

Bellwork

22Jan19

Solve the inequality. Graph the solution.

1.  $x + 8 \geq -9$
2.  $15 < b - 4$
3.  $t - 21 < -12$
4.  $7 + y \leq 3$

Graph the function. Compare the graph to the graph of  $f(x) = |x|$ . Describe the domain and range.

5.  $h(x) = 3|x|$

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4.6

Arithmetic Sequences

What You Will Learn

Write the terms of arithmetic sequences.

Graph arithmetic sequences.

Write arithmetic sequences as functions

A sequence is an ordered list of numbers. Each number in a sequence is called a term. Each term has a specific position  $n$  in the sequence.

5, 10, 15, 20, 25, . . . ,  $a_n$ , . . .

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**Arithmetic Sequence**

In an **arithmetic sequence**, the difference between each pair of consecutive terms is the same. This difference is called the **common difference**. Each term is found by adding the common difference to the previous term.

5, 10, 15, 20, . . . Terms of an arithmetic sequence

+5 +5 +5 ← common difference

**Example**

Write the next three terms of the arithmetic sequence. -7, -14, -21, -28, . . .

**SOLUTION**

Use a table to organize the terms and find the pattern.

Position	1	2	3	4
Term	-7	-14	-21	-28

+(-7) +(-7) +(-7) ← Each term is 7 less than the previous term. So, the common difference is -7.

Add -7 to a term to find the next term.

Position	1	2	3	4	5	6	7
Term	-7	-14	-21	-28	-35	-42	-49

+(-7) +(-7) +(-7)

▶ The next three terms are -35, -42, and -49.

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Try these on your own

Write the next three terms of the arithmetic sequence.

1. -12, 0, 12, 24, . . .
2. 0.2, 0.6, 1, 1.4, . . .
3.  $4, 3\frac{3}{4}, 3\frac{1}{2}, 3\frac{1}{4}, . . .$

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Equation for an Arithmetic Sequence

Let  $a_n$  be the  $n$ th term of an arithmetic sequence with first term  $a_1$  and common difference  $d$ . The  $n$ th term is given by  $a_n = a_1 + (n - 1)d$ .

Because consecutive terms of an arithmetic sequence have a common difference, the sequence has a constant rate of change. So, the points represented by any arithmetic sequence lie on a line. You can use the first term and the common difference to write a linear function that describes an arithmetic sequence. Let  $a = 4$  and  $d = 3$ .

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Position, $n$	Term, $a_n$	Written using $a_1$ and $d$	Numbers
1	first term, $a_1$	$a_1$	4
2	second term, $a_2$	$a_1 + d$	$4 + 3 = 7$
3	third term, $a_3$	$a_1 + 2d$	$4 + 2(3) = 10$
4	fourth term, $a_4$	$a_1 + 3d$	$4 + 3(3) = 13$
⋮	⋮	⋮	⋮
$n$	$n$ th term, $a_n$	$a_1 + (n - 1)d$	$4 + (n - 1)(3)$

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Write an equation for the  $n$ th term of the arithmetic sequence 14, 11, 8, 5, ...  
Then find  $a_{50}$ .

**SOLUTION**

The first term is 14, and the common difference is  $-3$ .

$a_n = a_1 + (n - 1)d$  Equation for an arithmetic sequence

$a_n = 14 + (n - 1)(-3)$  Substitute 14 for  $a_1$  and  $-3$  for  $d$ .

$a_n = -3n + 17$  Simplify.

Use the equation to find the 50th term.

$a_n = -3n + 17$  Write the equation.

$a_{50} = -3(50) + 17$  Substitute 50 for  $n$ .

$= -133$  Simplify.

The 50th term of the arithmetic sequence is  $-133$ .

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**Bellwork** 23Jan19

- Write the next three terms of the arithmetic sequence.  $-4, -8, -12, -16, \dots$
- Graph the arithmetic sequence.  $5, 11, 17, 23, \dots$
- Dorrie increases the number of situps she does each week by 8 after doing 10 sit-ups the first week.

Week	1	2	3	4
Sit-Ups	10	18	26	34

- Write a function that represents the arithmetic sequence.
- Graph the function.
- Dorrie's goal is to do 74 sit-ups in one week. In which week will she meet that goal?

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Try these on your own

Write an equation for the  $n$ th term of the arithmetic sequence. Then find  $a_{25}$ .

4, 5, 6, 7, ...

8, 16, 24, 32, ...

1, 0,  $-1$ ,  $-2$ , ...

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Online bidding for a purse increases by \$5 for each bid after the \$60 initial bid.

Bid number	1	2	3	4
Bid amount	\$60	\$65	\$70	\$75

- Write a function that represents the arithmetic sequence.
- Graph the function.
- The winning bid is \$105. How many bids were there?

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a) The first term is 60, and the common difference is 5.

$f(n) = a_1 + (n - 1)d$  Function for an arithmetic sequence

$f(n) = 60 + (n - 1)5$  Substitute 60 for  $a_1$  and 5 for  $d$ .

$f(n) = 5n + 55$  Simplify.

The function  $f(n) = 5n + 55$  represents the arithmetic sequence

b)

c) Use the function to find the value of  $n$  for which  $f(n) = 105$ .

$f(n) = 5n + 55$  Write the function.

$105 = 5n + 55$  Substitute 105 for  $f(n)$ .  $10 = n$

Solve for  $n$ . There were 10 bids.

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