Extra information	Marks
27.7	$\overrightarrow{OP}=\frac{3}{4}\mathbf{a}, \overrightarrow{PA}=\frac{1}{4}\mathbf{a}, \overrightarrow{OQ}=k\mathbf{b}$ where k is a scalar constant. $\overrightarrow{AQ}=\overrightarrow{AO}+\overrightarrow{OQ}=-\mathbf{a}+k\mathbf{b}$ $\overrightarrow{PM}=\overrightarrow{PA}+\overrightarrow{AM}=\overrightarrow{PA}+\frac{1}{2}\overrightarrow{AQ}$ $=\frac{1}{4}\mathbf{a}+\frac{1}{2}(-\mathbf{a}+k\mathbf{b})=-\frac{1}{4}\mathbf{a}+\frac{1}{2}k\mathbf{b}$ $\overrightarrow{PB}=\overrightarrow{PO}+\overrightarrow{OB}=-\frac{3}{4}\mathbf{a}+\mathbf{b}$ $=3\overrightarrow{PM}$ So $1=3\times\frac{1}{2}k$ $k=\frac{2}{3}$ Substituting into $\overrightarrow{OQ}$: $\overrightarrow{OQ}=\frac{2}{3}\mathbf{b}$ So $OQ:QB=2:1$	$\overrightarrow{OP}=\frac{3}{4}\mathbf{a}$ or $\overrightarrow{PA}=\frac{1}{4}\mathbf{a}$ Attempt to find $\overrightarrow{AQ}$ in terms of **a** and **b** Use of $\overrightarrow{AM}=\frac{1}{2}\overrightarrow{AQ}$ Full process to solve for k Final answer	1 1 1 1 1

Question	Answer	Extra information	Marks
27.8	$\overrightarrow{CB} = 3\mathbf{a}$ $\overrightarrow{AC} = \overrightarrow{AO} + \overrightarrow{OC} = -9\mathbf{a} + \mathbf{c}$ $\overrightarrow{AP} = \frac{3}{4}AC = -\frac{27}{4}\mathbf{a} + \frac{3}{4}\mathbf{c}$ $\overrightarrow{OB} = \overrightarrow{OC} + \overrightarrow{CB} = 3\mathbf{a} + \mathbf{c}$ $\overrightarrow{OP} = \overrightarrow{OA} + \overrightarrow{AP} = 9\mathbf{a} - \frac{27}{4}\mathbf{a} + \frac{3}{4}\mathbf{c} = \frac{9}{4}\mathbf{a} + \frac{3}{4}\mathbf{c}$ $\overrightarrow{OP} = \frac{3}{4}\overrightarrow{OB}$ Thus *O*, *P* and *B* are collinear	$\overrightarrow{CB} = 3\mathbf{a}$ Attempt to find $\overrightarrow{AP}$ in terms of **a** and **b** Attempt to find $\overrightarrow{OP}$ in terms of **a** and **b** Shows that $\overrightarrow{OP}$ and $\overrightarrow{OB}$ are multiples, thus collinear	1 1 1 1
27.9 (a)	Convert km/h to m/s 8 km/h = $\frac{8\times1000}{60\times60}$ m/s =2.22.. m/s Jordan is faster	Correct calculation for conversion Clear comparison of the two speeds	1 1
27.9 (b)	Distance = 8.5 km $2.5 \text{ m/s} = \frac{2.5\times60\times60}{1000} = 9 \text{ km/h}$ Combined speed of runners = 8 + 9 = 17 km/h 8.5 ÷ 17 = 0.5 hours The runners will pass each other after 30 minutes	Attempt to combine speeds Dividing total distance by combined speeds Correct answer	1 1 1

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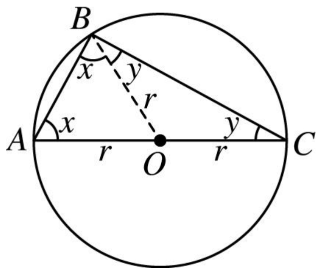
Question	Answer	Extra information	Marks
27.9 (c)	Riley’s speed is 8 km/h = 4 km per 30 minutes The runners meet 4 km from point A	Attempt to convert 8 km/h to km per your time from part b Correct answer, including units (4 km or 4000 m)	1 1
27.10	Consider an unknown angle (ABC) in a semicircle as shown.  Let $\angle BAC = x$ and let $\angle BCA = y$ Let the radius of the circle be *r*. $OC = OA = OB = r$ As the base angles of an isosceles triangle are equal, $\angle OBA = x, \angle OBC = y$ So, $\angle ACB = x + y$ Angles in a triangle add to 180°: $x + y + x + y = 180$ $2(x + y) = 180$ $x + y = 90$ Therefore, the angle in a semicircle is a right angle	Clear use of isosceles triangle to identify angle OCA (= x) or angle OCB (= y) $ACB = x + y$ $x + y + x + y = 180$ Fully correct proof	1 1 1 1