Oxford Revise | Edexcel A Level Maths | Answers

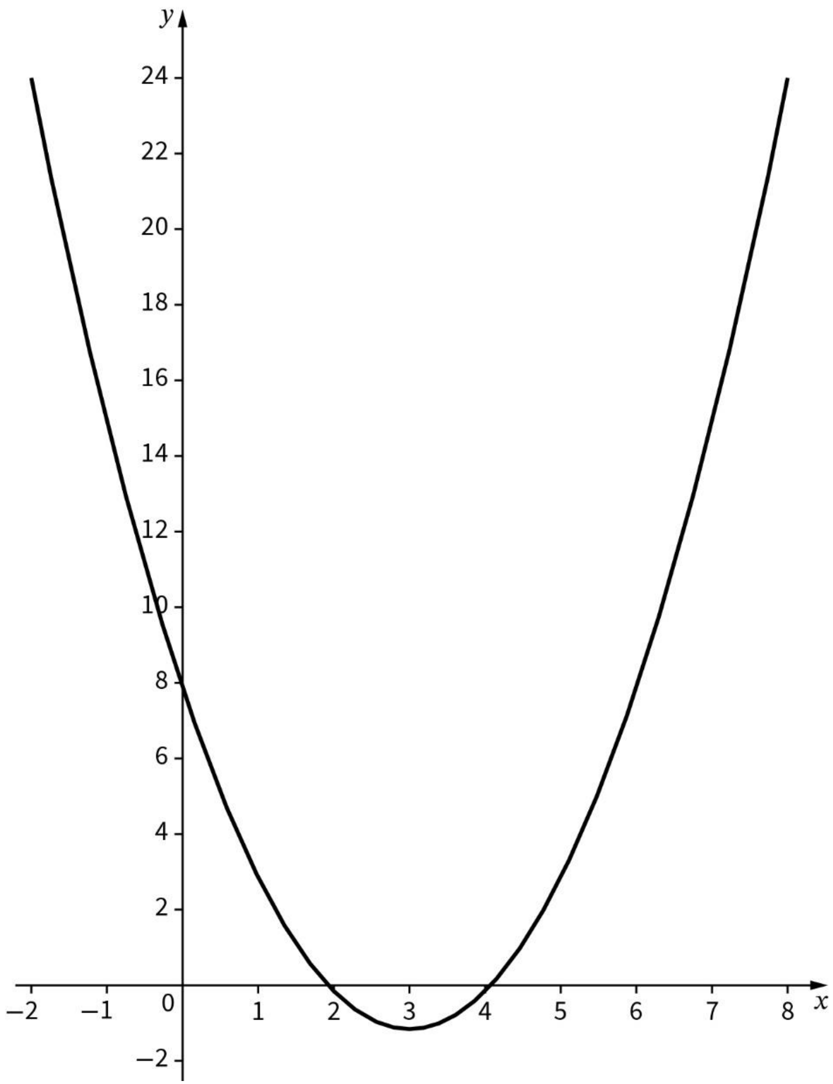
- Method (**M**) marks are awarded for showing you know a method and have attempted to apply it.
- Accuracy (**A**) marks should only be awarded if the relevant M marks have been awarded.
- Unconditional accuracy (**B**) marks are awarded independently of M marks. They do not rely on method.
- The abbreviation **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 18 Parametric equations

Question	Answer	Extra information	Marks
18.1 (a)	$t = x - 3$ $y = (x-3)^2 - 1$ $y = x^2 - 6x + 8$	 Correct substitution Expanding	 M1 A1
18.1 (b)	From quadratic in part (a), y-intercept is $(0, 8)$ $x^2 - 6x + 8 = 0$ $(x-2)(x-4) = 0$ Therefore, x-intercepts at $(2, 0)$ and $(4, 0)$	Identifying from the equation Attempting to solve quadratic Correct x-intercepts	B1 M1 A1

18.1 (c)		Correct shape of curve Correct x-intercepts at (2, 0) and (4, 0), and y-intercept at (0, 8) Correct end points at (–2, 24) and (8, 24)	M1 A1 A1

Question	Answer	Extra information	Marks
	Total		**8 marks**
18.2 (a)	$t=\frac{x+1}{3}$ $y=\left(\frac{x+1}{3}\right)^2-4$ $y+4=\frac{x^2+2x+1}{9}$ $9y+36=x^2+2x+1$ $9y=x^2+2x-35$ $y=\frac{(x+7)(x-5)}{9}$	Correct substitution Correct rearrangement	M1 A1
18.2 (b)	The curve is only defined for $-13<x<11$	Restricted domain. Suitable reason.	B1
	Total		**3 marks**
18.3 (a)	$x^2 = 9\sin^2 t$ $y^2 = 9\cos^2 t$ $x^2 + y^2 = 9\sin^2 t + 9\cos^2 t$ $x^2 + y^2 = 9(\sin^2 t + \cos^2 t)$ $x^2 + y^2 = 9$	Squaring both equations Finding the sum Use of trigonometric identity $\sin^2 t+\cos^2 t\equiv 1$	M1 M1 A1
18.3 (b)	Since this is a circle with centre (0, 0) and radius 3 the intercepts are (3, 0), (–3, 0), (0, 3) and (0, –3)	From knowledge of the graph Two correct intercepts Other two correct intercepts	 B1 B1

Question	Answer	Extra information	Marks
	Total		**5 marks**
18.4 (a)	$x - 2 = 4\sin t$ and $y - 3 = 4\cos t$ $(x-2)^2 = 16\sin^2 t$ $(y-3)^2 = 16\cos^2 t$ $(x-2)^2 + (y-3)^2 = 16\sin^2 t + 16\cos^2 t$ $(x-2)^2 + (y-3)^2 = 16(\sin^2 t + \cos^2 t)$ $(x-2)^2 + (y-3)^2 = 16$	Rearranging Squaring both equations Adding the equations Use of trigonometric identity $\sin^2 t + \cos^2 t \equiv 1$	M1 M1 M1 A1
18.4 (b)	Centre = (2, 3)	Reading from equation	B1
18.4 (c)	Radius = 4	Reading from equation	B1
18.4 (d)	$x = 1 + 3\sin t$ $y = 2 + 3\cos t$	Recognising how the centre and radius of the previous circle feature in the parametric form and applying	B1 B1
	Total		**8 marks**

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Question	Answer	Extra information	Marks
18.5 (a)	$x^2 = \tan^2 t = \dfrac{\sin^2 t}{\cos^2 t}$	Squaring and converting tan to sin/cos	M1
	$= \dfrac{y}{1-y}$	Substituting y and $1 - y$	M1
	$x^2(1-y) = y$ $x^2 - x^2 y = y$ $x^2 = y + x^2 y$ $x^2 = y(1+x^2)$		
	$y = \dfrac{x^2}{1+x^2}$	Completing the rearrangement	A1
18.5 (b)	$kx = \dfrac{x^2}{1+x^2} \Rightarrow kx(1+x^2) = x^2$	Equating and rearranging	M1
	$kx + kx^3 - x^2 = 0 \Rightarrow kx^2 - x + k = 0$		
	$b^2 - 4ac > 0 \Rightarrow 1 - 4k^2 > 0$	Use of the discriminant	M1
	$(1+2k)(1-2k) > 0$		
	$k < -\dfrac{1}{2}$ or $k > \dfrac{1}{2}$	Correct range for k	A1
	Total		**6 marks**

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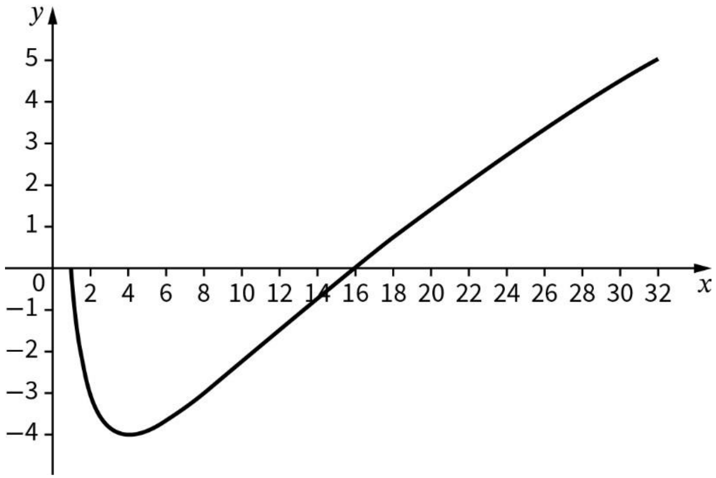
Question	Answer	Extra information	Marks
18.6 (a)	$t = \log_2 x$ $y = (\log_2 x)^2 - 4\log_2 x$ $y = \log_2 x(\log_2 x - 4)$ $y = \log_2 x(\log_2 x - \log_2 16)$ $y = \log_2 x \times \log_2 \dfrac{x}{16}$	Correct substitution Making 4 into $\log_2 16$ rearrangement Use of log rule to obtain correct answer	M1 M1 A1
18.6 (b)	$y = t^2 - 4t$ $= (t-2)^2 - 4$ Coordinates (4, –4)	 Completing the square Using the value of the parameter at the minimum point to substitute back in to find *x*	 M1 A1
18.6 (c)	$y = t^2 - 4t = 0$ $t(t-4) = 0$ $t = 0,\ t = 4$ $x = 2^0 = 1$ and $x = 2^4 = 16$	Setting $y = 0$ and solving for t Solving for x	M1 A1

Question	Answer	Extra information	Marks
18.6 (d)		Correct shape Correct *x*-intercepts Correct turning point at (4, –4) and correct end points at (1, 0) and (32, 5)	B1 B1 B1
	Total		**10 marks**
18.7 (a)	$0 = 10t - 5t^2$ $0 = 5t(2 - t)$ $t = 2$ $x = 10 \times 2$ $= 20$ (m)	Setting $y = 0$ Finding the value of *t* from the bracket and substituting into the equation for *x* equation Correct answer	M1 M1 A1

Question	Answer	Extra information	Marks
18.7 (b)	$y = 10t - 5t^2$ $y = -5(t^2 - 2t)$ $= -5\left[(t-1)^2 - 1\right]$ $= 5 - 5(t-1)^2$ Maximum height is 5 m	Any valid method, such as completing the square Correct answer	M1 A1
18.7 (c)	$y = x - 5\left(\frac{x}{10}\right)^2$ $y = x - \frac{5x^2}{100}$ $100y = 100x - 5x^2$ $20y = 20x - x^2$	Substituting Completing method and correct answer	M1 A1
	Total		**7 marks**

Question	Answer	Extra information	Marks
18.8 (a)	When $x = 0$	Substituting $x = 0$	M1
	$0 = \ln(t + 1)$		
	$t + 1 = e^0$		
	$t + 1 = 1$		
	Therefore, $t = 0$	Solving for t	A1
	$y = \frac{1}{4}(0^2 + 1)$	Substituting $t = 0$ into equation for y	M1
	$= \frac{1}{4}$		
	Therefore, the curve intersects the y-axis at $\left(0, \frac{1}{4}\right)$	Writing as coordinates	A1
18.8 (b)	$x = \ln(t + 1)$	Rearranging to make the parameter the subject so a substitution can be made	B1
	$e^x = t + 1$		
	$t = e^x - 1$		
	$y = \frac{1}{4}\left[(e^x - 1)^2 + 1\right]$	Substituting into equation for y	M1
	$= \frac{1}{4}\left[(e^{2x} - 2e^x + 1) + 1\right]$		
	$= \frac{1}{4}(e^{2x} - 2e^x + 2)$	Expanding and rearranging to obtain the required result	A1
	Total		**7 marks**

Question	Answer	Extra information	Marks
18.9 (a)	$15 = 50 + 5d$ $d = -7$	Substituting the given term into the formula Correct value	M1 A1
18.9 (b)	$15 = a + 3 \times 4$ $a = 15 - 12$ $= 3$	Using knowledge of the fourth term and common difference to find the first term Correct calculation	M1 A1
18.9 (c)	$15 = 1920 \times r^7$ $r^7 = \frac{1}{128}$ $r = \frac{1}{2}$	Formula for the eighth term Correct solution	M1 A1
	Total		**6 marks**
18.10 (a)	Substituting $\frac{1}{2}$ into the expression: $2\left(\frac{1}{2}\right)^3 + 3\left(\frac{1}{2}\right)^2 - 18\left(\frac{1}{2}\right) + 8$ $= \frac{1}{4} + \frac{3}{4} - 9 + 8$ $= 0$	Use of the factor theorem Correct calculation	M1 A1
18.10 (b)	$(2x - 1)(x^2 + 2x - 8)$ $(2x - 1)(x - 2)(x + 4)$ $x = 0.5, x = 2, x = -4$	Finding the quadratic bracket by any method For full factorisation Correct solutions obtained from brackets	M1 M1 A1

Question	Answer	Extra information	Marks
18.10 (c)	$x = -0.5$, $x = -2$, $x = 4$	Numbers multiplied by –1 since it is a reflection in the y-axis	B1
	Total		**6 marks**