Oxford Revise | Edexcel A Level Maths | Answers

- Method (**M**) marks are awarded for showing you know a method and have attempted to apply it.
- Accuracy (**A**) marks should only be awarded if the relevant M marks have been awarded.
- Unconditional accuracy (**B**) marks are awarded independently of M marks. They do not rely on method.
- The abbreviation **o.e.** means 'or equivalent (and appropriate)'.

Please note that:

- efficient use of advanced calculators is expected
- inexact numerical answers should be given to three significant figures unless the question states otherwise; values from statistical tables should be quoted in full
- when a value of g is required, it is taken as $g = 9.8\ \text{m s}^{-2}$ unless stated otherwise in the question.

Chapter 34 Kinematics

Question	Answer	Extra information	Marks
34.1	$40\ \text{km h}^{-1} = \frac{40\times1000}{60\times60}$ $= 11.11\ldots\ \text{m s}^{-1}$	Converting units	B1
	$s = ut + \frac{1}{2}at^2$	Attempting to use $s = ut + \frac{1}{2}at^2$	M1
	$= (11.1\ldots)6 + \frac{1}{2}\times3\times6^2$		
	$= 121\ \text{m}$	Correct answer (at least 3 s.f.)	A1
	Total		**3 marks**

ISBN 9781382057707

Question	Answer	Extra information	Marks
34.2 (a)	$v = u + at$ $V = 0 + (-9.8)(5)$ $= -49$ Speed = 49 (m s^{-1})	Use of $v = u + at$ Correct answer. Must be positive.	M1 A1
34.2 (b)	$s = ut + \frac{1}{2}at^2$ $= 0.5(-9.8)(5^2)$ $= -122.5$ Height of window is 123 (m)	Use of $s = ut + \frac{1}{2}at^2$ Correct answer. Must be positive.	M1 A1
	Total		**4 marks**
34.3 (a)	$v^2 = u^2 + 2as$ $0 = 6^2 - 19.6s$ $s = \frac{36}{19.6}$ $= 1.84$ (m) Height above ground is 1.84 + 2 = 3.84 (m)	Use of $v^2 = u^2 + 2as$ Correct answer	M1 A1
34.3 (b)	$s = ut + \frac{1}{2}at^2$ $1 = 6t - 4.9t^2$ $4.9t^2 - 6t + 1 = 0$ $t = 0.199\ldots, 1.025\ldots$ Time above 3 m is $1.025\ldots - 0.199\ldots = 0.83$ (s)	 Forming a quadratic in t Both values for t Correct answer	 M1 A1 A1

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Question	Answer	Extra information	Marks
	Total		**5 marks**
34.4 (a)	$\mathbf{v} = \mathbf{u} + \mathbf{a}t$ $\mathbf{v} = \begin{pmatrix}1\\1\end{pmatrix} + 3\begin{pmatrix}3\\-4\end{pmatrix}$ $\mathbf{v} = \begin{pmatrix}10\\-11\end{pmatrix}$ or $\mathbf{v} = 10\mathbf{i} - 11\mathbf{j}$ Speed $= \sqrt{10^2 + 11^2}$ $= \sqrt{221}$ $= 14.9$ (m s^{-1})	Forming a vector equation in column vectors or **ij** form Either form accepted Correct answer only	M1 A1 A1
34.4 (b)	$s = ut + \frac{1}{2}at^2$ $\mathbf{s} = 6\begin{pmatrix}1\\1\end{pmatrix} + \frac{1}{2} \times 36 \times \begin{pmatrix}3\\-4\end{pmatrix}$ $\mathbf{s} = \begin{pmatrix}6\\6\end{pmatrix} + \begin{pmatrix}54\\-72\end{pmatrix} = \begin{pmatrix}60\\-66\end{pmatrix}$ $\begin{pmatrix}-2\\1\end{pmatrix} + \begin{pmatrix}60\\-66\end{pmatrix} = \begin{pmatrix}58\\-65\end{pmatrix}$ Position of B is $58\mathbf{i} - 65\mathbf{j}$	Forming a vector equation using $s = ut + \frac{1}{2}at^2$ Correct answer only	M1 A1
	Total		**5 marks**

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Question	Answer	Extra information	Marks
34.5	$v = u + at$	Attempting to use $v = u + at$	M1
	$k\begin{pmatrix}1\\-1\end{pmatrix} = \begin{pmatrix}-4\\2\end{pmatrix} + t\begin{pmatrix}1\\2\end{pmatrix}$	Any correct equation	A1
	$k = -4 + t$		
	$-k = 2 + 2t$		
	$-(-4 + t) = 2 + 2t$	Use of ratio to achieve an equation in t only	M1
	$4 - t = 2 + 2t$		
	$2 = 3t$		
	$t = \frac{2}{3}$ (s)	Correct answer only	A1
	Total		**4 marks**

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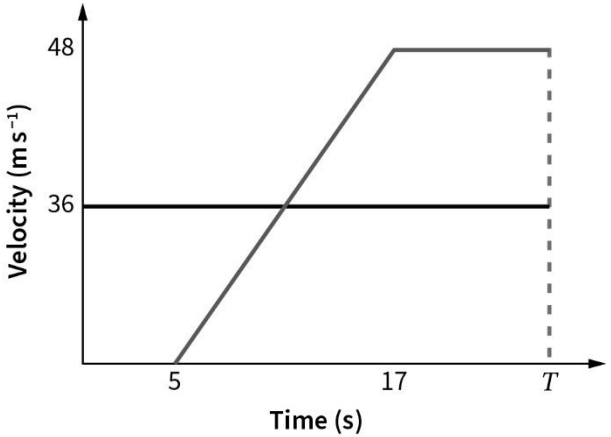
Question	Answer	Extra information	Marks
			
34.6	The motorbike accelerates for $\frac{48}{4}$ = 12 seconds	Correct acceleration of motorbike	B1
	The car and the motorbike will have travelled the same distance at time T		
	Using area under the graph = distance travelled		
	Car: $36T$ Motorbike: $\frac{1}{2}(T-17+T-5)\times 48 = 24(2T-22)$	Forming an equation for the area under the graph for the car or the motorbike	M1
	$36T = 24(2T - 22)$ $3T = 2(2T - 22)$ $T = 44$ (s)	Correct equation equating distance travelled by car and motorbike	M1
	It takes 44 – 5 = 39 seconds for the motorbike to catch the car.	Correct answer	A1
	Total		**4 marks**

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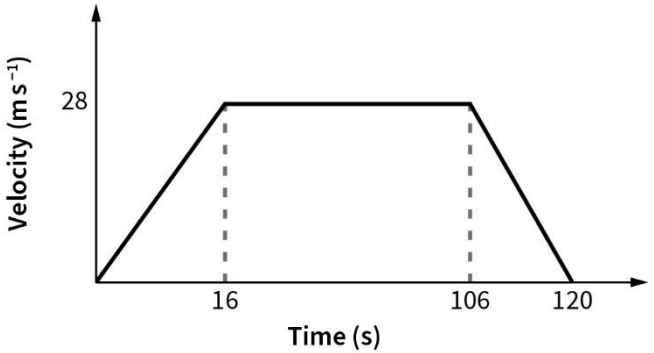
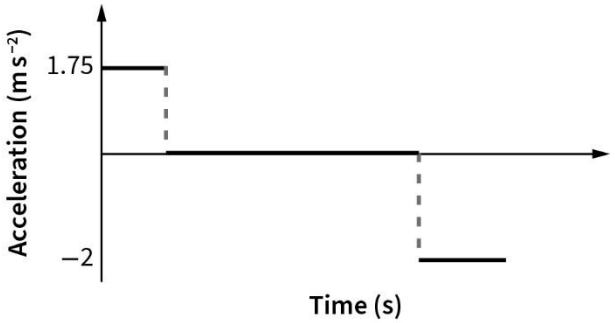
Question	Answer	Extra information	Marks
34.7 (a)	The deceleration section takes $\frac{28}{2}$ = 14 seconds  The acceleration section takes 120 – 90 – 14 = 16 seconds	Use of $v = u + at$ or gradient of graph General trapezium shape Correct times on horizontal axis	B1 B1 B1
34.7 (b)	Acceleration = $\frac{28}{16}$ = 1.75 (m s^{-2})	Use of gradient Correct answer only	M1 A1
34.7 (c)	 	Three horizontal line segments Correct values on acceleration axis	B1 B1
	Total		**7 marks**

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Question	Answer	Extra information	Marks
34.8 (a)	Deceleration section takes $2T$ seconds		B1
	Area under the graph = $12T + 3600 + 24T$	Expression for area	M1
	Distance travelled = area		
	$7200 = 36T + 3600$	Correct equation with T only	A1
	$T = 10$ (seconds)	Correct answer only	A1
34.8 (b)	Acceleration = $\frac{24}{10}$	Use of gradient or $v = u + at$	M1
	$= 2.4$ (m s^{-1})	Correct answer only	A1
	Total		**6 marks**
34.9 (a)	$\mathbf{v} = \int \mathbf{a}\ \mathrm{d}t = \left(\frac{4}{3}t^3 - t + c\right)\mathbf{i} + \left(t^2 + 3t + d\right)\mathbf{j}$	Attempting to integrate **v** with respect to time. Condone omission of c and d for this mark.	M1
	When $t = 3$, $\mathbf{v} = 40\mathbf{i} + 8\mathbf{j}$		
	$40\mathbf{i} + 8\mathbf{j} = \left(\frac{4}{3}3^3 - 3 + c\right)\mathbf{i} + \left(3^2 + 9 + d\right)\mathbf{j}$	Method to evaluate integration constants	M1
	$c = 7$, $d = -10$		
	$\mathbf{v} = \left(\frac{4}{3}t^3 - t + 7\right)\mathbf{i} + \left(t^2 + 3t - 10\right)\mathbf{j}$	Correct answer only	A1
34.9 (b)	When moving parallel to **i**, the **j** component of velocity is zero.		
	$t^2 + 3t - 10 = 0$	Forming a quadratic in t	M1A1
	$t = 2$ (t must be positive)	Must discard $t = -5$ solution	A1
	Total		**6 marks**

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Question	Answer	Extra information	Marks
34.10 (a)	When $t = 1$, $\mathbf{v} = 4\mathbf{i} + 8\mathbf{j} \Rightarrow \lvert\mathbf{v}\rvert = \sqrt{4^2 + 8^2}$ $= 4\sqrt{5}$ $= 8.94 \text{ (m s}^{-1}\text{)}$	Substitution of $t = 1$ and correct use of Pythagoras' theorem Correct answer	M1 A1
34.10 (b)	$\mathbf{a} = \frac{\mathrm{d}\mathbf{v}}{\mathrm{d}t}$ $= (6t + 1)\mathbf{i} + (-2)\mathbf{j}$	Attempting to differentiate Correct answer	M1 A1
34.10 (c)	$\mathbf{r} = \int \mathbf{v}\, \mathrm{d}t = \left(t^3 + \frac{t^2}{2} + c\right)\mathbf{i} + \left(10t - t^2 + d\right)\mathbf{j}$ When $t = 1$, $1.5\mathbf{i} - 5\mathbf{j} = \left(1^3 + \frac{1^2}{2} + c\right)\mathbf{i} + \left(10 - 1^2 + d\right)\mathbf{j}$ $c = 0$, $d = -14$ When $t = 3$, $\mathbf{r} = \frac{63}{2}\mathbf{i} + 7\mathbf{j}$	Attempting to integrate **v** with respect to time. Condone omission of c and d for this mark. Attempting to find constants of integration Correct answer only	M1 M1 A1
	Total		**7 marks**

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