

Name:

Date:

Period:

## 5.8 Writing an Exponential function from two points

Alg 1 review

b:  $(1+r)$  growth  
 $(1-r)$  decay

r: rate

Warm up

$$f(x) = ab^x$$

starting value

A flu outbreak hits an elementary school on Monday, with an initial number of 20 ill students coming to school. The number of ill students then increases by 25% per hour.

- a) Is this situation an example of exponential growth or exponential decay?  
b) Write an exponential function to model this Monday flu outbreak.

$$a = 20$$

$$r = 0.25 \text{ increase}$$

$$b = 1 + 0.25$$

$$f(x) = 20(1.25)^x$$

Writing the exponential function given two points

Write the equation through the given two points.  $(-1, 8)$  and  $(1, 2)$ 

1. Substitute the values into the function and create a system.

$$8 = ab^{-1} \quad 2 = ab^1$$

2. Solve each equation for a.

$$a = \frac{8}{b^{-1}} \quad a = \frac{2}{b}$$

3. Set each equation equal to each other and solve for b.

$$\frac{8}{b^{-1}} = \frac{2}{b}$$

cross multiply and collect b's on one side

$$\frac{b}{b^{-1}} = \frac{2}{8}$$

$$b^{1-(-1)} = \frac{1}{4}$$

use properties of exponents

$$b^2 = \frac{1}{4}$$

square root (ignore neg. root)

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

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

4. Substitute "b" back into either equation and solve for "a"

$$a = \frac{2}{\frac{1}{2}} \rightarrow 2 \cdot \frac{2}{1} = 4$$

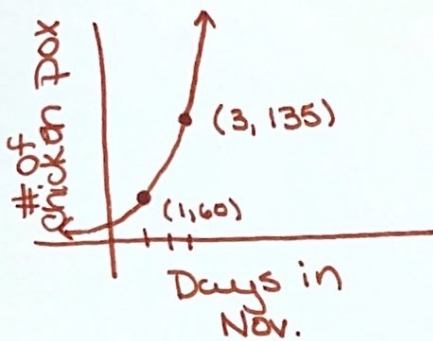
$$a = 4$$

$$f(x) = 4\left(\frac{1}{2}\right)^x$$

This is a decay.  
Note: y values decreasing as x values increase

Ryan has the chickenpox! He was told that the number of pockmarks on his body would grow exponentially until his body overcomes the illness. He found that he had 60 pockmarks on November 1, and by November 3 the number had grown to 135. (Assume  $x=0$  is Oct 31) To find out when the first pockmark appeared, he will need to find the exponential function that will model the number of pockmarks based on the day.

Draw a rough sketch of the situation. Label the x and y axis, and label the points.



Growth

Use these points to write the equation of his function of the form  $f(x) = ab^x$ .

(1, 60) (3, 135)

$$60 = ab^1$$

$$a = \frac{60}{b}$$

$$\frac{60}{b} = \frac{135}{b^3}$$

$$\frac{b^3}{b} = \frac{135}{60}$$

$$b^2 = \sqrt{\frac{135}{60}} = 1.5$$

just positive

$$b = 1.5$$

$$a = \frac{60}{1.5} = 40$$

$$a = 40$$

$$f(x) = 40(1.5)^x$$

According to the model, what day did Ryan get his first chicken pox?

$$y = 1$$

$$f(x) = 40(1.5)^x$$

$$1 = 40(1.5)^x$$

$$\frac{1}{40} = (1.5)^x$$

$$\log\left(\frac{1}{40}\right) = \log(1.5)^x$$

$$\log\left(\frac{1}{40}\right) = x \log(1.5)$$

$$x = \frac{\log\left(\frac{1}{40}\right)}{\log(1.5)}$$

$$\approx -9.098$$

$\approx$  9 days prior to  
to Oct 31

$$\approx \text{Oct 22}$$

