Interpreting and Creating Exponential Functions

Entry Ticket

- Create a function for the following scenarios. Determine the population after 2 years:

Scenario 1: A bear population that begins with 50 bears in 2000 and increase by 10 every year.

Scenario 2: A colony of bacteria that begins with 50 bacteria and doubles every hour.

Turn and Talk: Compare and contrast the functions and strategies used to model these scenarios with a classmate.

What is the difference between Linear and Exponential Functions?

- **Linear** functions change by a constant number (think addition and subtraction)

- **Exponential functions** change by a constant factor (think multiplication and division)

Turn and Talk: identify each of the scenarios from the entry ticket as linear or exponential. Justify your reasoning.

Exponential Functions

There are two main forms of exponential functions:

$f(x) = ab^x$ and $a(1 + r)^x$ OR $a(1 - r)^x$

a = initial/beginning value

b = change factor

r = growth or decay rate

Interpreting Exponential Functions

Scenario 2 from entry ticket (bacteria):

a = 50 (bacteria population begins with 50 bacteria)

b = 2 (bacteria doubles every hour)

X = time (in hours)

→ $f(x) = 50(2^x)$

Turn and Talk: Evaluate the function for x = 0. What do you notice about the bacteria population when x = 0?

Interpreting Exponentials (continued)

B	r	Growth or Decay?	Note
< 1	< 0	decay	Decreasing by a constant factor
> 1	> 0	growth	Growing by a constant factor
= 1	= 0	Linear growth	Turns into a linear function

Example: Investments

- We invest in a stock that yields a 7% annual return. We begin with an initial investment of $500.
  - Create a function to model the situation.
  - How much money will we have after 5 years?

Example 2

- Tom invested in a stock that unfortunately lost an average of 7% annually. Tom began with an initial investment of $1500.
  - Create a function to model the situation.
  - How much money will Tom have after 8 years?

Example 3

The return of a second stock is modeled by the function, for t years:

$$f(t) = 350(0.9)^t$$

Turn and Talk: What is the initial investment for this scenario? Is the stock making money or losing money? What is the growth/decay rate?

Example 4

- The return of a third stock is modeled by the following function, in t years:

$$f(t) = 1000(1.25)^t$$

Turn and Talk: What is the initial investment for this scenario? Is the stock making money or losing money? What is the growth/decay rate?

Summarizing

- With a classmate, create 1-2 bullet points paraphrasing the most important concepts/ideas from this conversation. Be prepared to share your thoughts with the whole class.

Exit Ticket

- Create a function for the following scenarios. Determine the population after 12 years/hours:

Scenario 1: A bear population that begins with 5 bears in 2000 and double every year.

Scenario 2: A colony of bacteria that begins with 50 million bacteria and is cut by 1/3 every hour due to medicine.