

3.6 #15-39 odd #47, 53-61 odd	Solving polynomial inequalities Solving rational inequalities
3.7: #23-37 odd	Variation
4.1 #17-23 odd #59-63 odd #77-81 odd #83-87 odd	prove f is one-to-one; prove g is not one-to-one determine if f is on-to-one and if so, determine its inverse sketch the inverse function by reflecting over $y=x$ use composition to show that the functions are inverses
4.2 #5-10 all #11-41 odd #43a,b,c,45,47	match an exponential function to its graph sketch graphs of exponential functions using transformations compound interest word problems
4.3 #1-8 all #9-33 odd #35-53 odd #69-77 odd #83-90 all	sketch graphs of logarithmic functions evaluate log expressions without a calculator convert between logarithmic and exponential expressions apply change of base formula & calculator to approximate log expressions graph logarithmic functions using transformations

4.2 Exponential Functions

$$f(x) = a^x$$

base \nearrow a \nwarrow exponent x

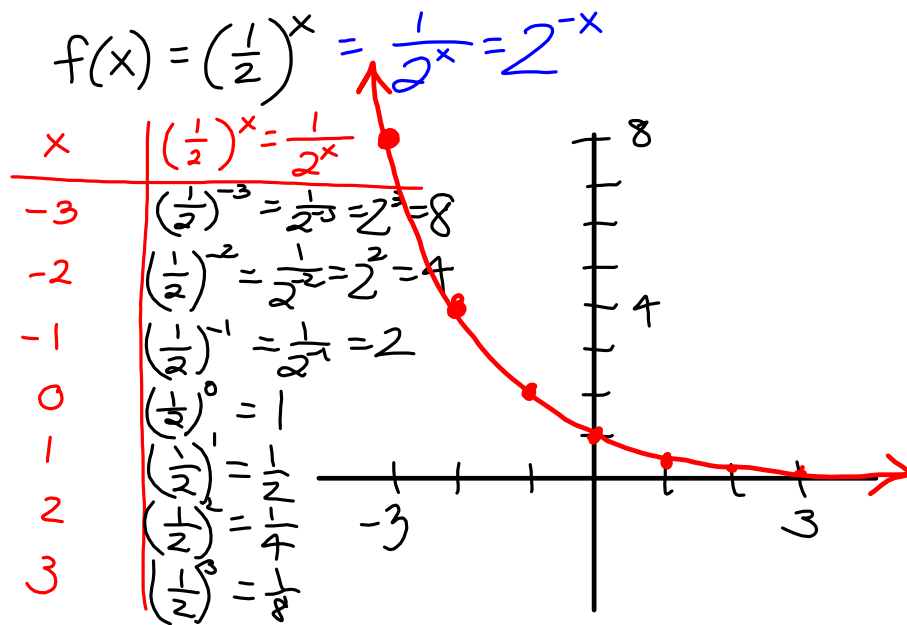
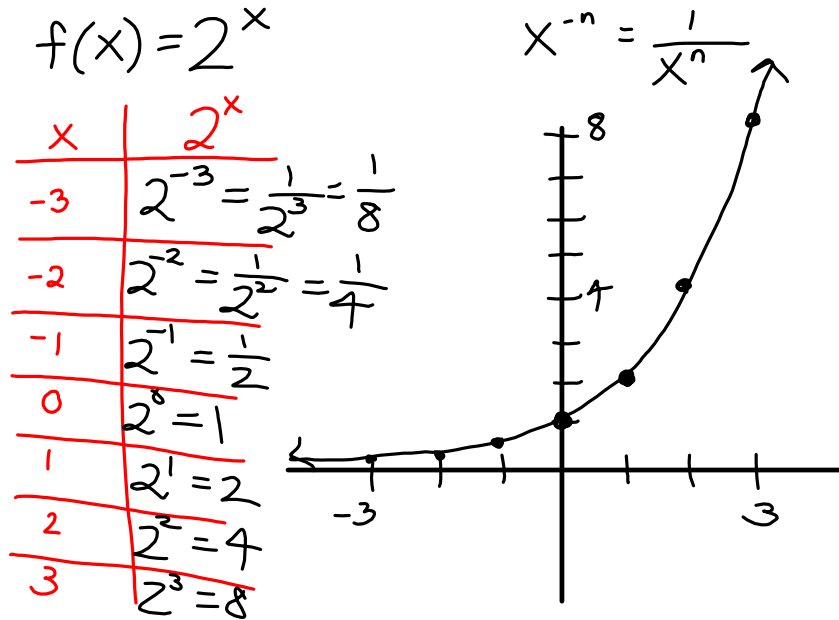
$a > 0$ excludes $(-1)^{1/2}$

$a \neq 1$ excludes $1^x = 1$ constant

Note: the variable is in the exponent, unlike power functions/polynomial

• $f(x) = x^2$ power/
poly

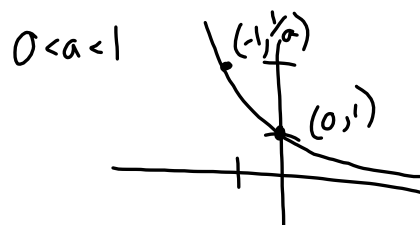
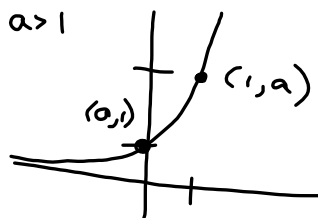
$f(x) = 2^x$ exp.



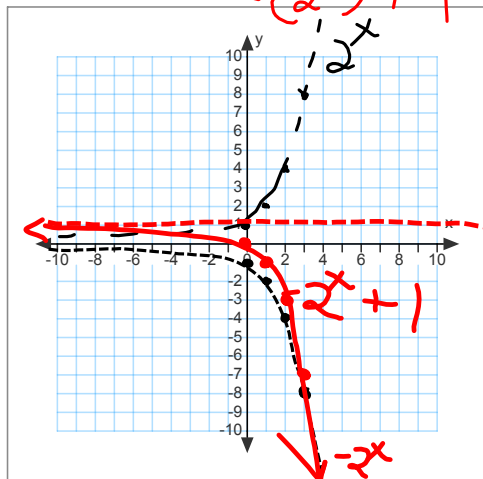
Properties of Exponential Functions

$$f(x) = a^x, \quad a > 0, a \neq 1$$

- continuous
- one-to-one
- Domain: $(-\infty, \infty)$
- Range: $(0, \infty)$
- horizontal asymptote: $y = 0$
- y-intercept: $(0, 1)$
- increasing if $a > 1$
- decreasing if $0 < a < 1$

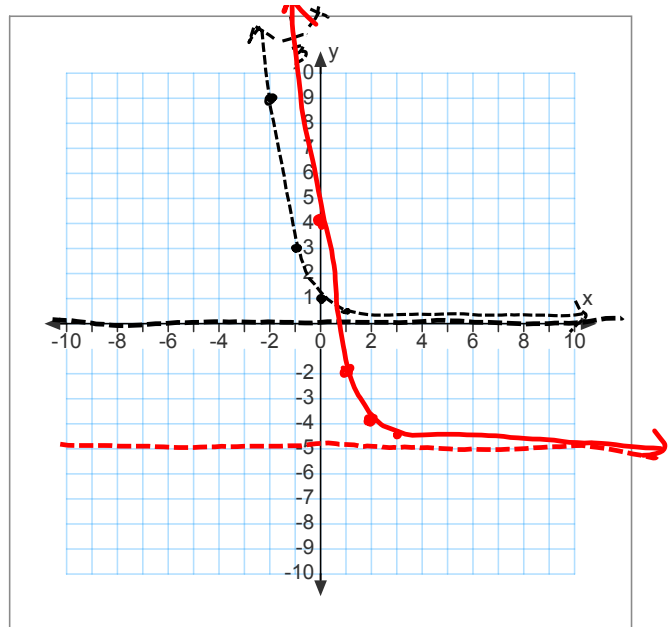


$$f(x) = -2^x + 1 \quad | \quad \neq (-2)^x + 1$$



$$f(x) = \left(\frac{1}{3}\right)^{x-2} - 5$$

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



Application: Compound Interest

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

A = amount of money

P = principal (initial investment)

t = time in # of years

r = interest rate (decimal)

n = # of times interest is compounded per year

Example:

\$100 @ 5% interest
compounded quarterly
for 1 year

$$P = 100$$

$$r = 0.05$$

$$n = 4$$

$$t = 1$$

$$A = 100 \left(1 + \frac{0.05}{4}\right)^{4 \cdot 1}$$

$$= \$105.09$$

If we invest \$1 at 100% interest for 1 year,

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

$$P = 1$$

$$r = 1$$

$$t = 1$$

$$n = \text{varies}$$

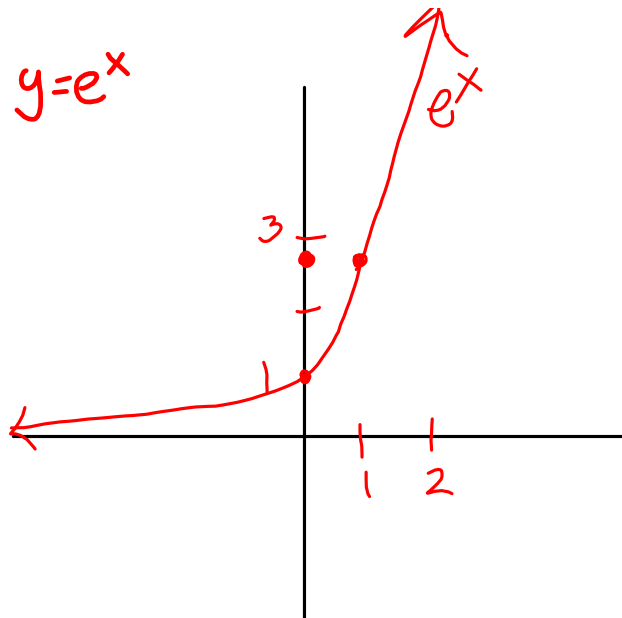
n		$A(n) = \left(1 + \frac{1}{n}\right)^n$
1	annually	$\left(1 + \frac{1}{1}\right)^1 = \2
2	semiannually	$\left(1 + \frac{1}{2}\right)^2 = \frac{9}{4} = \2.25
4	quarterly	$\left(1 + \frac{1}{4}\right)^4 = \2.44
12	monthly	$\left(1 + \frac{1}{12}\right)^{12} = \2.61
365	daily	$\left(1 + \frac{1}{365}\right)^{365} = \2.71
8760	hourly	$\left(1 + \frac{1}{8760}\right)^{8760} = \2.72
-->	∞	e

$$e = 2.718$$

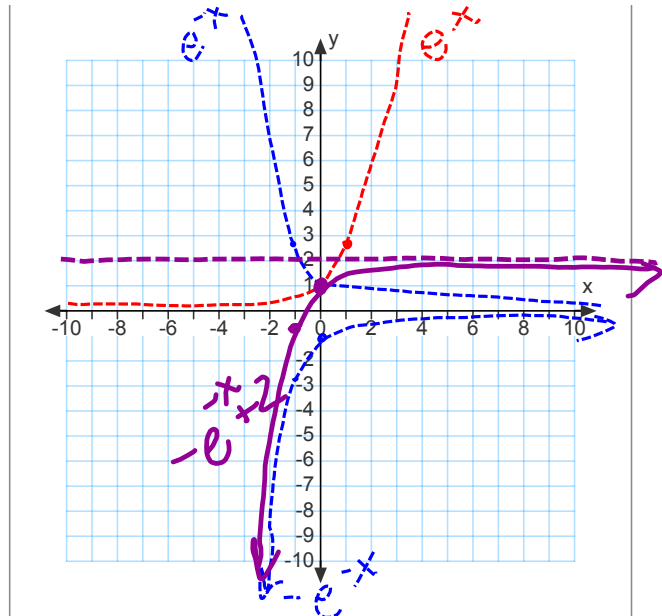
$$e^2 = e^2 \approx 7.389$$

$$e^{-0.23} \approx 0.7945$$

$$e^{-0.23}$$



$$y = -e^{-x} + 2$$



4.3 Logarithmic Functions

Inverses of Exponential Functions

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

$$y = 2^x$$

$$x = 2^y$$

y = the power to which we raise 2
to get x

$$f^{-1}(x) = \text{--- " " ---}$$

$$f^{-1}(x) = \log_2 x \quad \text{"log, base 2, of } x \text{"}$$

$$\log_2 8 = 3 \iff 2^3 = 8$$

3 is the power to which
we raise 2 to get 8

Simplify/evaluate :

$$\log_{10} 1000 = \boxed{3}$$

$$\log_{10} 0.001 = \boxed{-3}$$

$$\log_3 27 = \boxed{3}$$

$$\log_5 1 = \boxed{0}$$

$$\log_6 6 = \boxed{1}$$

$$10^{\boxed{3}} = 1000$$

$$10^{\boxed{-3}} = 0.001 = \frac{1}{1000}$$

For $f(x) = a^x$, the inverse function is
 $f^{-1}(x) = \log_a x$.
 $y = \log_a x$ is the number y such
 that $x = a^y$, where $x > 0$ and
 a is a positive constant other
 than 1.

log graphs :

Vertical
 asymptote
 • $x = 0$

x-int: $(1, 0)$
 domain: $(0, \infty)$
 range: $(-\infty, \infty)$

