Algebra 1        3.5
Recognize arithmetic sequences
Relate arithmetic sequences to linear functions

sequence
term
arithmetic sequence — *adding rule*
common difference (d) — *add every time*
whiteboards

## KeyConcept Arithmetic Sequence

**Words**

An arithmetic sequence is a numerical pattern that increases or decreases at a constant rate called the *common difference*.

**Examples**

3, 5, 7, 9, 11, . . .
+2 +2 +2 +2
$d = 2$

33, 29, 25, 21, 17, . . .
−4 −4 −4 −4
$d = -4$

$a_1 = 3 \qquad d = 2$

$$a_n = a_1 + (n-1)d$$

$$a_n = 3 + (n-1) \cdot 2$$

$$= 3 + 2n + {}^-2$$

$$a_n = 2n + 1$$

$a_1 = 33 \qquad d = -4$

$$a_n = 33 + (n-1)(-4)$$

$$= 33 + {}^-4n + 4$$

$$a_n = -4n + 37$$

**KeyConcept** *n*th Term of an Arithmetic Sequence

The *n*th term of an arithmetic sequence with first term $a_1$ and common difference $d$ is given by $a_n = a_1 + (n-1)d,$ where $n$ is a positive integer.

**Guided**Practice

$a_1 = 3$  $\left.\begin{array}{c} +-13 \\ -13 \end{array}\right\} d$

**Consider the arithmetic sequence 3, −10, −23, −36, …**

**3A.** Write an equation for the $n$th term of the sequence.

$= -179$

**3B.** Find the 15th term in the sequence.

$a_n = a_1 + (n-1)d$

**3C.** Graph the first five terms of the sequence.

$a_n = 3 + (n-1) \cdot -13$

**3D.** Which term of the sequence is −114?

$10^{th}$

$= 3 + -13n + 13$

$a_n = -13n + 16$

$3 + (14)(-13)$

$3 + -182 = -179$

$a_n = 3 + (n-1)(-13)$

$-114 = 3 + -13n + 13$

Note: distributive property to simplify

$-114 = 16 + -13n$

$\underline{-16 \qquad -16}$

$\dfrac{-130}{-13} = \dfrac{-13n}{-13} \qquad n = 10$

3, -10, -23, -36, -49

| | |
|---|---|
| 1 | 3 |
| 2 | -10 |
| 3 | -23 |
| 4 | -36 |
| 5 | -49 |
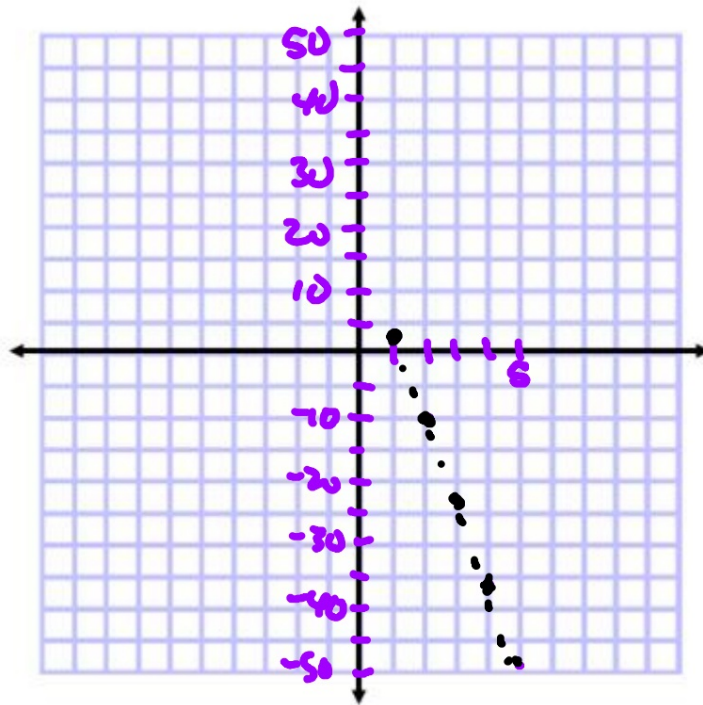
Write an equation for the $n$th term of each arithmetic sequence. Then graph the first five terms of the sequence.
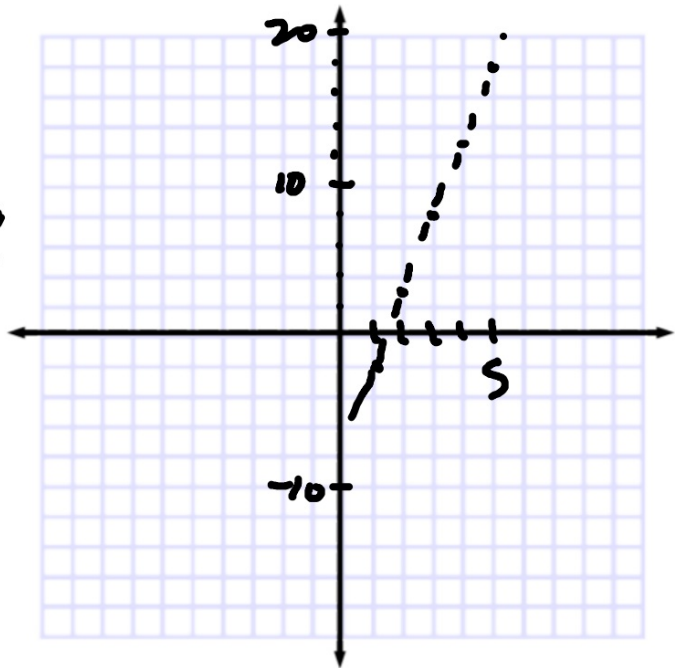
$d = 5$

**19.** $-2, 3, 8, 13, \ldots$

$a_n = -2 + (n-1) \cdot 5$

$a_n = -2 + 5n + -5$

$a_n = 5n + -7$

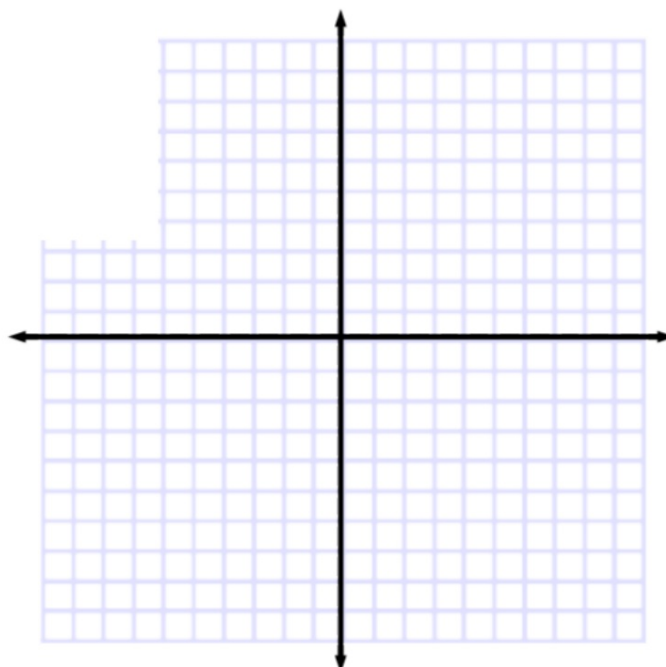| n | $a_n$ |
|---|---|
| 1 | -2 |
| 2 | 3 |
| 3 | 8 |
| 4 | 13 |
| 5 | 18 |

**Write an equation for the *n*th term of each arithmetic sequence. Then graph the first five terms of the sequence.**

**5.** 15, 13, 11, 9, …                                  ᵢ, …

Can you buy 1/2 of a stamp? (discrete)
Can you buy a negative number of stamps?

## Real-World Example 4 Arithmetic Sequences as Functions

**INVITATIONS** Marisol is mailing invitations to her quinceañera. The arithmetic sequence $0.42, $0.84, $1.26, $1.68, ... represents the cost of postage.

**a.** Write a function to represent this sequence.

**b.** Graph the function and determine the domain.

4. **TRACK** The chart below shows the length of Martin's long jumps.

| Jump | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Length (ft) | 8 | 9.5 | 11 | 12.5 |

**A.** Write a function to represent this arithmetic sequence.

**B.** Then graph the function.