2.7 Algebraic Proof: 10-minute Pack

AQA 8365 · Calculator allowed · about 10 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Let n be an integer. Prove that the sum of three consecutive integers is a multiple of 3.

(Total for Question 1 is 3 marks)

2 Show that $(x^2 - 9)/(x^2 - x - 6)$ simplifies to $(x + 3)/(x + 2)$, stating any values of x that must be excluded.

(Total for Question 2 is 3 marks)

3 Let n be a positive integer. Prove that $n^3 - n$ is divisible by 6.

(Total for Question 3 is 4 marks)

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Mark scheme · 2.7 Algebraic Proof: 10-minute Pack

Question 1

writes the sum of three consecutive integers as n + (n+1) + (n+2)	**M1**
simplifies correctly to 3n + 3	**M1**
factorises to 3(n+1) and states this is a multiple of 3 for every integer n	**A1**

Answer: n + (n+1) + (n+2) = 3(n+1), a multiple of 3

Question 2

factorises the numerator, $x^2 - 9 = (x-3)(x+3)$	**M1**
factorises the denominator, $x^2 - x - 6 = (x-3)(x+2)$	**A1**
cancels the common factor (x-3) correctly to give (x+3)/(x+2), stating x is not equal to 3 and x is not equal to -2	**A1**

Answer: (x+3)/(x+2), for x not equal to 3, -2

Question 3

factorises $n^3 - n$ as n(n-1)(n+1)	**M1**
identifies n-1, n, n+1 as three consecutive integers	**M1**
valid reasoning that among any three consecutive integers, at least one is divisible by 3 and at least one is even (divisible by 2)	**A1**
correct conclusion that the product is divisible by both 2 and 3, hence divisible by 6	**A1**

Answer: $n^3 - n = (n-1)n(n+1)$, always divisible by 6

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