8.2 Arithmetic Sequences and Series

**Arithmetic Sequence**: a sequence in which each term after the first differs from the preceding term by a constant amount

Ex. $-4, -1, 2, 5, 8, \ldots$

**Common Difference**: the difference between consecutive terms

\[ d = a_{n+1} - a_n \]

$d$: common difference of a sequence

\[ a_n: \text{the } n\text{th term}, \text{ or general terms}, \text{ of a sequence} \]

Ex. Find the common difference of $7, 2, -3, -8, -13, \ldots$

Ex. Write the first six terms of the arithmetic sequence in which $a_1 = 200$ and $d = -60$. 

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**The General Term of an Arithmetic Sequence**

**Formula for The $n$th term (the General Term) of an Arithmetic Sequence**

\[ a_n = a_1 + (n - 1)d \]

Ex. Find $a_{60}$ of the arithmetic sequence with $a_1 = 8$ and $d = 6$.

Ex. Find $a_{25}$ of the arithmetic sequence with $a_1 = 14$ and $d = -3$. 
Ex. Find the formula for the \( n \)th term (the general term) if \( a_1 = 6 \) and \( d = 7 \). (Use the formula above.)

Ex. Given the arithmetic sequence \( 2, 7, 12, 17, \ldots \).

(a) Write a formula for the \( n \)th term of the arithmetic sequence. (Use the formula above.)

(b) Use the formula for \( a_n \) to find \( a_{20} \).

Ex. (#32) Find the 19\(^{\text{th}}\) term of an arithmetic sequence with \( a_1 = -11 \) and \( a_{30} = 163 \).

Ex. (#36) Find the number of terms of the finite arithmetic sequence.
\[ 7, 16, 25, 34, \ldots, 574 \]
The Sum of the First $n$ Terms of an Arithmetic Sequence

Formula for the Sum of the First $n$ Terms of an Arithmetic Sequence

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

Ex. Find the sum of the first 50 terms of the arithmetic sequence:

$-15, -9, -3, 3, \ldots$

Ex. Find the sum of $2 + 4 + 6 + 8 + \cdots + 200$.

Ex. Given $\sum_{i=1}^{200} 4i$.

(a) Write out the first three terms and the last term.

(b) Find the indicated sum.
Ex. Given $\sum_{i=1}^{40} (-2i + 6)$.

(c) Write out the first three terms and the last term.

(d) Find the indicated sum.

Ex. (#66) Jose must choose between two job offers. The first job pays $50,000 per year. Each year thereafter, he would receive a raise of $2400. A second job offers $54,000 per year with a raise of $2000 each year thereafter. However, with the second job, Jose would have to pay $100 per month out of his paycheck for health insurance. If Jose anticipates working for the company for 6 years, find the total amount he would earn from each job.