

Vertical Progression:

<p>8th Grade</p>	<p>8.F.B Use functions to model relationships between quantities.</p> <ul style="list-style-type: none"> ○ 8.F.B.4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
<p>Algebra 1</p>	<p>ELG.MA.HS.F.BF Build functions that model relationships between two quantities.</p> <ul style="list-style-type: none"> ○ F-BF.1 Write functions that describe a relationship between two quantities. ★ ○ F-BF.1a Determine explicit expressions, recursive processes, or steps for calculations from context. ★ <p>Note: Functions may include linear, quadratic, exponential, polynomial (quadratic or cubic), square root, cube root, and piecewise-defined functions (including step and absolute value).</p>
<p>Algebra 2</p>	<p>ELG.MA.HS.F.4 Build functions that model relationships between two quantities.</p> <ul style="list-style-type: none"> ○ F-BF.1 Write functions that describe a relationship between two quantities. ★ ○ F-BF.1a Determine explicit expressions, recursive processes, or steps for calculations from context. ★ ○ F-BF.1b Combine standard function types using arithmetic operations (for example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential and relate this function to the model). ★ <p>Note: Functions may include linear, quadratic, exponential, polynomial, square root, cube root, piecewise defined (including step and absolute value), rational, trigonometric, and logarithmic.</p>
	<p>ELG.MA.HS.F.4 Build functions that model relationships between two quantities.</p> <ul style="list-style-type: none"> ○ F-BF.1 Write functions that describe a relationship between two quantities. ★ ○ F-BF.1c (+) Compose functions. <i>For example, if $T(y)$ is the temperature in the atmosphere as a function of height, and $h(t)$ is the height of a weather balloon as a function of time, then $T(h(t))$ is the temperature at the location of the weather balloon as a function of time.</i>

Students will demonstrate command of the ELG by:

- Applying knowledge of linear and exponential functions to write functions.
- Describing choice of function type.
- Distinguish between an explicit and recursive formula for sequences.
- Writing an explicit formula for an arithmetic sequence $a_n = a_1 + (n-1)d$
- Writing an explicit formula for geometric sequence $a_n = a_1 \cdot r^{n-1}$
- Determining when a real world problem models an arithmetic or geometric sequence.

Vocabulary:

- arithmetic sequence
- common difference
- common ratio
- explicit expression and formula
- geometric sequence
- recursive process and formula
- term

Sample Instructional/Assessment Tasks:

1) Standard(s): F-BF.1a

Source: North Carolina DPI

Item Prompt:

A single bacterium is placed in a test tube and splits in two after one minute. After two minutes, the resulting two bacteria split in two, creating four bacteria. This process continues for one hour until the test tube is filled up. How many bacteria are in the test tube after 5 minutes? 15 minutes? Write a recursive rule to find the number of bacteria in the test tube after n minutes. Convert this rule into explicit form. How many bacteria are in the test tube after one hour?

Correct Answer:

2, 4, 8...

$$a_1 = 2^1 \quad a_5 = 2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$$

$$a_2 = 2^2 \quad a_{15} = 2^{15} = 32,768$$

$$a_3 = 2^3 \quad a_n = 2^n$$

$$a_1 = 2^1; a_n = 2(a_{n-1})$$

$$f(x) = 2^x \quad f(60) = 2^{60} = 1.153 \times 10^{18}$$

2) Standard(s): F-BF.1a

Source: Smarter Balanced Assessment Consortia

Item Prompt:

A new social networking website was made available. The website had 10 members its first week. Beginning the second week, the creators of the website had a goal to triple the number of members every week.

a. Determine an explicit formula for $f(n)$, the number of members the creators had a goal of getting n weeks after the website was made available.

b. Determine a recursive formula for $f(n)$.

Correct Answer:

a. $f(n) = 10(3^{n-1})$

b. $a_1=10; a_n = 3(a_{n-1})$ for $n > 1$