

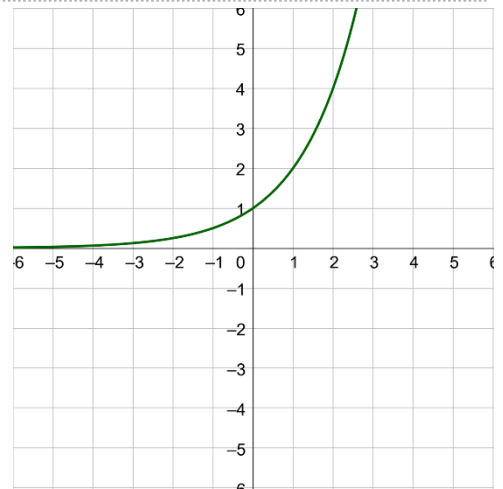
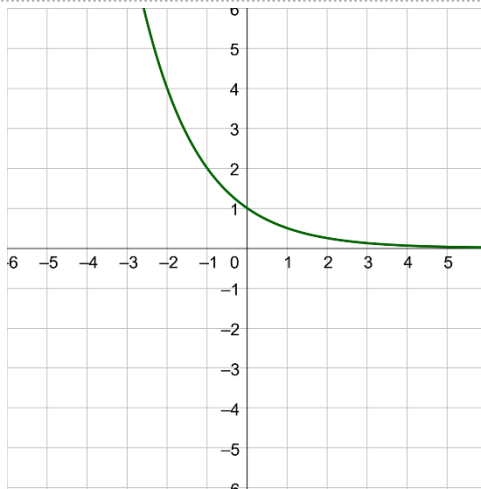
Precalculus

3-01 Exponential Functions

Exponential function

$$y = a \cdot b^x$$

- a is _____ amount (y -int)
- b is _____
- x is _____
- If $b > 1$
 - Exponential _____
- If $0 < b < 1$
 - Exponential _____
- Domain: _____
- Range: _____
- Horizontal Asymptote: _____
- y -intercept: _____



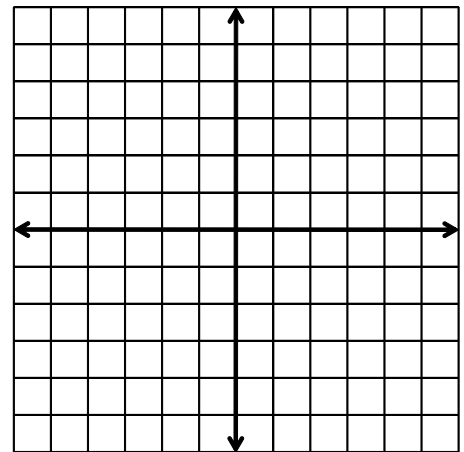
Transformations

$$y = a \cdot b^{x-h} + k$$

- a _____ stretch
 - If a is negative, then _____ over x -axis
- h moves _____
- k moves _____
- Domain: _____
- Range:
 - _____ if $a > 0$
 - _____ if $a < 0$
- Horizontal Asymptote: _____
- y -int: _____ if $h = 0$

Graph by making a table

Graph $y = 4^{-x} + 3$



Exponential functions are _____**Each x gives a _____ y** Solve $16 = 2^{x+2}$ Solve $\left(\frac{1}{3}\right)^x = 81$ **Natural Base**

- $e = \left(1 + \frac{1}{n}\right)^n$ when $n \rightarrow \infty$
- $e \approx$ _____ ...

Compound Interest

$$A = P \left(1 + \frac{r}{n}\right)^{nt}$$

A = current amount**P = principle (initial amount)****r = yearly interest rate (APR)****n = number of compoundings per year****t = years****Compounded Continuously**

$$A = Pe^{rt}$$

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3-02 Logarithmic Functions

$$f(x) = \log_b x$$

- “log base b of x ”
- Logarithms are _____ of _____ functions
- Logarithms are _____!

$$y = \log_b x \leftrightarrow x = b^y$$

Evaluate

- Think “What _____ of the base gives the big number?”

$$\log_5 125$$

$$\log_2 \frac{1}{64}$$

Calculator

- LOG \rightarrow _____ \rightarrow log
- LN \rightarrow _____ \rightarrow ln

Use your calculator to evaluate $\log 300$

Properties of Logarithms

- $\log_b 1 = 0$
- $\log_b b = 1$
- $\log_b b^x = x$
- If $\log_b x = \log_b y$, then $x = y$

Simplify $\log_5 1$

$\log_e e$

$8^{\log_8 30}$

Solve $\log_3(x^2 + 4) = \log_3 29$

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3-03 Properties of Logarithms

Properties of Logarithms

- **Product Property:** $\log_b(uv) = \log_b u + \log_b v$
- **Quotient Property:** $\log_b\left(\frac{u}{v}\right) = \log_b u - \log_b v$
- **Power Property:** $\log_b u^n = n \log_b u$

Write each log in terms of $\ln 2$ and $\ln 5$.

$\ln 10$

$$\ln \frac{5}{32}$$

Expand

$\log 3x^2y$

$$\ln \frac{\sqrt{4x+1}}{8}$$

Condense

$$\frac{1}{3} \log x + 5 \log(x - 3)$$

$$4 \ln(x - 4) - 2 \ln x$$

$$\frac{1}{5} (\log_3 x + \log_3(x - 2))$$

Change-of-Base Formula

$$\log_b c = \frac{\log_a c}{\log_a b}$$

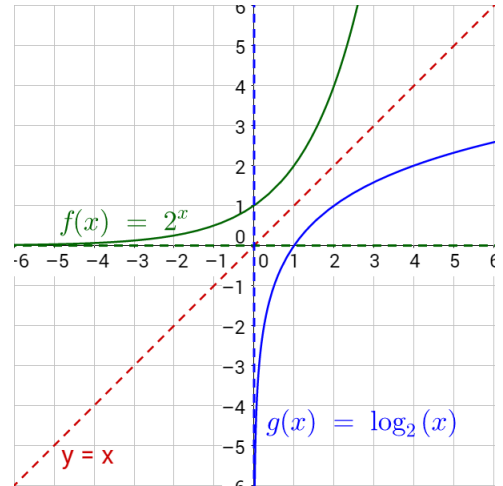
Evaluate $\log_3 17$

Graphing Logarithms

- Because logs are _____ of exponentials, the x and y are _____ and the graph is _____ over the line $y = x$.

$y = \log_b(x - h)$

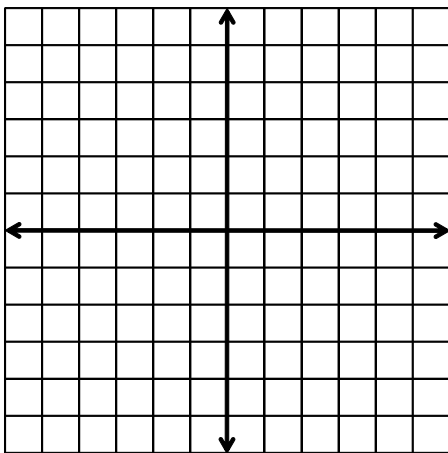
- Domain: _____
- Range: _____
- VA: _____
- x -int: _____



To graph a logarithm

1. Find and graph the vertical _____
2. Make a _____
3. Use _____ formula
 $\log_b x = \frac{\log x}{\log b}$
4. Or use the _____ function on some TI graphing calcs
 MATH \rightarrow logBASE

Graph $y = \log_2(x + 1)$



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3-04 Solving Exponential and Logarithmic Equations

Solve Exponential Equations

Shortcut Method

1-to-1 method (rewrite with the same base)

$$\left(\frac{1}{5}\right)^x = 125$$

General Method

_____ of both sides

$$5 - 3e^x = 2$$

$$6(2^{t+5}) + 4 = 11$$

$$e^{2x} - 7e^x + 12 = 0$$

Logarithmic Equations

Shortcut Method

1-to-1 Property

$$\ln x - \ln 3 = 0$$

General Method

_____ Exponentiate both sides

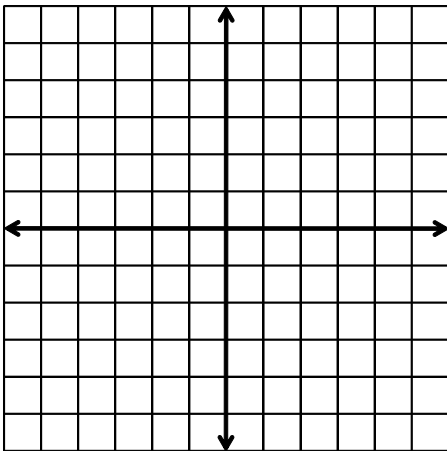
$$6 + 3 \ln x = 4$$

$$\log_4 x + \log_4(x - 9) = 1$$

Graphical method

If the other methods don't apply

- Make _____
- Find the _____

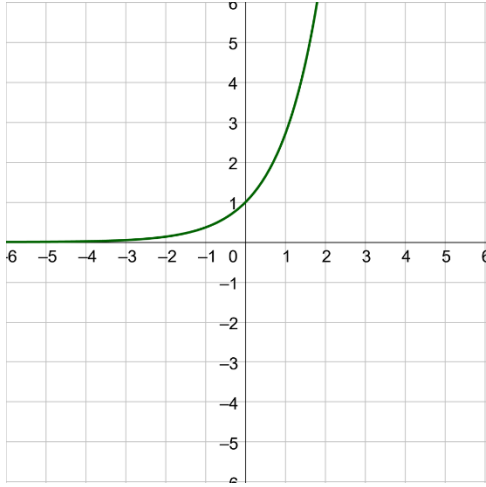
Solve $\log_2 x = \ln 2x$ 

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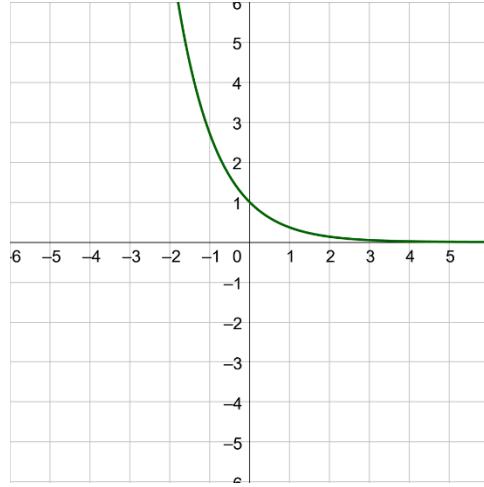
3-05 Exponential and Logarithmic Models

Exponential Growth and Decay

Exponential Growth



Exponential Decay



Suppose a population growing according to the model $P = 800e^{0.03t}$ where t is in years.

What is the initial size?

How long to double?

Radioactive decay

- $y = ae^{-bx}$
- $A = A_0e^{kt}$

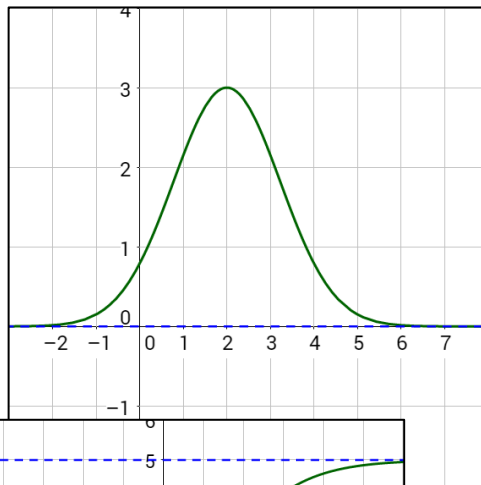
Half-life

- Time it takes for _____ of the material to _____

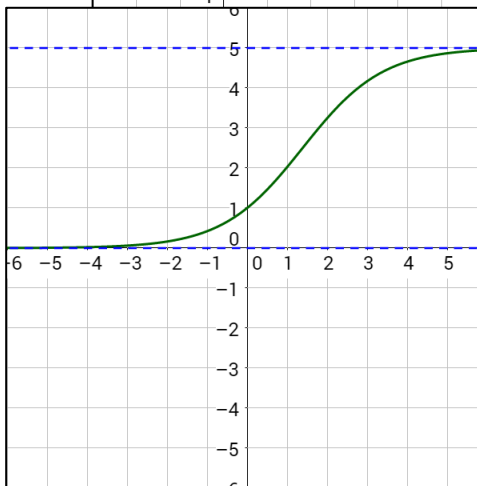
C^{14} has a half-life of 5700 years. If a sample starts with 3 g of C^{14} , how much will remain after 100 years?

Gaussian Model "The Curve"

- _____ Distribution
- $y = ae^{-\frac{(x-b)^2}{c}}$

**Logistic Growth Model**

- Used for _____
- $y = \frac{a}{1+be^{-rx}}$

**Logarithmic Models**

- $y = a + b \ln x$
- $y = a + b \log x$
- Richter Scale
 - _____ magnitude
- Decibels
 - _____ of sound