

Essential Question: How can we determine the rate of change of an exponential function?

Do Now: Consider the exponential function: $f(x) = 8(2)^x$

a) Evaluate $f(3)$.

Finding x algebraically.

b) Find the value of x if $f(x) = 1024$.

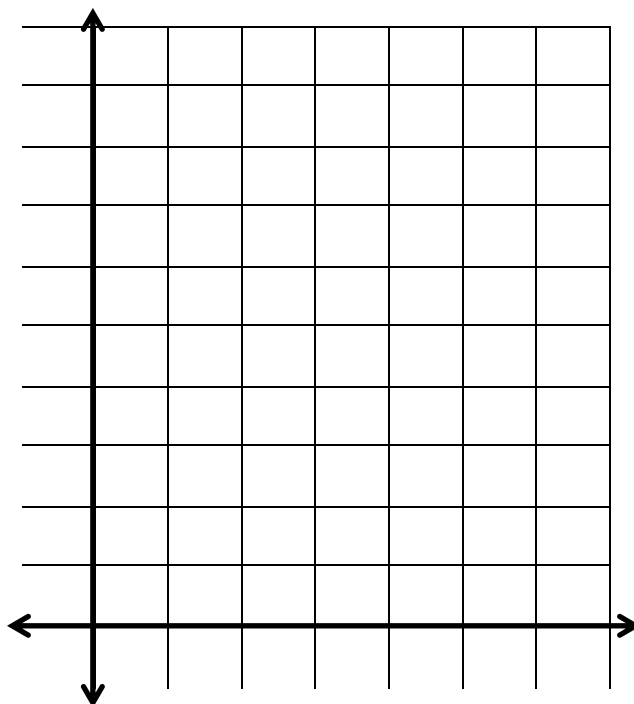


Let's take a closer look at exponential functions.

Make a table of values and graph the following exponential function over the given interval.

1. Graph $f(x) = (2.5)^x$ over the interval $0 \leq x \leq 3$

| x | f(x) |
|---|------|
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What is the average rate of change of this function over the given interval?

Interval begins at: () Average Rate of Change: $\frac{\Delta y}{\Delta x}$

Interval ends at: ()

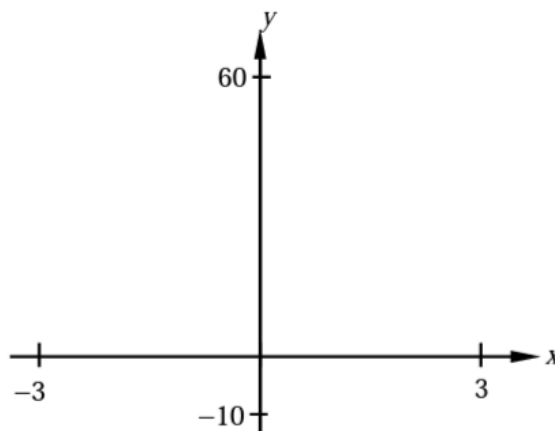


All **linear** functions have a constant rate of change.

In an **exponential** function, an average rate of change can be calculated over a specified interval.

2. Consider the exponential function $f(x) = 10(2)^x$.

- a) Find the value of $f(0)$. What is the significance of this value?
- b) Is this an increasing or decreasing exponential function? How do you know?
- c) Using your calculator, sketch a graph of this function on the axes shown below. Use the window indicated. Mark the y-intercept.



- d) What is the function's average rate of change over the interval $-1 \leq x \leq 2$?
- e) Is this rate of change greater than or less than that of the linear function $g(x) = 10x + 7$? Explain.



Exponential functions are curved lines that either increase or decrease rapidly. We can determine an **average** _____ of a specific part of an exponential function by using the two points that mark the beginning and end of the _____. Use these two points and $\frac{\Delta y}{\Delta x}$ to calculate the average rate of change.

1. Classify each of the following exponential functions as either increasing or decreasing and give the value of their y-intercepts.

a) $f(x) = 125(1.25)^x$

b) $f(x) = 22(0.75)^x$

c) $f(x) = 256\left(\frac{5}{2}\right)^x$

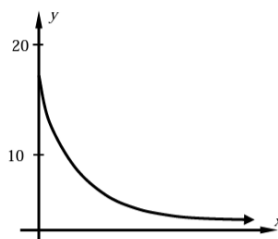
2. Which of the following could be the equation of the exponential function graphed below? Explain how you made your choice.

(1) $y = 15(1.25)^x$

(2) $y = 50(1.04)^x$

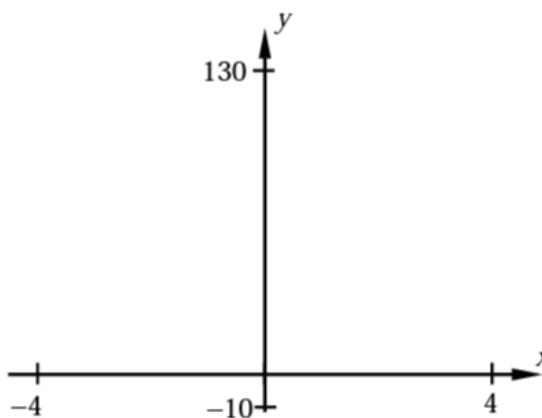
(3) $y = 18(0.75)^x$

(4) $y = 40(0.45)^x$



3. Using your graphing calculator, create a table of values and draw a sketch of the exponential function $y = 3(2.5)^x$ over the interval $-4 \leq x \leq 4$. Use the window indicated.

| x | y |
|---|---|
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What is the average rate of change of the function over the given interval?

4. Which of the following is a decreasing exponential function whose y-intercept is 20?

(1) $y = 20\left(\frac{4}{3}\right)^x$

(2) $y = -2x + 20$

(3) $y = 20\left(\frac{1}{3}\right)^x$

(4) $y = \left(\frac{1}{3}\right)^x + 20$

5. Which of the following equations would best describe the data in the table?

(1) $y = 10x + 2$

(2) $y = 8x + 2$

(3) $y = 5(2)^x$

(4) $y = 2(5)^x$

| x | 0 | 1 | 2 | 3 | 4 |
|---|---|----|----|-----|------|
| y | 2 | 10 | 50 | 250 | 1250 |