

5.5: Exponential Decay

SWBAT write and graph exponential decay functions.

Assignments:

HW41

New Cars

On average, a new car depreciates (loses value) by about 20% per year. Does this mean that the car is worth nothing after 5 years? If not, approximately how much is it worth? Explain your solution.

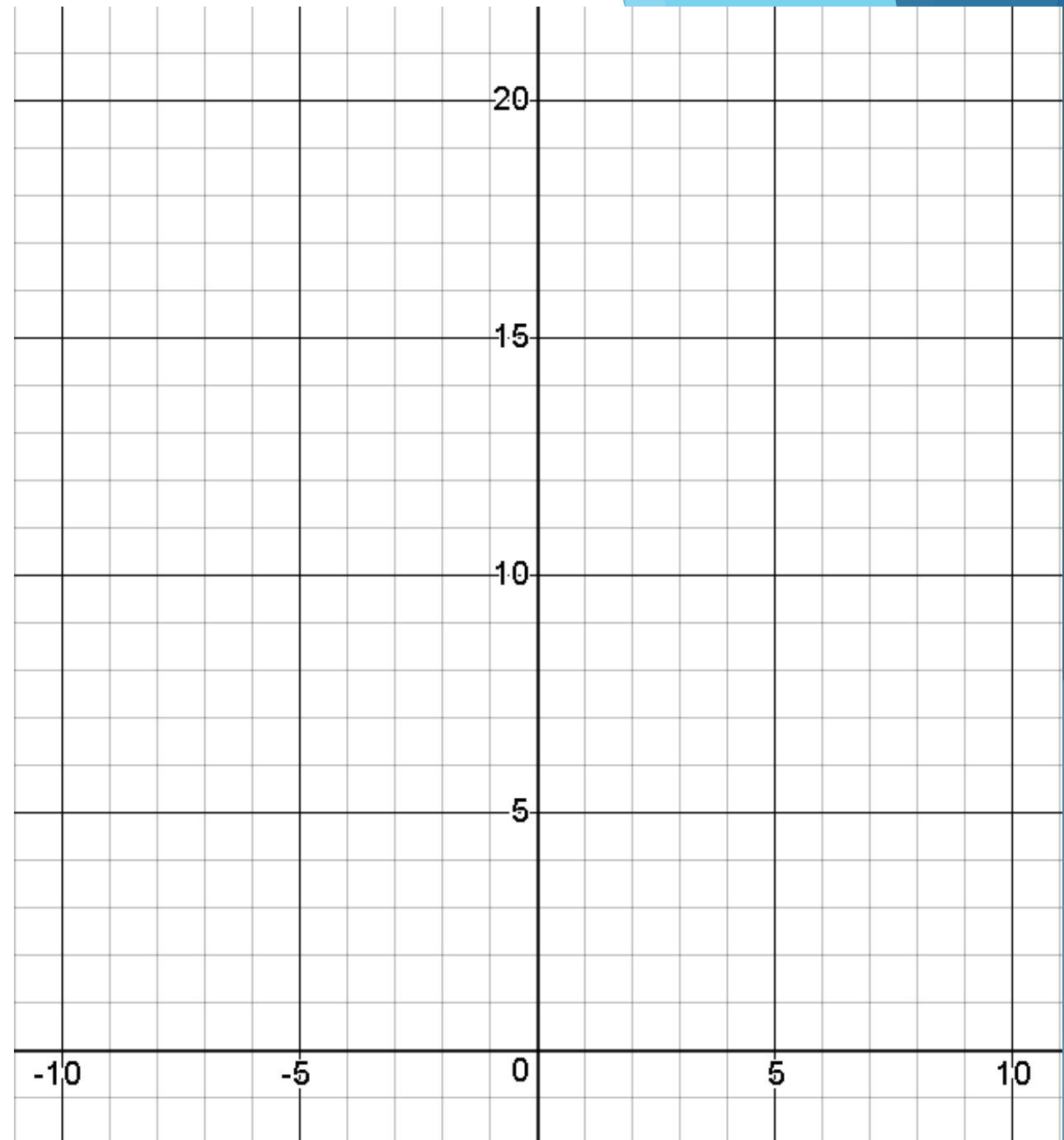
If a car loses 20% of its value, how much is it worth? (What percentage?)

New Car, cont.

- ▶ Imagine your new car is worth \$10,000. Make a table that shows the value of the car over 5 more years if the car is losing value at 20% per year.

Time (in years)	Price of car

- ▶ Then graph your solution on a set of axes.
- ▶ What do we notice about the table and/or the graph?
- ▶ Write a function to model the situation.



What is an exponential function?

- ▶ A function where the input is an **exponent**

- ▶ General form of an exponential function:

$$f(x) = a \cdot b^x$$

where $a \neq 0$ and $b > 0$ and $\neq 1$

- ▶ In general, a represents the “initial” or starting value, and b is the “growth factor” that tells us how much the output is changing.
- ▶ When $0 < b < 1$, we have *exponential decay functions*.

Decide if the function represents exponential growth or decay. Why?

1. $f(x) = 3(2)^x$

2. $g(x) = 3\left(\frac{1}{2}\right)^x$

3. $h(x) = 5\left(\frac{1}{3}\right)^x$

4. $m(x) = 6.1\left(\frac{4}{3}\right)^x$

5. $n(x) = -2(0.7)^x$

6. $k(x) = 0.2(1.43)^x$

You pay \$495 for a new tablet computer. The value of the computer depreciates by 10% per year.

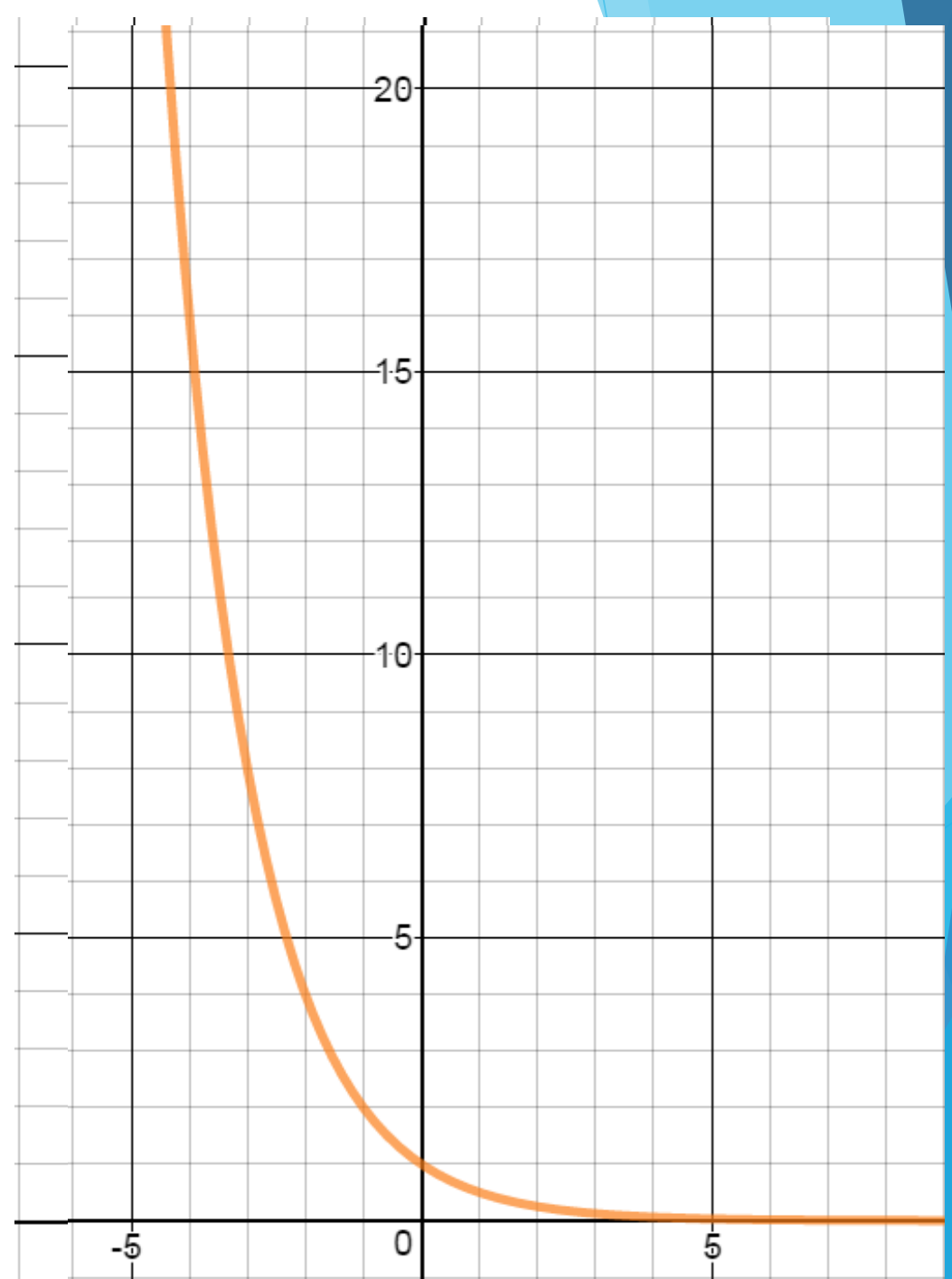
1. Write an exponential decay function for this situation.
2. Find the output values for $x = \{0,1,2,3,4,5\}$. Round to the nearest dollar.
3. The next value you could find would be (6,263). What does this point mean in the context of the question?

Graphing an exponential function

► $f(x) = \left(\frac{1}{2}\right)^x$

x	$\left(\frac{1}{2}\right)^x$	$f(x)$
-2		
-1		
0		
1		
2		

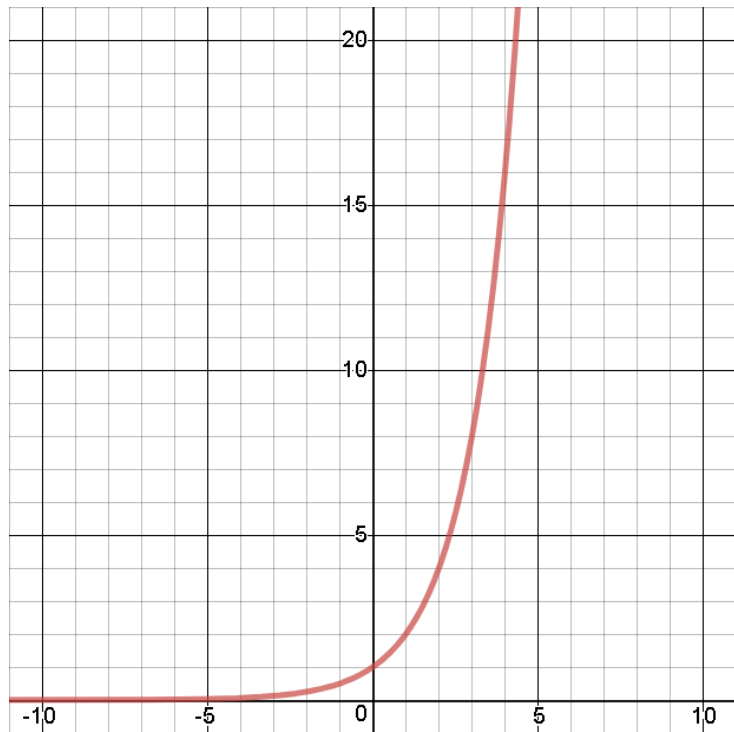
What's the difference between this graph and the graph of the growth function $f(x) = 2^x$? What's the same?



Exponential Growth vs. Exponential Decay

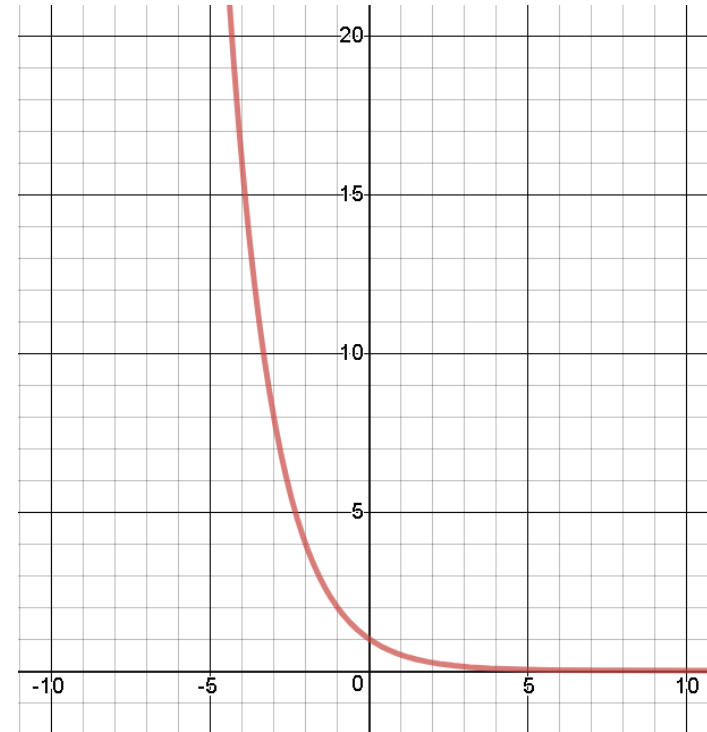
Growth

- ▶ Growth factor b is greater than 1
- ▶ $f(x) = a(1 + r)^x$



Decay

- ▶ Growth factor $0 < b < 1$
- ▶ $f(x) = a(1 - r)^x$



Both have the same domain, range, and horizontal asymptote.

Graphing Exponential Decay

Create a table and identify the domain, the range, and the horizontal asymptote. Then, graph the function.

1. $f(x) = (0.6)^x$
2. $g(x) = 4 * \left(\frac{1}{4}\right)^x$
3. $h(x) = 3 * \left(\frac{1}{2}\right)^x + 5$

