

Maths Questions By Topic:

Proofs

A-Level Edexcel

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1. (i) Use proof by exhaustion to show that for $n \in \mathbb{N}$, $n \le 4$	
$(n+1)^3 > 3^n$	
(n+1) > 3	(2)
	、
(ii) Given that $m^3 + 5$ is odd, use proof by contradiction to show, using algebra, that m is even.	
is even.	(4)
	(-)

Question 1 continued	





Question 1 continued



Question 1 continued	
	(Total for Question 1 is 6 marks)



2. A student is investigating the following statement about natural numbers.	
" $n^3 - n$ is a multiple of 4"	
(a) Prove, using algebra, that the statement is true for all odd numbers.	(4)
	(+)
(b) Use a counterexample to show that the statement is not always true.	(1)
	(1)

Question 2 continued



Question 2 continued	



Question 2 continued	
Question 2 continueu	
	(Total for Question 2 is 5 marks)



3. Prove by contradiction that there are no positive integers p and q such that				
		$4p^2 - q^2 = 25$		
		· P		(4)
				(4)

Question 3 continued	



Question 3 continued	
	(Total for Question 3 is 4 marks)



4. (a) Prove that for all positive values of <i>a</i> and	d <i>b</i>	
	$\frac{4a}{b} + \frac{b}{a} \geqslant 4$	(4)
(b) Prove, by counter example, that this is	not true for all values of a and b .	(1)

Question 4 continued
(Total for Question 4 is 5 marks)



Prove that for all $n \in \mathbb{N}$, $n^2 + 2$ is not divisible by 4	(4)
) "Given $x \in \mathbb{R}$, the value of $ 3x - 28 $ is greater than or equal to the value, giving a reason, if the above statement is always true, sometimes	alue of $(x-9)$." nest true or never true. (2)

Question 5 continued	
	(Total for Question 5 is 6 marks)



6. Given $n \in \mathbb{N}$, prove that $n^3 + 2$ is not divisible by 8	(4)
	(4)

Question 6 continued	
	(Total for Question 6 is 4 marks)
	(Total for Question o is 4 marks)



7.	(i) Show that $x^2 - 8x + 17 > 0$ for all real values of x	(3)
	(ii) "If I add 3 to a number and square the sum, the result is greater than the squar original number."	e of the
	State, giving a reason, if the above statement is always true, sometimes true or	never true.
		(2)

Question 7 continued	
	Total for Question 7 is 5 marks)
	Total for Question / 18 5 marks)



8.	 (i) Use a counter example to show that the following statement is false. "n² - n - 1 is a prime number, for 3 ≤ n ≤ 10." (ii) Prove that the following statement is always true. 	(2)
	"The difference between the cube and the square of an odd number is even."	
	For example $5^3 - 5^2 = 100$ is even.	(4)
		-

Question 8 continued	
	(Total for Question 8 is 6 marks)



9. (a) Prove that for all positive values of x and y	
$\sqrt{xy} \leqslant \frac{x+y}{2}$	(2)
(b) Prove by counter example that this is not true when x and y are both negative.	
(o) cases of second configuration and the second configuration and below the second configuration and t	(1)
	-
(Total for Question 9 is 3 mar	·ks)

e more than a multiple of 3	(4)

Question 10 continued



estion 10 continued	
	(Total for Question 10 is 4 marks)



11.	"If m and n are irrational numbers, where $m \neq n$, then mn is also irrational."		
	Disprove this statement by means of a counter example.	(2)	
	(Total for Overtin	11 is 2 montes)	
	(Total for Question	n 11 is 2 marks)	

12. (i) Kayden claims that	
$3^x \geqslant 2^x$	
Determine whether Kayden's claim is always true, sometimes true or never true,	
justifying your answer.	(2)
	(2)
(ii) Prove that $\sqrt{3}$ is an irrational number.	(6)

Question 12 continued			

Question 12 continued	
	(Total for Question 12 is 8 marks)

