

Learning Goal: I will be write and interpret logarithmic equations.

Minds On: Zombie Apocalypse and Population Growth

Action: Logarithmic Investigation

Consolidation: Evaluating Logs

Unit 7

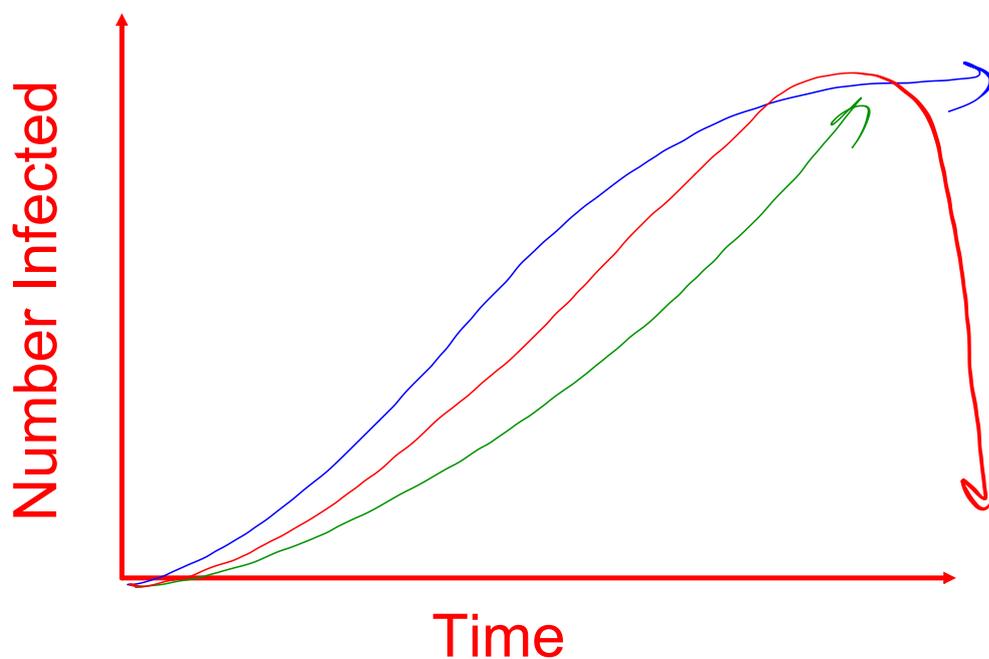
Exponential and Logarithmic Functions

RAFT - read or work quietly until 10:30

Minds On

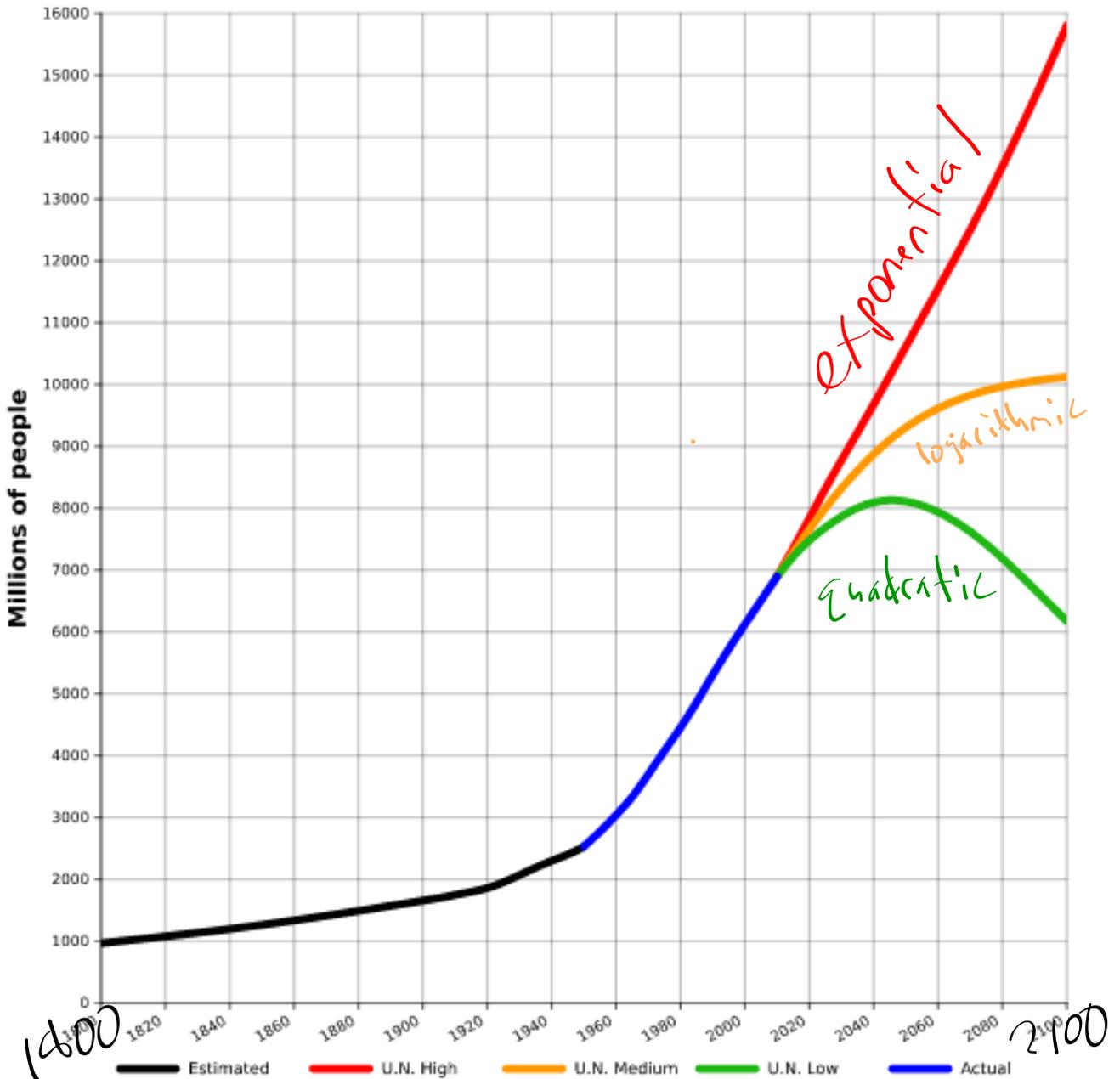
Zombie Apocalypse

On a whiteboard, draw a rough sketch of what you think the spread of a zombie infection might look like over time.



Minds On

World Population



Action

What's the Inverse?

Determine the inverse of each equation, then graph the original function and the inverse.

1. $y = 3x + 1$

$$x = 3y + 1$$
$$y = \frac{x-1}{3}$$

2. $y = x^2 + 6$

$$x = y^2 + 6$$
$$y = \sqrt{x-6}$$

3. $y = 2^x$

$$x = 2^y$$
$$y = ?$$

Action

Properties of Inverse Functions

The Equations

- swap x & y
- rearrange for y

The Graphs

- reflected on $y = x$

The Tables

- x and y values switch

Action

Desmos Investigation

Desmos Investigation

Graph the function $f(x) = 2^x$ in Desmos.

Complete the table of values below:

x	y
-2	0.25
-1	0.5
0	1
1	2
2	4
3	8
4	16

1. What is the domain of this function?

$$\{x \in \mathbb{R}\}$$

2. What is the range of this function?

$$\{f(x) \in \mathbb{R} \mid f(x) > 0\}$$

Interchange x and y in the equation of f to get the equation of the inverse equation $f^{-1}(x)$.

Graph the inverse equation on the same axes.

How do the two graphs compare?

$x = 2^y$ reflected along $y = x$

Create a table of values for this inverse function, using “nice” values. You may need to move around to find nice points.

x	y
1	0
2	1
4	2
8	3
16	4

1. What is the domain of this inverse function?

$$\{x \in \mathbb{R} \mid x > 0\}$$

2. What is the range of this inverse function?

$$\{f(x) \in \mathbb{R}\}$$

3. How do the points of $f(x)$ seem to relate to those of $f^{-1}(x)$?

x and y values switch

4. Now graph the function $g(x) = \log_2 x$. What do you notice?

It's inverse of $y = 2^x$

Same as $x = 2^y$

5. Using each point you found in your last table of values, replace the x and y in the statement $y = \log_2 x$ with the x and y values from your points.

$$0 = \log_2 1 \quad 2 = \log_2 4 \quad 4 = \log_2 16$$

$$1 = \log_2 2 \quad 3 = \log_2 8 \quad 5 = \log_2 32$$

6. Based on what you did in #5, what meaning does the expression $\log_a x$ have?

What exponent do you raise 'a' to, to get 'x'.

$$\log_7 49 = 2$$

7. Remove all other graphs. Now graph $y = a^x$ and $y = \log_a x$.
 Set a slider for a between 0 and 10 with a step of 0.1.
 Complete the table below to describe the behaviour of $y = a^x$ and $y = \log_a x$.

	$y = a^x$	$y = \log_a x$
$a > 1$	as $a \uparrow$, graph goes up faster	as $a \uparrow$, graph goes up slower
$0 < a < 1$	graph is decreasing	graph is decreasing
Domain	$\{x \in \mathbb{R}\}$	$\{x \in \mathbb{R} \mid x > 0\}$
Range	$\{f(x) \in \mathbb{R} \mid f(x) > 0\}$	$\{f(x) \in \mathbb{R}\}$
Asymptotes	$y = 0$	$x = 0$
Intercepts	$y = 1$	$x = 1$

Consolidation

Evaluating Logs

Evaluate each logarithm below:

$$\log_3 9$$

$$= 2$$

$$\log_2 32$$

$$= 5$$

$$2^5 = 32$$

$$\log_4 \frac{1}{16}$$

$$= -2$$

$$\log_2 1$$

$$= 0$$

$$2^0 = 1$$

$$\log_{25} 5$$

$$= \frac{1}{2}$$

$$\log_{16} 2$$

$$= \frac{1}{4}$$

$$\log_7 \sqrt{7}$$

$$= \frac{1}{2}$$

$$\log_2(-4)$$

$$= \text{impossible}$$

remember: $6^{-2} = \frac{1}{6^2}$, $25^{\frac{1}{2}} = \sqrt{25}$

Consolidation

Practice

Pg. 451

4 - 6, 9 - 11

Given $y = 4^x$ what is inverse function?

$$y = \log_4 x$$