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 1 Indices, surds and proof

Question	Answer	Extra information	Marks
1.1	$2^3 + 1 = 9 = 3^2$, which is not prime	Any valid counter example	B1
	Total		**1 mark**
1.2	Let $p = 2n + 1$, $q = 2m + 1$ and $p + q = 2k + 1$ $p + q - p = 2k + 1 - (2n + 1)$ $= 2k + 1 - 2n - 1$ $= 2k - 2n$ $= 2(k - n)$, which is even	Defining three distinct odd numbers. Allow any equally appropriate alternative that assumes all three facts.	M1
	This is a contradiction.	Any step that shows that if $p + q$ is odd and either p or q is odd, then the other must be even	M1
	Therefore, if $p + q$ is odd, and p is odd, then q must be even.	Valid conclusion	A1

Question	Answer	Extra information	Marks
	Total		**3 marks**
1.3	Let $p = 2n + 1$ and $q = 2n + 3$ $pq = 4n^2 + 8n + 3$ $= 4(n^2 + 2n) + 3$ This is of the form $4m + 3$ where m is an integer, which is 1 less than a multiple of 4 since $4m + 3 + 1 = 4(m + 1)$ They may use $p = 2n + 1$ and $2n – 1$ to give $(2n + 1)(2n – 1) = 4n^2 – 1$ Alternatively, they may use $pq = 4n^2 + 8n + 3$ $= 4n^2 + 8n + 4 – 1$ $= 4(n^2 + 2n + 1) – 1$	Defining two consecutive odd numbers. Allow any appropriate alternatives, e.g. $p = 2n − 1$ and $q = 2n + 1$ Multiplying them together Valid conclusion Allow alternative proof	M1 M1 A1
	Total		**3 marks**
1.4	$\left(\frac{a^3}{b^{-2}}\right)^3 = \frac{a^9}{b^{-6}}$ $= a^9b^6$	Use of index law $\left(a^b\right)^c = a^{bc}$ on both the top and the bottom of the fraction Correct simplification	M1 A1
	Total		**2 marks**

Question	Answer	Extra information	Marks
1.5 (a)	$4^x \times 2^{2x-1} = \left(2^2\right)^x \times 2^{2x-1}$ $= 2^{2x} \times 2^{2x-1} = 2^{4x-1}$	For 4 written as power of 2 Use of index laws $\left(a^b\right)^c = a^{bc}$ and $a^b \times a^c = a^{b+c}$	M1 A1
1.5 (b)	$2^{4x-1} = \frac{1}{\sqrt{2}}$ $2^{4x-1} = 2^{-0.5}$ $4x-1 = -\frac{1}{2}$ $4x = \frac{1}{2} \Rightarrow x = \frac{1}{8}$	Substituting their expression from (a) Writing $\frac{1}{\sqrt{2}}$ as a power of 2 Correct solution	M1 M1 A1
	Total		**5 marks**
1.6	$3^{3x+1} \times \left(3^2\right)^{2x-3} = \left(3^3\right)^{2x} \times \left(3^4\right)^{x-2}$ $3x+1+2(2x-3) = 6x+4(x-2)$ $3x+1+4x-6 = 6x+4x-8$ $7x - 5 = 10x - 8$ $3x = 3$ $x = 1$	Writing all terms as powers of 3 Attempting to simplify Correct solution	M1 M1 A1
	Total		**3 marks**

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Question	Answer	Extra information	Marks
1.7 (a)	$\left(2^a \times 3^b\right)^2 \div \left(2^{2a-1} \times 3^{3b}\right)$ $= \left(2^{2a} \times 3^{2b}\right) \div \left(2^{2a-1} \times 3^{3b}\right)$ $= 2^{2a-(2a-1)} \times 3^{2b-3b}$ $= \frac{2}{3^b}$ (or 2×3^{-b})	Use of index law $(a^b)^c = a^{bc}$ Attempting to combine the powers of 2 and 3 Correct simplification	M1 M1 A1
1.7 (b)	$\frac{2}{3^b} = 6^k \quad \Rightarrow \quad 2 = 6^k \times 3^b$ $2 = 2^k \times 3^k \times 3^b$ $= 2^k \times 3^{k+b}$ Therefore $k = 1$	Multiplying both sides by 3^b Correct solution	M1 A1
1.7 (c)	The student is correct because the expression in (a) is independent of *a* Alternatively, there are no *a* in the expression so it's impossible to set up an equation to solve for *a* Or, they may say $-b = k$, so *b* must equal −1	Any valid reason	B1
	Total		**6 marks**
1.8	If $x = \frac{1}{4}$, $\sqrt{x} = \sqrt{\frac{1}{4}} = \frac{1}{2}$ $\frac{1}{2} > \frac{1}{4}$ so the statement is not true.	Any valid counter example using the fact that when you square a number between 0 and 1 it gets smaller	B1

Question	Answer	Extra information	Marks
	Total		**1 mark**
1.9 (a)	$x=\frac{\sqrt{50}}{1-\sqrt{2}}$	Factorising and rearranging	M1
	$x=\frac{\sqrt{50}}{1-\sqrt{2}}\times\frac{1+\sqrt{2}}{1+\sqrt{2}}$	Attempting to rationalise denominator. Must see $\frac{1+\sqrt{2}}{1+\sqrt{2}}$	M1
	$=\frac{\sqrt{50}+\sqrt{100}}{1-2}$		
	$=\frac{5\sqrt{2}+10}{-1}$		
	$=-10-5\sqrt{2}$	Correct answer	A1
1.9 (b)	$\left(3^4\right)^{11x-2}=3^{-2.5}$	Attempting to convert to powers of 3	M1
	$44x-8=-\frac{5}{2}$	Use of index laws. Allow one error in the indices.	M1
	$x=\frac{1}{8}$	Correct solution	A1
	Total		**6 marks**
1.10	Assume that integers *a* and *b* exist such that $8a+6b=5$	Valid statement of the converse	M1
	Factorise the LHS so $2(4a+3b)=5$		
	LHS is even but RHS is odd, which is a contradiction.	Establishing a contradictory statement	M1
	Therefore, no such integers *a* and *b* exist.	Correct conclusion	A1

Question	Answer	Extra information	Marks
	Total		**3 marks**
1.11	$\left(2^2\right)^p = \dfrac{2^{\frac{1}{2}}}{2^q}$ $2p = 0.5 - q$ $q = 0.5 - 2p$ o.e.	Writing all terms as powers of 2 Forming a correct equation Rearranging into the required format	M1 M1 A1
	Total		**3 marks**
1.12	$16 \geq 4$, $25 \geq 8$, $36 \geq 16$	Correctly checking 3, 4 and 5 only	B1
	Total		**1 mark**
1.13	Assume that all three sides, *a*, *b* and *c* of a right-angled triangle are odd. Pythagoras' theorem says $a^2 + b^2 = c^2$ The square of an odd number is also odd, since $(2k + 1)^2 = 2(2k^2 + 2k) + 1$ The sum of two odd numbers is even, since $(2p + 1) + (2q + 1) = 2(p + q + 1)$ LHS of Pythagoras' theorem is even and RHS is odd, therefore the expressions cannot be equal, which is a contradiction. Therefore, all three sides cannot be odd.	Valid statement of the converse Stating Pythagoras' theorem Proof of intermediate fact Proof of intermediate fact Correct conclusion	M1 M1 M1 M1 A1
	Total		**5 marks**

Question	Answer	Extra information	Marks
1.14	$a^2 - b^2 = 5$ or $a^2 - b^2 = -5$ If $a = 3$, $a^2 = 9$, so $b^2 = 4$ or 14 b is an integer so $b^2 = 4$ and $b > 0$ therefore $b = 2$	Identifying $a^2 - b^2$ as a square root of 25 For both possible values of b Identifying correct b	M1 M1 A1
	Total		**3 marks**
1.15	$(2n + 3)^2 - (2n + 1)^2$ $= 4n^2 + 12n + 9 - (4n^2 + 4n + 1)$ $= 4n^2 + 12n + 9 - 4n^2 - 4n - 1$ $= 8n + 8$ $= 8(n + 1)$ which is divisible by 8	Attempting to expand brackets All terms and signs correct Correct conclusion	M1 M1 A1
	Total		**3 marks**
1.16 (a)	$(m - 3n)^2 \geq 0$ as it is a square. Multiplying out and rearranging gives $m^2 + 9n^2 \geq 6mn$ Dividing by mn gives $\frac{m}{n} + 9\frac{n}{m} \geq 6$ since mn is positive.	Attempting to rearrange given expression to construct proof in reverse Expanding correctly Correct final step	M1 M1 A1
1.16 (b)	$m = -1$, $n = 1$	Any valid counter example	B1
	Total		**4 marks**

Question	Answer	Extra information	Marks
1.17	Assume that there are a finite set of primes p_1 to p_n Multiply $p_1 \times p_2 \times \ldots \times p_n$ and add 1 This number must either be prime or have a prime factor. If prime, it is different from all of $p_1, \ldots p_n$ If it has a prime factor, this must be a prime factor not in the original set, as all of the primes in the original set will leave a remainder of 1 when divided. Therefore, there will always be another prime no matter how big your initial set.	Valid statement of the converse Statement from well-known proof Statement that prime factorisations are unique Correct conclusion The proof shown is the most common. Accept any valid proof.	M1 M1 M1 A1
	Total		**4 marks**
1.18	Assume p and q are even integers and pq is an odd integer. $pq = 2m \times 2n = 4mn$, which is even when m, n are integers. This contradicts the assumption that pq is an odd integer. Therefore, if pq is odd, p and q cannot both be even, so at least one of them must be odd.	Valid statement of the converse Expressing p and q as even numbers Correct conclusion	M1 M1 A1
	Total		**3 marks**

Question	Answer	Extra information	Marks
1.19	By contradiction: Assume $\sqrt{2}$ is rational. Therefore $\sqrt{2}$ can be written as $\frac{a}{b}$ where a and b are integers with no common factors. $\sqrt{2} = \frac{a}{b} \Rightarrow b\sqrt{2} = a \Rightarrow 2b^2 = a^2$ Therefore, a^2 is even. If a^2 is even, a is even, so let $a = 2k$ $2b^2 = a^2$ $2b^2 = (2k)^2 = 4k^2$ $b^2 = 2k^2$ Therefore, b^2 is even, and therefore b is even. If a and b are both even, they have a common factor of 2 This is a contradiction, therefore $\sqrt{2}$ is irrational.	Use of standard proof Valid statement of the converse Showing a is even Statement of fact Showing b is even Correct conclusion	M1 M1 M1 M1 A1
	Total		**5 marks**
1.20	If n is even, $n = 2k$ $(2k)^2 = 4k^2$, which is not of the form $4n - 1$ If n is odd, $n = 2k + 1$ $(2k+1)^2 = 4k^2 + 4k + 1 = 4(k^2 + k) + 1$, which is not of the form $4n - 1$	Proof for all even numbers Proof for all odd numbers	B1 B1
	Total		**2 marks**

Question	Answer	Extra information	Marks
1.21	Two consecutive cubes must be the cube of an odd number and the cube of an even number. Using $(2k)^3$ and $(2k + 1)^3$ $(2k+1)^3 - (2k)^3$ $= 8k^3 + 12k^2 + 6k + 1 - 8k^3$ $= 12k^2 + 6k + 1 = 2(6k^2 + 3k) + 1$, which is an odd number	Writing expressions for consecutive cubes. Allow acceptable alternative expressions. Correct expansion. Allow up to one expansion error for this mark. Correct conclusion	M1 M1 A1
	Total		**3 marks**