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 10 Binomial expansion

Question	Answer	Extra information	Marks
10.1	$(2-x)^4$ $= 2^4 + 4\times 2^3(-x) + 6\times 2^2(-x)^2 + 4\times 2(-x)^3 + (-x)^4$ $= 16 - 32x + 24x^2 - 8x^3 + x^4$	Correct binomial expansion. Allow one error. Three correct terms Completely correct simplification	M1 A1 A1
	Total		**3 marks**

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Question	Answer	Extra information	Marks
10.2	$(1+2x)^{12}$ $=1+12\times 2x+\frac{12\times 11}{2!}(2x)^2+\frac{12\times 11\times 10}{3!}(2x)^3$ $=1+24x+264x^2+1760x^3$	Correct binomial expansion. Allow one error. Three correct terms Completely correct simplification	M1 A1 A1
	Total		**3 marks**
10.3 (a)	$(2+x)^{15}$ $= 2^{15}+15\times 2^{14}\times x+\frac{15\times 14}{2!}2^{13}\times x^2+\frac{15\times 14\times 13}{3!}2^{12}\times x^3+\cdots$ $= 32\,768 + 245\,760x + 860\,160x^2 + 1\,863\,680x^3$	Correct binomial expansion. Allow 1 error First term correct Second and third term correct Completely correct simplification	M1 B1 A1 A1
10.3 (b)	Let $x = 0.01$ $2.01^{15} = (2 + 0.01)^{15}$ $\approx 32\,768 + 245\,760 \times 0.01 + 860\,160 \times 0.01^2 + 1\,863\,680\times 0.01^3$ $= 35\,313.479\,68$	Correct estimate	B1
	Total		**5 marks**

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Question	Answer	Extra information	Marks
10.4 (a)	$\left(3+\frac{x}{4}\right)^8$ $= 3^8 + 8\times3^7\times\left(\frac{x}{4}\right)+\frac{8\times7}{2!}3^6\times\left(\frac{x}{4}\right)^2+\cdots$ $= 6561 + 4374x + 1275.75x^2 + \ldots$	Correct binomial expansion. Allow one error. First term correct Second term correct Completely correct simplification	M1 B1 A1 A1
10.4 (b)	Let $x = 0.2$ $= 6561 + 4374\ (0.2) + 1275.75 \times 0.2^2$ $= 7486.83$	Correct value for substitution Substituting correctly Correct answer	B1 M1 A1
	Total		**7 marks**
10.5 (a)	$(1-kx)^8$ $=1+8\times(-kx)+\frac{8\times7}{2!}(-kx)^2+\frac{8\times7\times6}{3!}(-kx)^3$ $=1-8kx+28k^2x^2-56k^3x^3$	Correct binomial expansion. Allow one error. Three correct terms Completely correct simplification	M1 A1 A1
10.5 (b)	$28k^2 = 7 \times (-8k)$ $28k^2 = -56k$ $28k = -56$ because $k \neq 0$ $k = -2$	Correct equation based on the relationship between the coefficients Correct solution	M1 A1

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Question	Answer	Extra information	Marks
10.5 (c)	Substituting –2 into $-56k^3$ -56×-8 $= 448$	Correct substitution Correct solution	M1 A1
	Total		**7 marks**
10.6 (a)	$\left(4-\frac{3x}{2}\right)^8 = 4^8 + 8\times 4^7 \times \left(-\frac{3x}{2}\right) + \frac{8\times 7}{2!}4^6 \times \left(-\frac{3x}{2}\right)^2 + \frac{8\times 7\times 6}{3!}4^5 \times \left(-\frac{3x}{2}\right)^3 (+...)$ $\left(4-\frac{3x}{2}\right)^8 = 65\,536 - \ldots$ $\left(4-\frac{3x}{2}\right)^8 = \ldots - 196\,608x + 258\,048x^2 - 193\,536x^3$	Correct binomial expansion. Allow one error. Correct first term Correct second term Completely correct expansion	M1 B1 A1 A1
10.6 (b)	$f(x) = \left(\frac{x+1}{x}\right)\left(4-\frac{3x}{2}\right)^8 = \left(1+\frac{1}{x}\right)\left(4-\frac{3x}{2}\right)^8$ $1 \times 258\,048x^2$ $\frac{1}{x} \times -193\,536x^3 = -193\,536x^2$ $258\,048 - 193\,536 = 64\,512$	Valid useful step Finding x^2 first term Finding x^2 second term Adding the coefficients of the two terms	M1 M1 M1 A1
	Total		**8 marks**

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Question	Answer	Extra information	Marks
10.7 (a)	$\left(1-\frac{x}{3}\right)^7$ $=1+7\times\left(-\frac{x}{3}\right)+\frac{7\times6}{2!}\times\left(-\frac{x}{3}\right)^2+\cdots$ $=1-\frac{7}{3}x+\frac{7}{3}x^2+\ldots$	Correct binomial expansion. Allow one error. Two correct terms Completely correct simplification	M1 A1 A1
10.7 (b)	$f(x)=3(ax+b)\left(1-\frac{x}{3}\right)^7$ $=(3ax+3b)\left(1-\frac{7}{3}x+\frac{7}{3}x^2+\cdots\right)$ $=3b+3ax-7bx+7bx^2-7ax^2+\cdots$ $=3b+(3a-7b)x+(7b-7a)x^2+\cdots$ $3b-7a=-1$ $7b-7a=7$ $4b=8$ $b=2$ $7(2)-7a=7$ $a=1$	Obtaining relevant term Using the given values of the coefficients Eliminating a Correct value of b Correct value of a	M1 M1 M1 A1 A1
	Total		**8 marks**

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Question	Answer	Extra information	Marks
10.8 (a)	$\frac{1}{\sqrt{1+x}} = (1+x)^{-0.5}$	Converting into index form	M1
	$1 - \frac{x}{2} + \frac{\left(-\frac{1}{2}\right)\left(-\frac{3}{2}\right)}{2!}x^2 + \frac{\left(-\frac{1}{2}\right)\left(-\frac{3}{2}\right)\left(-\frac{5}{2}\right)}{3!}x^3 + \cdots$	Correct binomial expansion. Allow one error.	M1
	$= 1 - \frac{x}{2} + \frac{3}{8}x^2 - \frac{5}{16}x^3 + \cdots$	Two correct terms Completely correct simplification	A1 A1
10.8 (b)	Substituting $-\frac{1}{5}$ is acceptable but substituting 4 is not because x must be such that $-1 < x < 1$ for the approximation to be valid.	Reference to the restriction on a binomial expansion for it to be valid	B1
	Total		**5 marks**

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Question	Answer	Extra information	Marks
10.9 (a)	$\frac{\sqrt{1+9x}}{\sqrt{1+4x}} = (1+9x)^{0.5} \times (1+4x)^{-0.5}$	Converting into index form	B1
	$(1+9x)^{0.5} = 1 + \frac{9x}{2} + \frac{\left(\frac{1}{2}\right)\left(-\frac{1}{2}\right)}{2!}(9x)^2$	Correct binomial expansions	M1
	$(1+4x)^{-0.5} = 1 - \frac{4x}{2} + \frac{\left(-\frac{1}{2}\right)\left(-\frac{3}{2}\right)}{2!}(4x)^2$		
	$1 + \frac{9x}{2} - \frac{81}{8}x^2$ and $1 - 2x + 6x^2$	Correct simplifications	A1
	$(1+9x)^{0.5} \times (1+4x)^{-0.5} = \left(1 + \frac{9x}{2} - \frac{81}{8}x^2\right)\left(1 - 2x + 6x^2\right)$		
	$\approx 1 - 2x + 6x^2 + \frac{9x}{2} - 9x^2 - \frac{81}{8}x^2 + \ldots$	Selecting the appropriate terms from the product	M1
	$= 1 + \frac{5}{2}x - \frac{105}{8}x^2 + \ldots$	Correct simplification	A1

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Question	Answer	Extra information	Marks
10.9 (b)	The valid range for the first expansion is $-\frac{1}{9} < x < \frac{1}{9}$ The valid range for the second expansion is $-\frac{1}{4} < x < \frac{1}{4}$ Therefore, the valid range is $-\frac{1}{9} < x < \frac{1}{9}$ since this is stricter.	Correct range identified	B1
	Total		**6 marks**
10.10 (a)	$\frac{2}{\sqrt{4+x}} = 2\times(4+x)^{-0.5}$ $= 2\times 4^{-0.5}\left(1+\frac{x}{4}\right)^{-0.5}$ $= \left(1+\frac{x}{4}\right)^{-0.5}$ $\left(1+\frac{x}{4}\right)^{-0.5} = 1+\left(-\frac{1}{2}\right)\left(\frac{x}{4}\right)+\frac{\left(-\frac{1}{2}\right)\left(-\frac{3}{2}\right)}{2!}\left(\frac{x}{4}\right)^2$ $= 1-\frac{1}{8}x+\ldots$ $= 1-\frac{1}{8}x+\frac{3}{128}x^2$	Correct binomial expansion Beginning of a correct simplification Fully correct simplification	M1 A1 A1

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Question	Answer	Extra information	Marks
10.10 (b)	Yes, it is valid. The expansion is valid for $-1 < \frac{x}{4} < 1$ so $-4 < x < 4$ $x = 3$ is in this range.	 Correct conclusion	 B1
	Total		**4 marks**
10.11 (a)	$30x^2 + 18x = A(3x+1)(x-1) + B(x-1) + C(3x+1)^2$ Substituting $x = 1$: $48 = 16C \Rightarrow C = 3$ Substituting $x = -\frac{1}{3}$: $-\frac{8}{3} = -\frac{4}{3}B \Rightarrow B = 2$ Comparing coefficients: $30 = 3A + 9C \Rightarrow A = 1$ $A = 1, B = 2, C = 3$	Correct equation Correct method, such as substituting $x = 1$ or $x = -\frac{1}{3}$ or comparing coefficients One correct variable All three correct	M1 M1 A1 A1

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Question	Answer	Extra information	Marks
10.11 (b)	$(1+3x)^{-1} = 1+(-1)(3x)+\frac{(-1)(-2)}{2!}(3x)^2-\cdots$ $= 1-3x+9x^2-\cdots$ $2\times(1+3x)^{-2} = 2\left(1-6x+27x^2-\cdots\right)$ $= 2-12x+54x^2-\cdots$ $3\times(x-1)^{-1} = -3\times(1-x)^{-1}$ $-3\times(1-x)^{-1} = -3\left(1+x+x^2+\cdots\right)$ $= -3-3x-3x^2-\cdots$ $f(x) = (1-3x+9x^2)+(2-12x+54x^2)+(-3-3x-3x^2)$ $= -18x+60x^2+\cdots$ Therefore $a = 0$, $b = -18$, $c = 60$	Use of binomial expansion for first partial fraction Correct simplification Use of binomial expansion for second partial fraction Correct manipulation Use of binomial expansion for third partial fraction and correct simplification Sum of the three expansions	M1 A1 M1 M1 M1 A1
10.11 (c)	$-\frac{1}{3} < x < \frac{1}{3}$	Valid range	B1
	Total		**11 marks**

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Question	Answer	Extra information	Marks
10.12 (a)	$x+4y+c=0 \Rightarrow y=-\frac{1}{4}x-\frac{1}{4}c$ Gradient of $AB = -\frac{1}{4}$, so $k = 4$	Rearranging to find gradient of the line Using product of gradients of perpendicular lines = −1	M1 A1
10.12 (b)	The point $\left(-\frac{8}{17},-\frac{n}{17}\right)$ lies on the line $y = 4x$ Therefore, $n = 32$	Valid statement Correct n	M1 A1
10.12 (c)	The point $\left(-\frac{8}{17},-\frac{32}{17}\right)$ lies on the line $x+4y+c=0$ $-\frac{8}{17}+4\left(-\frac{32}{17}\right)+c=0$ $c=\frac{8}{17}+\frac{128}{17}$ $c=8$	Substituting the coordinates into the equation of the line Correct value of c	M1 A1
10.12 (d)	Given that $x + 4y + 8 = 0$ If $y = 0$, $x = –8$ $(–8, 0)$ If $x = 0$, $y = –2$ $(0, –2)$	Correct coordinates Correct coordinates	B1 B1

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Question	Answer	Extra information	Marks
10.12 (e)	Area of $OAB = \frac{1}{2} \times 8 \times 2$ $= 8$	Using intercepts to form a right-angled triangle Area found using the standard formula	M1 A1
	Total		**10 marks**
10.13 (a)	Centre = (2, 3)	Reading from equation	B1
10.13 (b)	The line has equation $2x + y = 7$ Substituting $x = 2$ and $y = 3$: $2 \times 2 + 3 = 7$ Therefore, the centre of the circle C is on the line L	Correct substitution to show statement	B1

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Question	Answer	Extra information	Marks
10.13 (c)	$y = 7 - 2x$		
	$(x-2)^2 + (7-2x-3)^2 = 20.25$	Correct substitution	M1
	$(x-2)^2 + (4-2x)^2 = 20.25$		
	$x^2 - 4x + 4 + 16 - 16x + 4x^2 = 20.25$		
	$20 - 20x + 5x^2 = 20.25$		
	$-0.25 - 20x + 5x^2 = 0$		
	$5x^2 - 20x - 0.25 = 0$		
	$20x^2 - 80x - 1 = 0$	Deriving the quadratic	M1
	$x = \frac{80 \pm \sqrt{6400 + 80}}{40} = \frac{80 \pm \sqrt{6480}}{40}$		
	$x = 4.01$ or -0.0125	Correct values of x to at least 3 s.f.	A1
	$y = 7 - 2x$ When $x = 4.01$, $y = -1.02$ When $x = -0.0125$, $y = 7.03$ Therefore, the points are (4.01, –1.02) and (–0.0125, 7.03)	Correct corresponding y-coordinates	A1
	Total		**6 marks**

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