## Two types of sequences

**Infinite Sequence**

A sequence that goes on forever. It has no last term.

**Finite Sequence**

A sequence that has a last term.

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Graph each infinite sequence on the coordinate plane by making the x-coordinate the term number and the y-coordinate the term itself.

A. 2, 5, 8, 11, 14, 17,...

To graph a sequence you can create a table and plot the ordered pairs:

| X (term #) | Y (value of the term) |
|---|---|
| 1 | 2 |
| 2 | 5 |
| 3 | 8 |
| 4 | 11 |
| 5 | 14 |
| 6 | 17 |

Plot these ordered pairs.

B. $1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}, \ldots$

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A. 2, 5, 8, 11, 14, 17,...

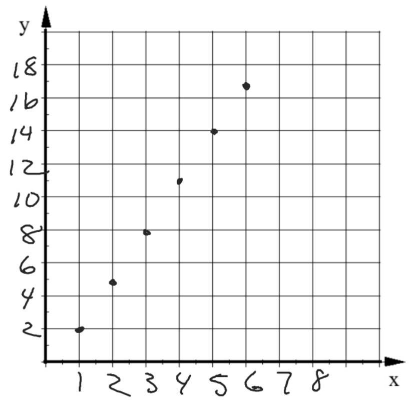
| X | Y |
|---|---|
| 1 | 2 |
| 2 | 5 |
| 3 | 8 |
| 4 | 11 |
| 5 | 14 |
| 6 | 17 |

Explicit Formula:

Arithmetic

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

$= 3n - 1$




This graph creates a line because the explicit formulas for all Arithmetic Sequences always simplify into a linear equation (y=mx+b).

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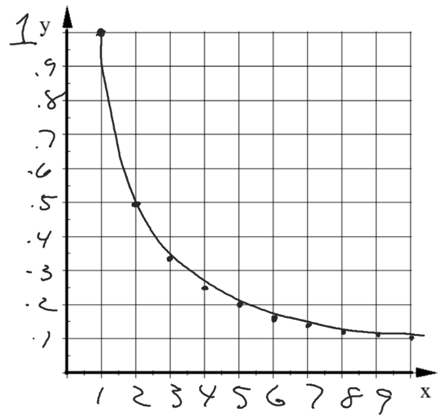
B. $1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}, \ldots$

Explicit Formula:

$a_n = \frac{1}{n}$




This graph will keep decreasing but always be positive. It will approach the x-axis

Some infinite sequences have a LIMIT.

When the terms of an infinite sequence get closer and closer to a fixed number L, then L is called the limit of the sequence.

The limit will be the Horizontal Asymptote of the graph of the terms of the sequence.

Does each sequence appear to have a limit? If yes, what is the limit?

A.

$23, 20, 17, 14, 11, \ldots$

Arithmetic

$d = -3$

NO LIMIT

No Arithmetic sequences have limits.
They either keep increasing or decreasing.

B.

$\begin{array}{ccccc} 1 & 2 & 3 & 4 & 5 \\ \frac{2}{2}, & \frac{3}{4}, & \frac{4}{6}, & \frac{5}{8}, & \frac{6}{10}, \ldots \end{array}$

$a_n = \frac{n+1}{2n}$

Limit $\frac{1}{2}$

If you substitute bigger and bigger numbers for x you'll see that x gets closer to 0.5.
Or, if you graph this sequence you'll see a horizontal asymptote y=0.5

Reminder of what you learned in the past:

Horizontal Asymptotes (HA) of Rational Functions.

- If the degree of the numerator and denominator are the same the HA is y = ratio of the leading coefficients.
- If the degree of the denominator is larger than the degree of the numerator the HA is y = 0
- If the degree of the numerator is larger than the degree of the denominator there is NO HA.

The Horizontal Asymptote of the explicit formula would be the LIMIT of the sequence.

Does each sequence appear to have a limit? If yes, what is the limit?

A.

$\begin{array}{ccccc} 1 & 2 & 3 & 4 & 5 \\ \frac{2}{4}, & \frac{4}{9}, & \frac{6}{16}, & \frac{8}{25}, & \frac{10}{36}, \ldots \end{array}$

$a_n = \frac{2n}{(n+1)^2}$

HA $y = 0$

LIMIT = 0

B.

$\begin{array}{ccccc} 1 & 2 & 3 & 4 & 5 \\ \frac{1}{30}, & \frac{8}{60}, & \frac{27}{90}, & \frac{64}{120}, & \frac{125}{150}, \ldots \end{array}$

$a_n = \frac{n^3}{30n}$

NO HA

NO LIMIT