

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 19 Derivatives

Question	Answer	Extra information	Marks
10.1 (a)	$12x^2 - 6x + 1$	Attempting to differentiate. One term correct.	M1
19.1 (d)		All terms correct	A1
10.1.(1)	24x - 6	Differentiating their (a)	M1
19.1 (0)		Correct expression	A1
	Total		
19.2 (a)	<i>b</i> = -12	Correct answer	B1
19.2 (b)	84 = 3c so c = 28	Attempting to find <i>c</i>	M1
	c = 4a so $a = 7$	Correct value of a	A1



Question	Answer	Extra information	Marks
	Total		3 marks
10.2 (a)	$40x^4 - 21x^2 - 5x^{-2} + 6x^{-3}$	One term correct	M1
19.3 (a)		All terms correct	A1
10.3 (b)	$160x^3 - 42x + 10x^{-3} - 18x^{-4}$	Differentiating their (a)	M1
19.3 (0)		Correct expression	A1
	Total		4 marks
19.4 (a)	They have added one to each power rather than subtracted one.	Correct reason	B1
10.4 (b)	$-9x^{-2} + 4 - 6x - 24x^{-4}$	Attempting to differentiate. One term correct.	M1
19.4 (0)		All terms correct	A1
	Total		3 marks
	$3x^2 + 19x - 14$	Expanding brackets	M1
19.5 (a)		Attempting to differentiate	M1
	Hence $6x + 19$	Both terms correct	A1
19.5 (b)	6	Correct expression	B1
	Total		4 marks
	$4x^3 - 15x^2 - 24x - 5$	Expanding brackets	M1
19.6 (a)		Attempting to differentiate	M1
	Hence $12x^2 - 30x - 24$	All terms correct	A1
10.6 (b)	24x - 30	Differentiating their (a)	M1
19.6 (b)		Correct expression	A1



Question	Answer	Extra information	Marks
	Total		5 marks
	$3x^2 - 4 + 5x^{-1}$	Writing in index form	M1
19.7 (a)		Attempting to differentiate	M1
	Hence $6x - 5x^{-2}$	Both terms correct	A1
10.7 (b)	$6 + 10x^{-3}$	Differentiating their (a)	M1
19.7 (0)		Correct expression	A1
	Total		5 marks
	$4x - 2x^{-2} + 7x^{-1}$	Writing in index form	M1
10.9 (a)	Hence $4 + 4x^{-3} - 7x^{-2}$	Attempting to differentiate	M1
19.8 (a)	$\Rightarrow \frac{\mathrm{d}y}{\mathrm{d}x} = 4 + \frac{4}{x^3} - \frac{7}{x^2}$	All terms correct	A1
10.9 (b)	$-12x^{-4} + 14x^{-3}$	Attempting to differentiate	M1
19.8 (0)		Correct expression	A1
	Total		5 marks
19.9 (a)	$\frac{21}{2}x^{\frac{1}{2}} + \frac{5}{2}x^{-\frac{1}{2}} + \frac{3}{2}x^{-\frac{3}{2}}$	B1 for each correct term	B1B1B1
19.9 (b)	$21 - \frac{1}{2}$ $5 - \frac{3}{2}$ $9 - \frac{5}{2}$	Attempting to differentiate their (a). One term correct.	M1
	$\frac{-x^2 - x^2 - x^2}{4}$	All terms correct	A1
	Total		5 marks



Question	Answer	Extra information	Marks
10 10 (2)	$9x^{\frac{1}{2}} + x^{-1} - x^{-\frac{5}{2}}$	Writing in index form	M1
19.10 (a)	Hence $\frac{dy}{dx} = \frac{9}{2}x^{-\frac{1}{2}} - x^{-2} + \frac{5}{2}x^{-\frac{7}{2}}$	Attempting to differentiate. One term correct. All terms correct	M1 A1
19.10 (b)	$\frac{9}{4}x^{-\frac{3}{2}} + 2x^{-3} - \frac{35}{4}x^{-\frac{9}{2}}$ Differentiating their (a). One term correct. All terms correct		M1 A1
	Total		5 marks
19.11 (a)	$7\cos 7x$	For $k \cos 7x$ Fully correct expression	M1 A1
19.11 (b)	$\begin{array}{c} -49 \sin 7x \\ \text{For } k \sin 7x \\ \text{Fully correct expression} \end{array}$		M1 A1
	Total		4 marks
19.12 (a)	$4e^{4x}$	Correct answer	B1
19.12 (b)	$16e^{4x}$	Correct answer	B1
	Total		2 marks
19.13 (a)	$2 \times 4^{2x} \ln 4$	For ln 4	A1
		For fully correct expression	A1
19.13 (b)	$4\times 4^{2x}(\ln 4)^2$	Attempting to differentiate their (a)	M1
17.15 (0)		Correct expression	A1
	Total		4 marks



Question	Answer	Extra information	Marks
19.14 (a)	$\frac{1}{x}$	Correct expression	
19.14 (b)	$-x^{-2}$	Attempting to differentiate their (a) Correct expression	M1 A1
	Total		3 marks
19.15	$15 \sec^2 3x$	For $k \sec^2 3x$ Fully correct expression	M1 A1
	Total		2 marks



Question	Answer	Extra information	Marks
	$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$		
	$= \lim_{h \to 0} \frac{3(x+h)^2 - 3x^2}{h}$	For correct substitution into formula	B1
	$= \lim_{h \to 0} \frac{3x^2 + 6hx + 3h^2 - 3x^2}{h}$	Attempting to simplify	M1
19.16	$=\lim_{h\to 0}\frac{6hx+3h^2}{h}$		
	$=\lim_{h\to 0}\frac{3h(2x+h)}{h}$		
	$=\lim_{h\to 0} [3(2x+h)]$	Correct limit expression	A1
	As $h \to 0$, $2x + h \to 2x$ so $3(2x + h) \to 6x$		
	So $f'(x) = 6x$	Correct final conclusion	A1
	Total		4 marks



Question	Answer	Extra information	Marks
	$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$		
	$=\lim_{h\to 0}\frac{(x+h)^3-x^3}{h}$	For correct substitution into formula	B1
	$= \lim_{h \to 0} \frac{x^3 + 3hx^2 + 3h^2x + h^3 - x^3}{h}$	Attempting to simplify	M1
19.17	$=\lim_{h\to 0}\frac{3hx^2+3h^2x+h^3}{h}$		
	$=\lim_{h\to 0}\frac{h(3x^2+3hx+h^2)}{h}$		
	$=\lim_{h\to 0} \left(3x^2 + 3hx + h^2\right)$	Correct limit expression	A1
	As $h \to 0$, $3x^2 + 3hx + h^2 \to 3x^2$		
	So $f'(x) = 3x^2$	Correct final conclusion	A1
	Total		4 marks



Question	Answer	Extra information	Marks
	$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \to 0} \frac{\cos(x+h) - \cos x}{h}$ $= \lim_{h \to 0} \frac{\cos x \cos h - \sin x \sin h - \cos x}{h}$	For correct substitution into formula and use of identity	M1
19.18	$= \lim_{h \to 0} \left[\left(\frac{\cos h - 1}{h} \right) \cos x - \left(\frac{\sin h}{h} \right) \sin x \right]$	Correct limit expression	A1
	Since as $h \to 0$, $\frac{\sin h}{h} \to 1$ and $\frac{\cos h - 1}{h} \to 0$, the expression in	Use of given limits and applying limiting process	M1
	the square brackets tends to $0 \times \cos x - 1 \times \sin x$		
	So $\lim_{h \to 0} \frac{\cos(x+h) - \cos x}{h} = -\sin x$		
	Hence $f'(x) = -\sin x$	Correct conclusion	A1
	Total		4 marks
	$400 - 200e^{-0.04 \times 10}$	Substituting	M1
19.19 (a)	= 265.935		
	= 266	Correct population	A1
19.19 (b)	200	Correct answer	B1
10.10 (2)	$0.04 imes 200e^{-0.04t}$	Attempting to differentiate	M1
19.19 (c)		Correct expression	A1



Question	Answer	Extra information		
10.10 (4)	$0.04 \times 200e^{-0.04 \times 8} = 5.809$	Substituting into their (c)	M1	
19.19 (u)	= 5.81 fish per month	Correct rate of change	A1	
	Total		7 marks	
19.20 (a)	Initial number of bacteria	Correct answer	B1	
	$360 \times e^{-0.02 \times 20}$	Substituting	M1	
19.20 (b)	= 241.3			
	= 241	Correct P	A1	
10.00 ()	$\frac{dP}{dt} = -0.02 \times 360e^{-0.02t}$	Differentiating	M1	
19.20 (c)	dt = -0.02P	For conclusion that $k = -0.02$. Can be implied by $-0.02P$	A1	
19.20 (d)	The number of bacteria is decreasing because the sign of $\frac{dP}{dt}$ is	Suitable reason	B1	
	negative.			
19.20 (e)	$-0.02 \times 360e^{-0.02 \times 13}$	Substituting into their (c)	M1	
	=-5.55 bacteria per second	Correct rate of change	A1	
	Total		8 marks	



Question	Answer	Extra informati	on	Extra information		
19.21 (a) (b) (c)	y 3 (c) $y = 2\sin x + 1$ (a) $y = \sin x$ (b) $y = \sin 3x$ (240°, 0) (300°, 0) (300°, 0) (330°, 0) (360°, 0) (360°, 0) (360°, 0)	 (a) Correct graph (b) Correct shape Correct <i>x</i>-inte (c) Correct shape Correct <i>x</i>- and Correct max/n Coordinate axes intersections (<i>x</i>-coordinates are degrees, °) Maximum/ minimum 	e ercepts d y-intercepts min y = f(x) (0, 0) (180, 0) (360, 0) (360, 0) (90, 1) (270, -1)	y = f(3x) (0,0) (60,0) (120,0) (120,0) (180,0) (240,0) (300,0) (360,0) (30,1) (90,-1) (150,1)	y = 2f(x) + 1 (0, 1) (210, 0) (330, 0) (90, 3) (270, -1)	B1 B1 B1 B1 B1 B1 B1
		Maximum/ minimum points (x-coordinates are degrees, °)	(90, 1) (270, -1)	(30, 1)(90, -1)(150, 1)(210, -1)(270, 1)(330, -1)	(90, 3) (270, -1)	



Question	Answer	Extra information	Marks
	Total		6 marks
	$m_{AB} = \frac{6}{3} = 2$	Attempting to find any gradient	M1
	$m_{BC} = \frac{6}{-12} = -\frac{1}{2}$	Both m_{AB} and m_{BC} gradients	A1
19.22 (a)	$m_{AC} = \frac{12}{-9} = -\frac{4}{3}$		
	$2 \times -\frac{1}{2} = -1$	Use of perpendicular rule	M1
	Hence there is a right angle (at <i>B</i>)	Correct conclusion	A1
19.22 (b)	$\left AB\right = \sqrt{6^2 + 3^2}$	Use of Pythagoras' theorem to find length AB	M1
	$=\sqrt{45}$	Poth lengths AP and PC correct	A 1
	$ BC = \sqrt{12} + 0$ $= \sqrt{180}$	Both lengths AB and BC correct	AI
	$\frac{1}{2}\sqrt{45}\sqrt{180}$	Use of formula for area of a triangle	M1
	$=45 \text{ units}^2$	Correct area	A1
	Total		8 marks