

Examples



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Workout

Question 1: Prove the following

- (a)  $(n + 7)^2 - (n + 1)^2 = 12(n + 4)$                       (b)  $(n + 1)^2 - (n - 3)^2 = 8(n - 1)$   
(c)  $(n + 1)^2 + (n + 5)^2 - (n + 9)^2 = (n + 5)(n - 11)$

Question 2: Prove the following

- (a)  $(n + 4)^2 - (n + 2)^2$  is always a multiple of 4 for all positive integer values of  $n$ .  
(b)  $(n + 10)^2 - (n + 2)^2$  is always a multiple of 16 for all positive integer values of  $n$ .  
(c)  $(2n + 3)^3 - (2n + 1)$  is always even for all positive integer values of  $n$ .  
(d)  $(5n + 2)^2 - (5n - 1)^2$  is always a multiple of 3 for all positive integer values of  $n$ .  
(e)  $(2n + 9)^2 - (2n + 5)^2$  is always a multiple of 4 for all positive integer values of  $n$ .  
(f)  $(n + 2)^2 - (n - 2)^2 + 3$  is always odd for all positive integer values of  $n$ .

Question 3:  $n$  is a positive integer.

- (a) Write an expression for an even number.  
(b) Write an expression of an odd number.

Question 4: Prove the following

- (a) The sum of any three consecutive integers is divisible by 3.  
(b) The sum of any three consecutive even numbers is always a multiple of 6.  
(c) The sum of two consecutive odd numbers is even.  
(d) The sum of three consecutive odd numbers is always a multiple of 3.  
(e) The sum of four consecutive odd numbers is always a multiple of 8.  
(f) The sum of two consecutive integers is always odd.  
(g) The sum of four consecutive integers is **not** a multiple of 4

Question 5: Prove the following

- (a) Prove the product of two odd numbers is always odd.
- (b) Prove the product of two even consecutive numbers is always a multiple of 4.
- (c) The difference between the squares of any two consecutive integers is equal to the sum of the two integers.
- (d) Prove the sum of the squares of any two consecutive even numbers is always a multiple of 4.
- (e) Prove that when any odd integer is squared, the result is always one more than a multiple of 8.

### Apply

Question 1: The first five terms of a linear square are 2, 7, 12, 17, 22

- (a) Find the  $n$ th term of the square

A new sequence is generated by squaring each term of the linear sequence and then adding 1.

- (b) Prove that all terms in the new sequence are divisible by 5.

Question 2: The first two terms of a fibonacci sequence are  $a$  and  $b$ .

- (a) Show the 4th term of the sequence is  $a+2b$
- (b) Prove that the sum of the first 10 terms is equal to 11 times the 7th term.

Question 3: Cara writes down a 3-digit number where the first digit is greater than the last. e.g. 681

She then reverses the number to give 186.

Cara then subtracts this number from her starting number.  $681 - 186 = 495$

She then reverses her answer to give 594.

Cara then adds these number  $495 + 594 = 1089$ .

$681$	$594$
$-186$	$+495$
$495$	$1089$

Cara repeats this several times and always gets 1089 as her answer.  
Prove algebraically that the answer is always 1089.

### Answers



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