## 11.2 Part 2 Arithmetic Series

Series -> the indicated sum of the terms of a sequence

The symbol  $S_n$  is used to represent the sum of the first n terms of a series.

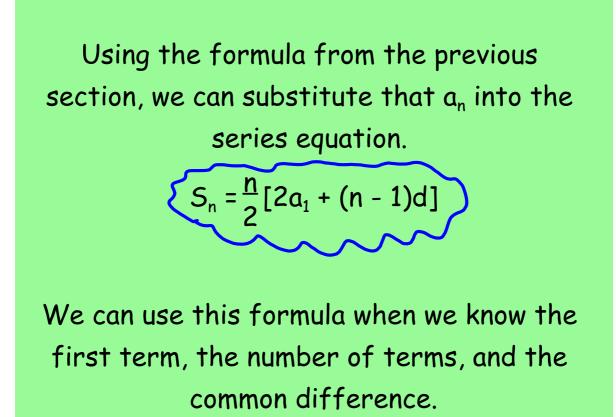
We use a special formula to find the arithmetic series without having to add all of the terms together.

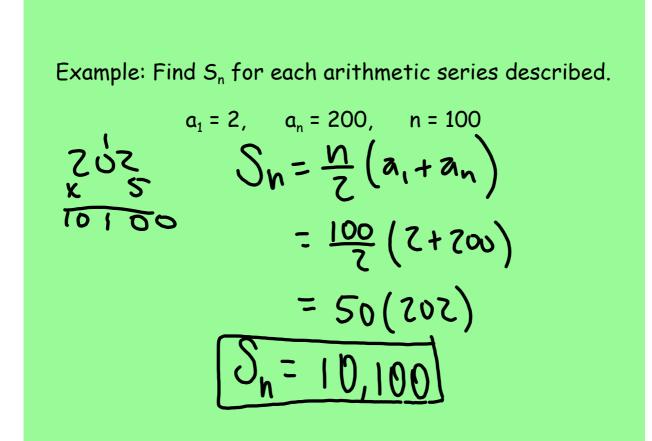
## Sum of An Arithmetic Series

The sum, S<sub>n</sub>, of the first n terms of an arithmetic series is given by the following formula:

 $(S_n = \frac{n}{2}(a_1 + a_n))$ 

This formula is used when the first term, the n<sup>th</sup> term, and the number of terms are known.





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Example: Find  $S_n$  for each arithmetic series described.

$$a_{1} = 5, \quad a_{n} = 100, \quad n = 200$$

$$S_{n} = \frac{n}{Z} (a_{1} + a_{n})$$

$$= \frac{200}{Z} (5 + 100)$$

$$= 100 (105)$$

$$S_{n} = 10500$$

Example: Find  $S_n$  for each arithmetic series described.

$$S_{n} = \frac{n}{2} \left[ 2a_{1} + (n-1)a \right]$$

$$= \frac{15}{2} \left[ 2(4) + (15-1)(3) \right]$$

$$= \frac{15}{2} \left[ 8 + (14)(3) \right] = \frac{15}{2} \left[ 8 + 42 \right]$$

$$= \frac{15}{2} \left[ 50 \right] = 15 \cdot 25$$

$$S_{n} = 375$$

Example: Find  $S_n$  for each arithmetic series described.

$$a_{1} = 50, \quad n = 20, \quad d = -4$$

$$\int_{n} = \frac{n}{2} \left[ 2a_{1} + (n-1)d \right]$$

$$= \frac{20}{2} \left[ 2 \cdot 50 + (20 - 1)(-4) \right]$$

$$= 10 \left[ 100 + (19)(-4) \right]$$

$$= 10 \left[ 100 + -76 \right] = 10 \left[ 24 \right]$$

$$\int_{n} = 240$$

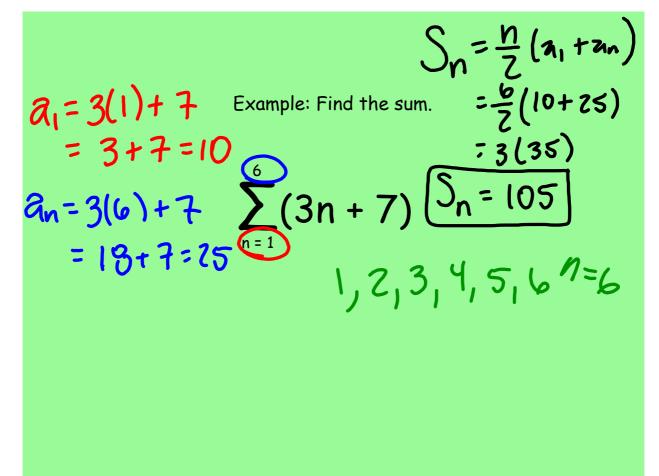
Example: Find S<sub>n</sub> for each arithmetic series described.  

$$\begin{array}{c}
3n = -3n \\
-3 + (n-1)el \\
-3n = -3 + (n-1)(-4) \\
= \frac{10}{2}(-3 + -3n) \\
= 5(-42) \\
\hline{3n = -210} \\
\hline{3$$

Example: Find S<sub>n</sub> for each arithmetic series described.  
9+11+13+15+...+31 
$$n = 7$$
  
 $d=2$   
 $a_{n} = a_{1} + (n-1)d$   
 $3l = 9 + (n-1)(2)$   
 $3l = 9 + 2n - 2$ ,  
 $3l = 7 + 2n$   
 $-7 - 7$   
 $24 = 2n$   $N = 12$   
 $n = \frac{12}{2}(9+31)$   
 $= \frac{12}{2}(9+31)$ 

A sigma notation can also be used to express an arithmetic series.

The upper number is the upper limit of the index. To generate the terms of the series, successively replace the index of summation with each value of the variable.



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