5.4: Exponential Growth

SWBAT describe and graph exponential growth functions.

Assignments:

HW40

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 $b > 0$ $and \neq 1$

- When $b > 1$, the function is called an *exponential growth function*.
- Discussion: Why does $b \neq 1$?
- In general, *a* represents the "initial" or starting value, and *b* is the "growth factor" that tells us how much the output is changing.

Scenario

Susanna heard some exciting news about a well-known celebrity. Within a day, she told 4 friends who hadn't heard the news yet. By the next day each of those friends told 4 other people who also hadn't yet heard the news. By the next day, each of those people had told four more, and so on.

1. Assume the rumor continues to spread in this manner. Let *N* be the function that assigns to *d* the number of people who hear the rumor on the d^{th} day. Write the function rule for N.
2. On which day will at least 100,000 people hear the rumor for the first time?
3. How many people will hear the rumor on the 20^{th} day?
4. Is the answer to question 4 realistic? Explain your reasoning.

Scenario

Joshua puts $500 in a savings account that pays 2% interest per month.

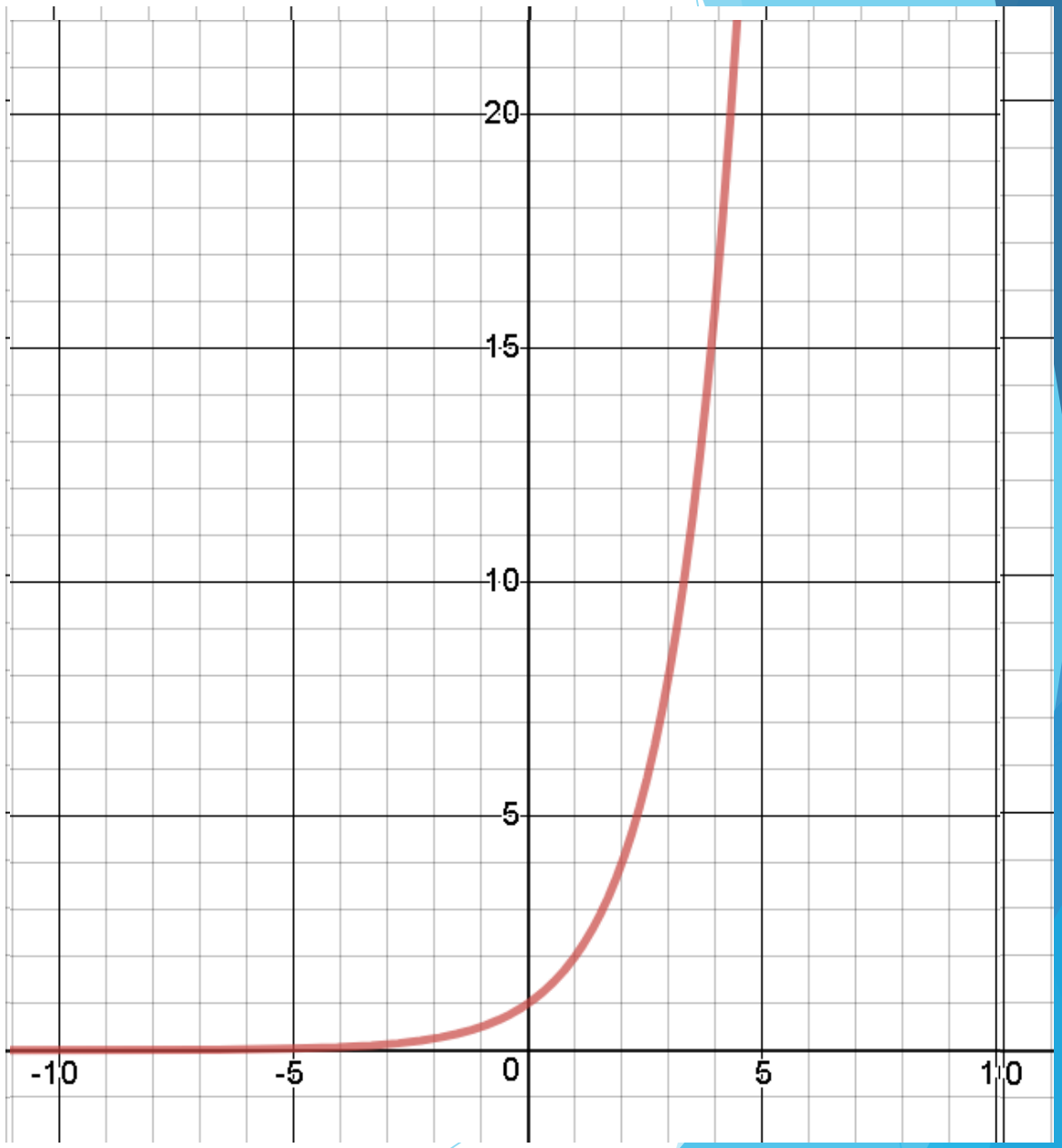
1. Assume that Joshua does not put more money into the account or take any out. Let S be the function that assigns to m the total amount of money in the account after m months. Write the function rule for S.
2. After how many months will there be at least $600 in the account?
3. How much money will there be in the account after 15 days?

Graphing an exponential function

- $f(x) = 1 * 2^x$

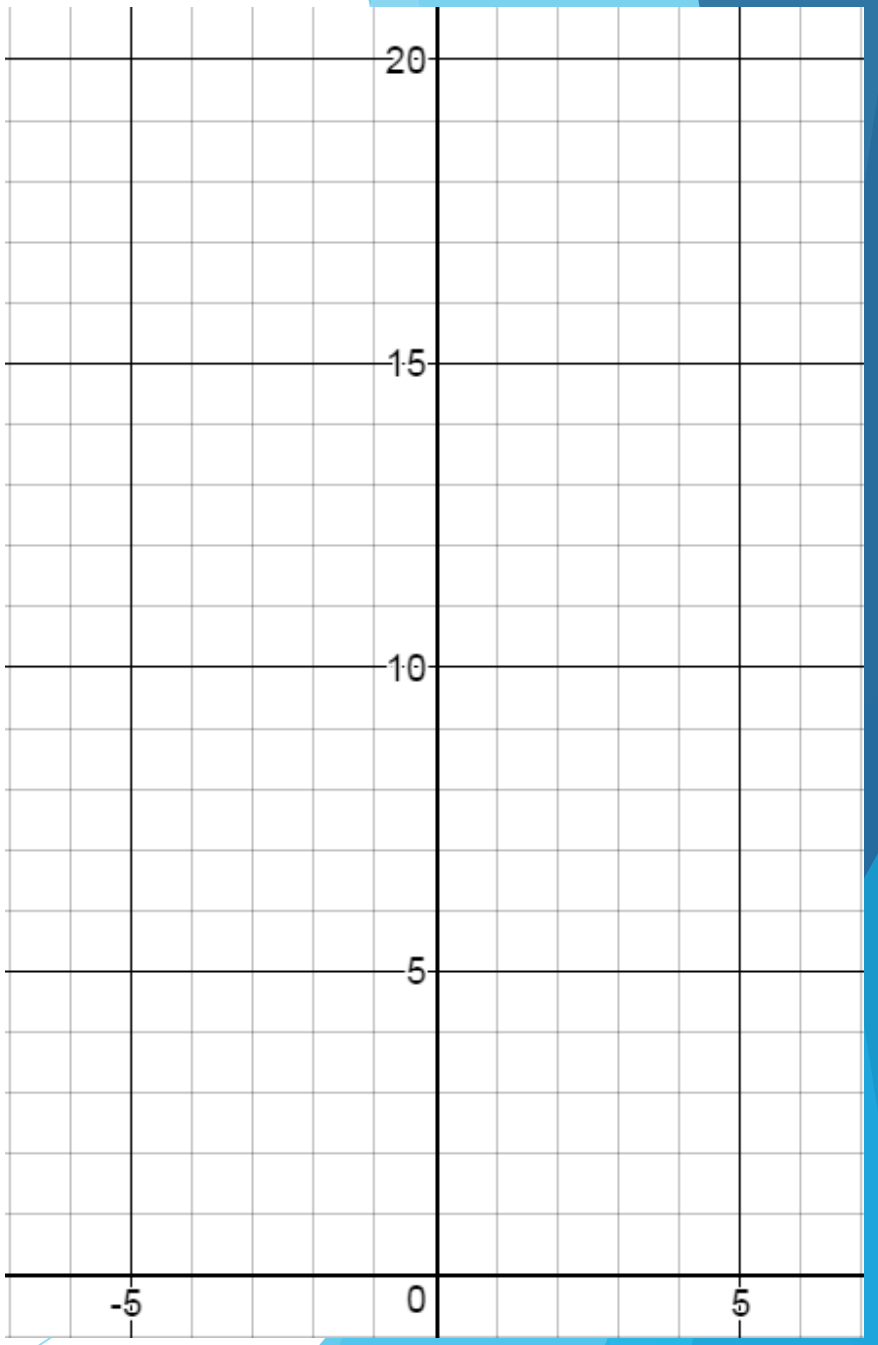
x	$f(x)$
0	
1	
2	
3	
4	

Think about what we know about negative exponents. Can the output ever be 0, or negative?



Basic Shape of an Exponential Function

- Horizontal Asymptote at $y = 0$
- Starts really, really small – the graph will lie almost on top of the x-axis on one side – and then gets really, really big
- Curved shape like a backwards L
- Domain:
- Range:

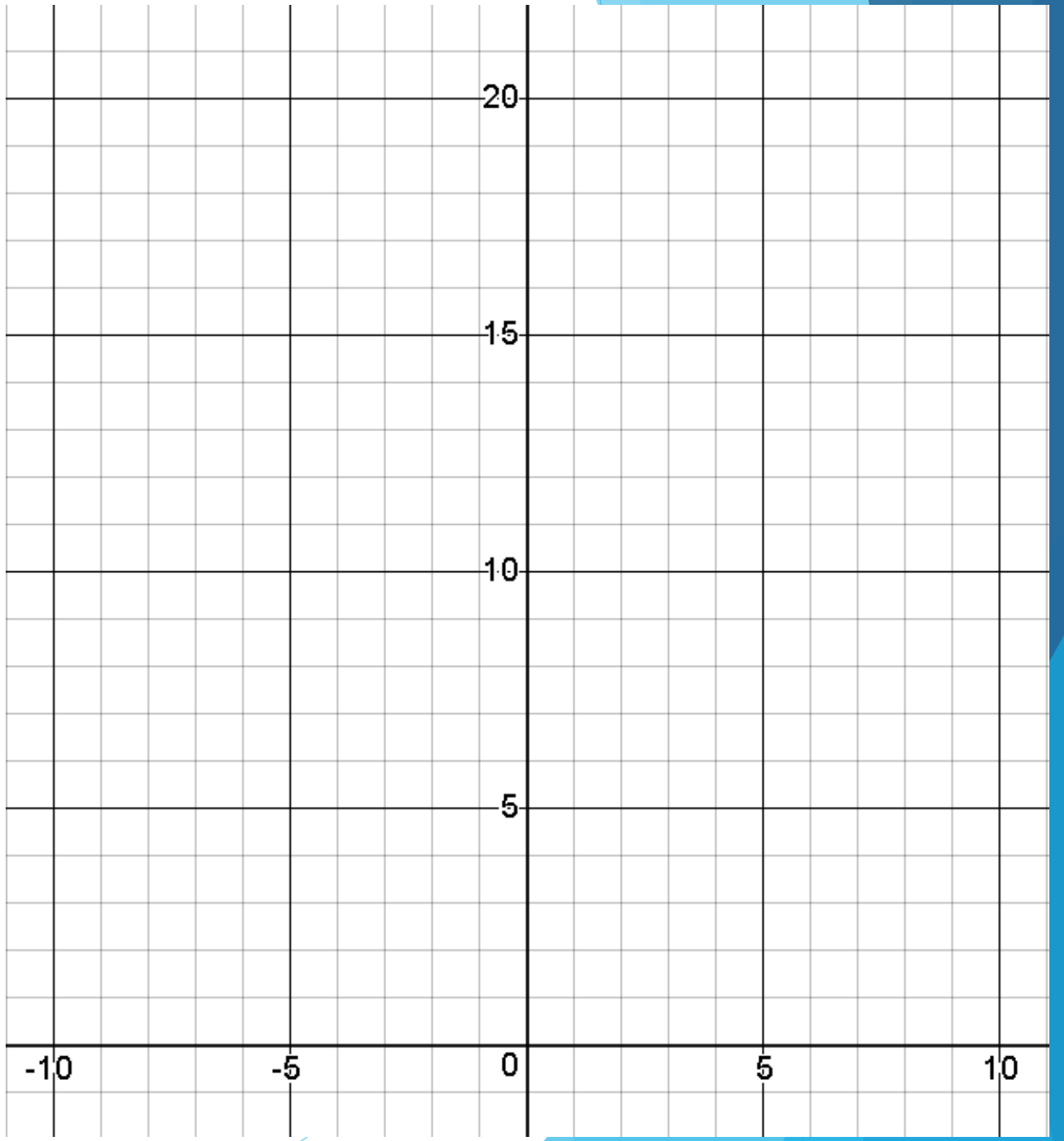


Asymptote: A line the graph will not cross

Exponential Growth & Function Transformations

- Create a table and draw the function. Identify the domain, the range, and the horizontal asymptote.

1. $f(x) = 3 * 2^x$
2. $f(x) = 2 * 4^x$
3. $f(x) = 2.5 * 3^x$
4. $f(x) = 5 * 7^x$

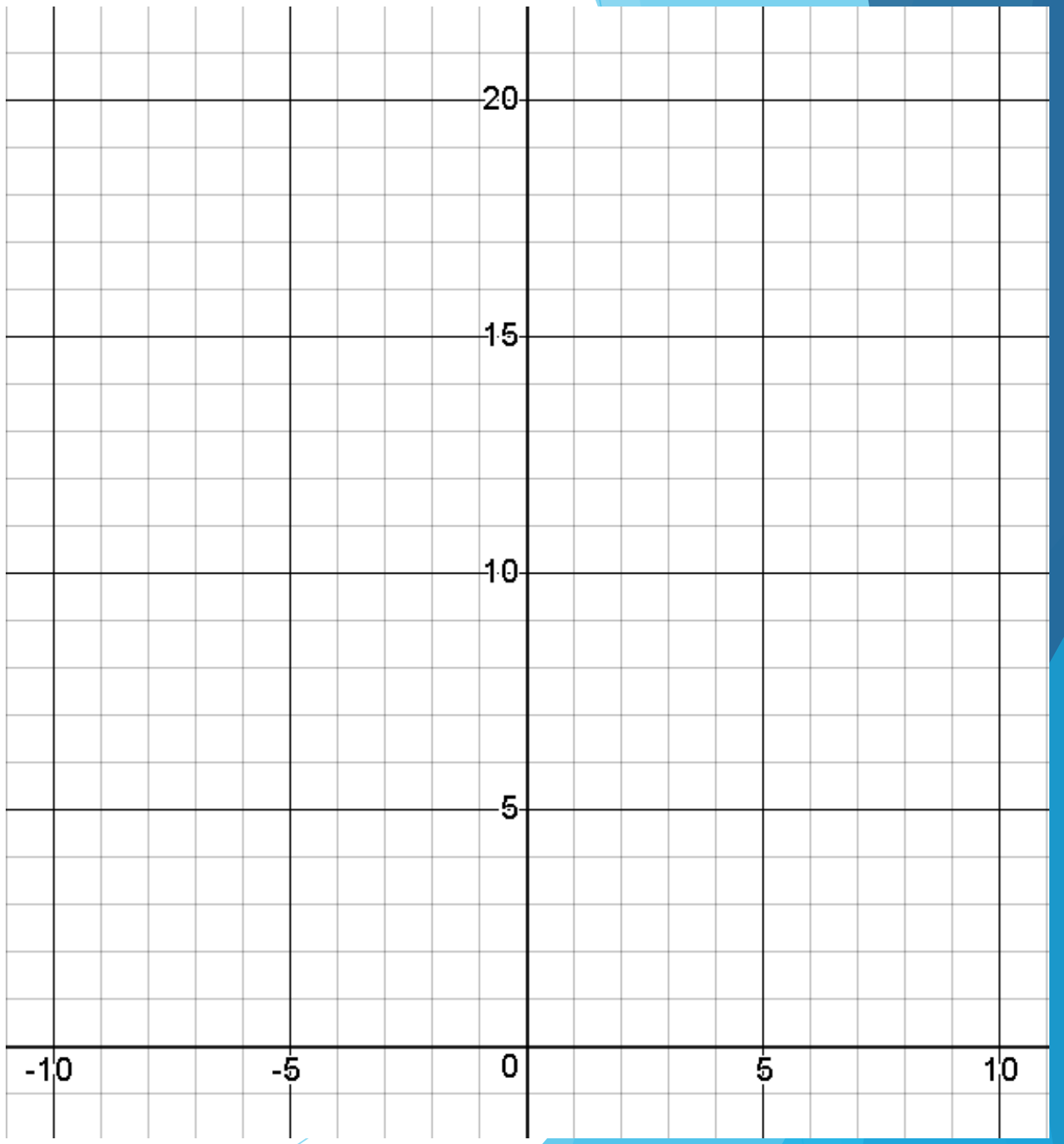


Exponential Growth & Function Transformations

- Identify the transformation(s). Create a table and draw the function. Identify the domain, the range, and the horizontal asymptote.

1. $f(x) = 3 * 2^x + 4$
2. $f(x) = 4^x + 2$
3. $f(x) = 3 * 3^x + 1$
4. $f(x) = 7^x - 1$

Recall that $f(x) + k$ shifts the graph up or down



Exponential Growth & Function Transformations

- Identify the transformation(s). Create a table and draw the function. Identify the domain, the range, and the horizontal asymptote.

1. $f(x) = 2^{x-4}$
2. $f(x) = 4^{x+1}$
3. $f(x) = 3 * 3^{x-2}$
4. $f(x) = \frac{1}{2} * 6^{x-3}$

Recall that $f(x + k)$ shifts the graph left or right