In an arithmetic sequence, the same amount is always added to get from one term to the next.

The amount that is added to get to each next term is called the common difference.

**EXAMPLE**  
Fill in the blanks to complete the arithmetic sequence below.

\[\_, 19, \_, \_, \_, \_, 67, \_\]

We begin by finding the common difference. To get from 19 to 67 in this sequence, we add the common difference 4 times.

\[\_, 19, \_, \_, \_, \_, 67, \_\]

Adding the common difference 4 times adds a total of \(67 - 19 = 48\). So, the common difference is \(48 \div 4 = 12\). We use this to find the missing terms, as shown.

\[7, 19, 31, 43, 55, 67, 79\]

**PRACTICE**  
Find the common difference for each arithmetic sequence below.

35. \(7, 16, 25, 34, 43, \ldots\)  
36. \(-33, -25, -17, -9, -1, \ldots\)  
37. \(29, 26, 23, 20, 17, \ldots\)  
38. \(\_, 21, \_, 35, \_, \ldots\)  
39. \(74, \_, \_, 41, \_, \ldots\)  
40. \(30, \_, \_, \_, \_, 32\frac{1}{2}, \ldots\)
PRACTICE | Fill in the blanks to complete each arithmetic sequence below.

41. 19, ____, ____, 64, ____, ____, 109

42. 98, ____, 112, ____, ____, ____, 140

43. ____, ____, ____, ____, 32, 30\(\frac{1}{2}\), ____

44. 10, ____, ____, ____, ____, 22, ____

PRACTICE | Answer each question below.

45. What is the common difference of an arithmetic sequence whose first term is 25 and whose tenth term is 115?

46. What is the common difference of an arithmetic sequence whose 23rd term is \(\frac{1}{3}\) and whose 25th term is \(\frac{1}{2}\)?

47. An arithmetic sequence has 10th term 4 and 30th term 68. What is the 20th term of the sequence?

48. An arithmetic sequence has five terms. The first term is 40, and the sum of all five terms is 80. What is the common difference?
Arithmetic Sequences, Part 1

**EXAMPLE**  What is the 50th term of the arithmetic sequence below?

\[ 2, \ 5, \ 8, \ 11, \ 14, \ 17, \ ... \]

The first term of the arithmetic sequence is 2 and the common difference is 3.

\[ +3 \quad +3 \quad +3 \quad +3 \quad +3 \]

\[ 2, \ 5, \ 8, \ 11, \ 14, \ 17, \ ... \]

To get to the 2nd term, we add 1 three to 2.
To get to the 3rd term, we add 2 threes to 2.
To get to the 4th term, we add 3 threes to 2.
To get to the 50th term, we add 49 threes to 2.
So, the 50th term is \(2 + 49(3) = 2 + 147 = 149\).

**PRACTICE**  Find the value of the missing term listed for each arithmetic sequence below.

49.  15, 19, 23, 27, 31, ... \[\text{10th}\]  

50.  -11, -6, -1, 4, 9, ... \[\text{40th}\]

51.  5, -2, -9, -16, -23, ... \[\text{15th}\]

52.  -29, -19, -9, 1, 11, ... \[\text{100th}\]

**PRACTICE**  Answer each question below.

53.  What is the 13th term of an arithmetic sequence whose first term is 9 and whose common difference is 8?  

54.  What is the first term of an arithmetic sequence whose 100th term is 40 and whose common difference is \(\frac{1}{3}\)?

55.  The 12th and 15th terms of an arithmetic sequence are 85 and 106. What is the first term of the sequence?
EXAMPLE

Write an expression for the $n^{th}$ term of the arithmetic sequence below.

-1, 4, 9, 14, 19, 24, ...

The first term of the sequence is -1 and the common difference is 5.

$-1, 4, 9, 14, 19, 24, ...$

+5 +5 +5 +5 +5

To get the 2nd term, we add 1 five to -1.
To get the 3rd term, we add 2 fives to -1.
To get the 4th term, we add 3 fives to -1.
To get the $n^{th}$ term, we add $(n-1)$ fives to -1.

So, the $n^{th}$ term is $-1 + (n-1)5$. Distributing the 5 and simplifying gives

$-1 + (n-1)5 = -1 + 5n - 5$

$= 5n - 6$.

PRACTICE

Write a simplified expression for the $n^{th}$ term of each arithmetic sequence below.

56. 18, 24, 30, 36, ..., $n^{th}$

57. 4, 19, 34, 49, ..., $n^{th}$

58. -13, -5, 3, ..., $n^{th}$

59. $\frac{9}{4}, \frac{5}{2}, \frac{11}{4}, \ldots$, $n^{th}$

PRACTICE

Answer each question below. Simplify all expressions.

60. An arithmetic sequence has first term $a$ and common difference 3. Write an expression for the 20th term of the sequence.

61. An arithmetic sequence has first term 6 and common difference $d$. Write an expression for the 101st term of the sequence.

62. In an arithmetic sequence, the 1st term is 20, the 2nd term is 32, and the $k^{th}$ term is 500. What is $k$?