3.1 Exponential Functions

Exponential functions are of the form:

$$f(x) = a^x$$ **(where a > 0, and does not equal 1)**

Domain: all real numbers

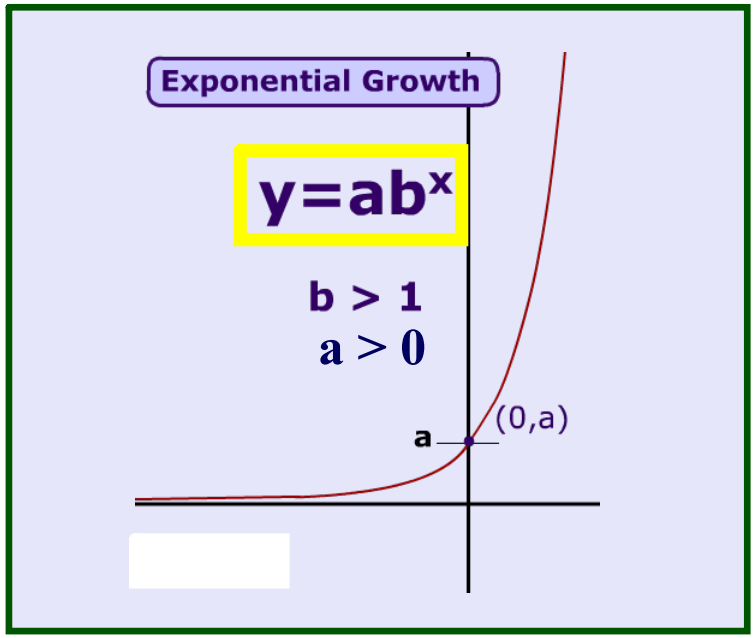
Examples of Exponential Growth:

1. $f(x) = 5^x$

2. $f(x) = 3 \cdot 2^x$

3. $f(x) = \frac{5}{6} \cdot 10^x$

4. $f(x) = \frac{1}{3} \cdot \left(\frac{\pi}{2}\right)^x$



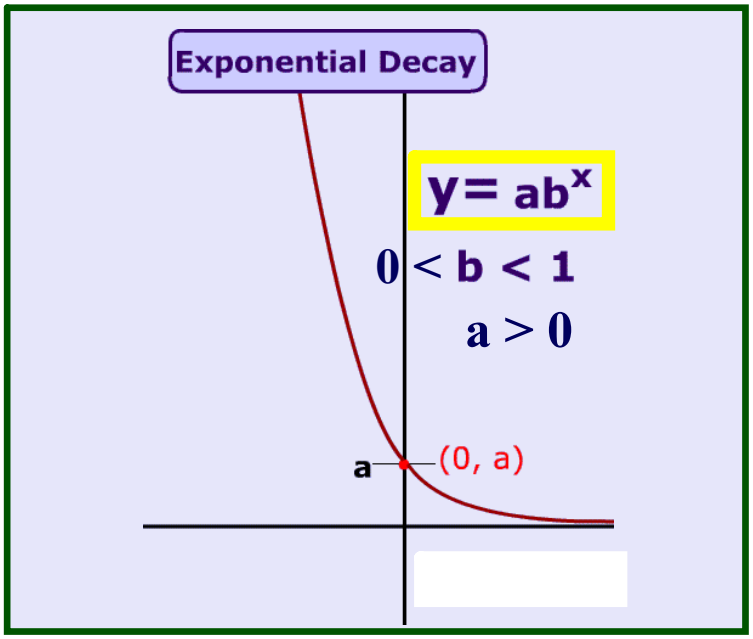
Examples of Exponential Decay:

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

2. $f(x)=3\cdot(0.65)^x$

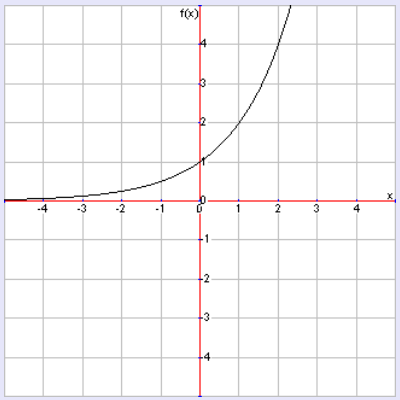
3. $f(x)=4\cdot\left(\frac{3}{8}\right)^x$

4. $f(x)=100\cdot\left(\frac{2}{3}\right)^x$

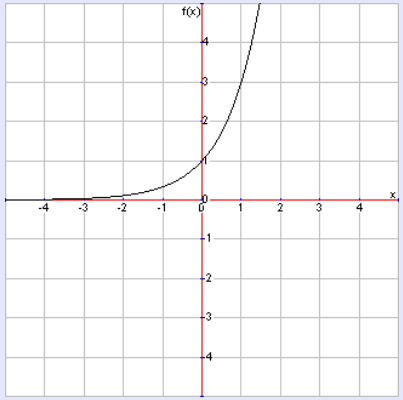


Some simple exponential growth equations:

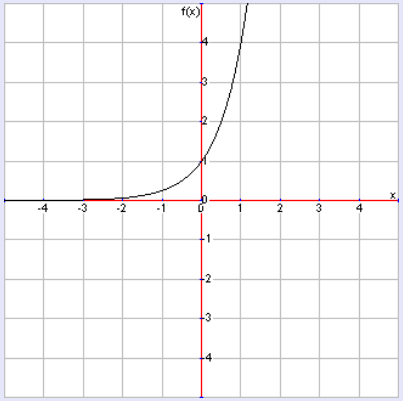
What features do these graphs have in common?



$f(x) = 2^x$



$f(x) = 3^x$



$f(x) = 4^x$

Any y - intercepts?

Any x - intercepts?

Domain?

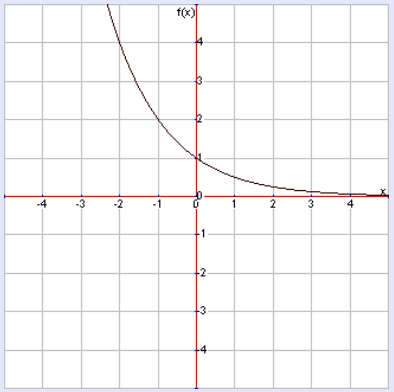
Asymptotes?

Increasing?

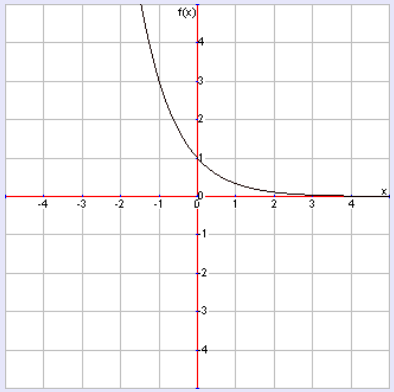
One-to-one?

Some simple exponential decay equations:

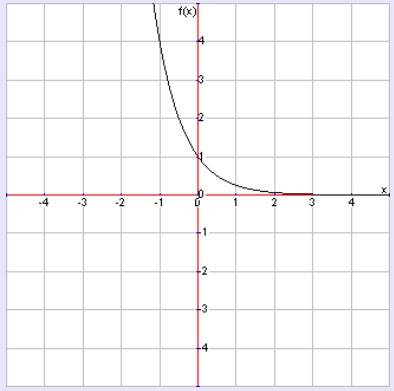
What features do these graphs have in common?



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



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



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

Any y - intercepts?

Any x - intercepts?

Domain?

Asymptotes?

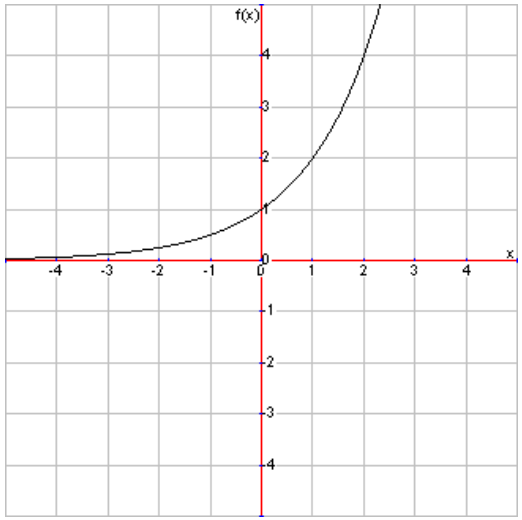
Increasing?

One-to-one?

Transformations:

Graph: $f(x) = 2^{-x} - 3$

Start with a parent graph!



$f(x) = 2^{x}$

?

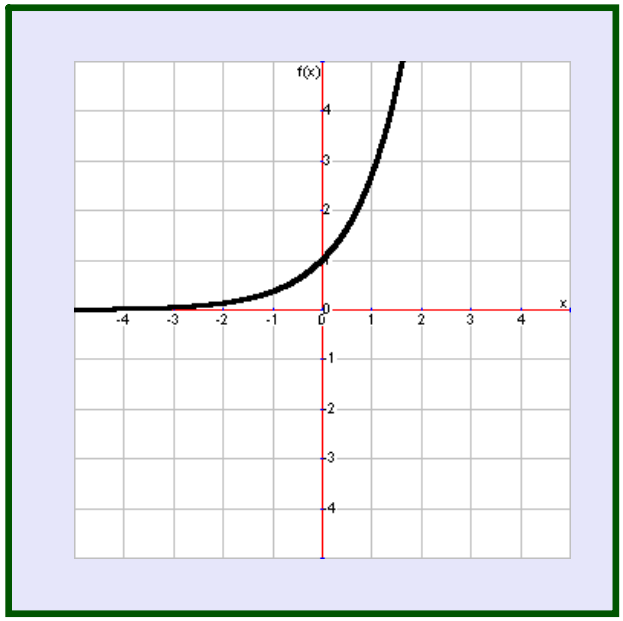
$f(x) = 2^{-x}$

?

$f(x) = 2^{-x} - 3$

A New Function:

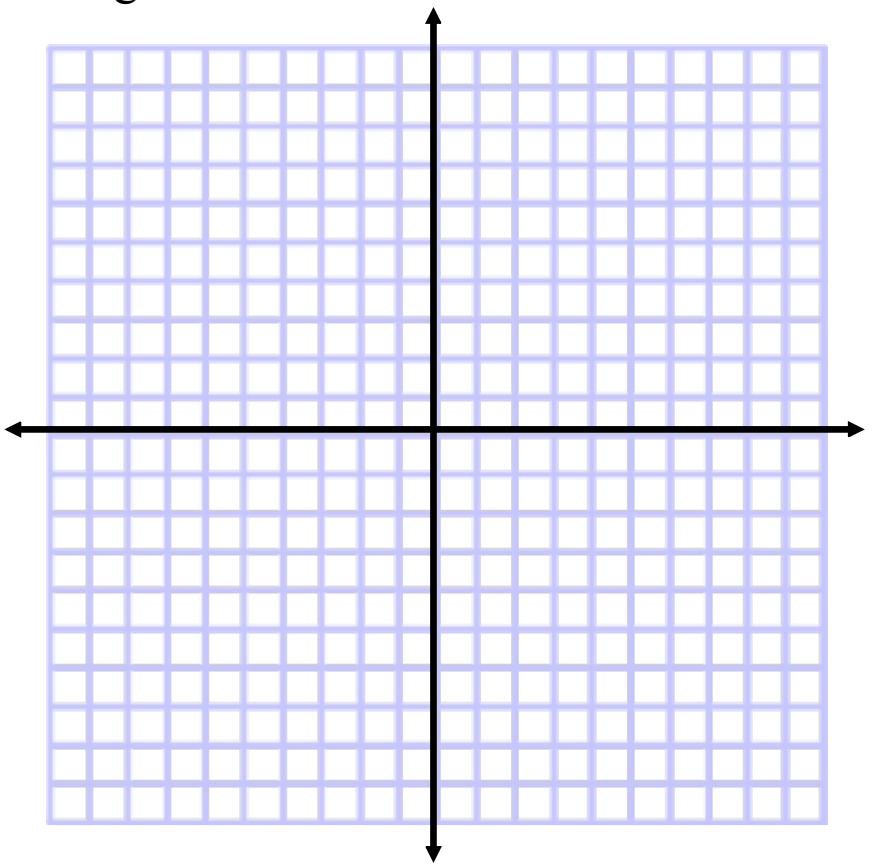
$$f(x) = e^x$$



Remember: *e* is just a number! (approximately 2.71828...)

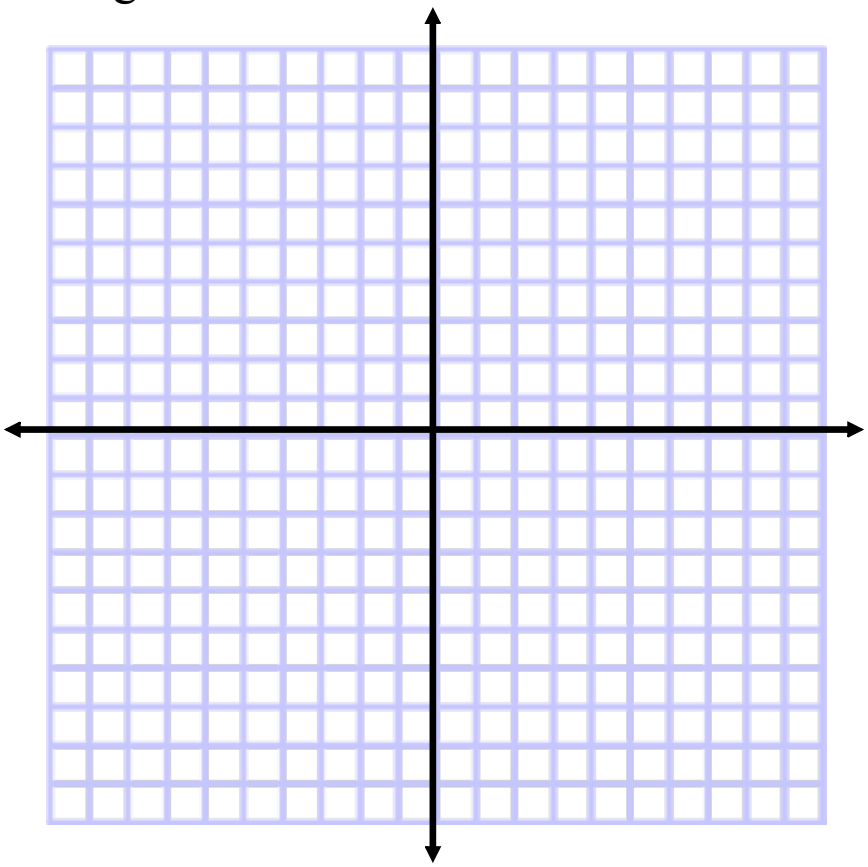
Use transformations to graph the following:

1. $f(x) = -3e^{x+3} - 2$



Use transformations to graph the following:

2. $y = -2\left(\frac{2}{3}\right)^{x+2} - 4$



What transformations should we apply to graph the following?

1. $y = \frac{1}{2} \cdot (4)^{x-2} - 5$

2. $y = \frac{3}{5} \cdot \left(\frac{1}{3}\right)^{x+3} + 4$

Solve each equation:

1. $5^{1-2x} = \frac{1}{5}$

2. $4^{x^2} = 2^x$

3. $9^{-x} = \frac{1}{3}$

Solve each equation:

1. $4^x - 2^x = 0$

2. $\left(e^4\right)^x \cdot e^{x^2} = e^{12}$

Assignment:

W.S. 3.1 (1-24)