Divide:

$$\frac{8}{-4-4i}\cdot\frac{(-4+4i)}{(-4+4i)}$$

$$\frac{-32+32i}{16-\cancel{16i}+\cancel{16i}-16i^2}$$

$16+16$

$$\frac{-32+32i}{32}$$

$$\boxed{-1+i}$$

Factor:

$$x^8-17x^4+16=0$$

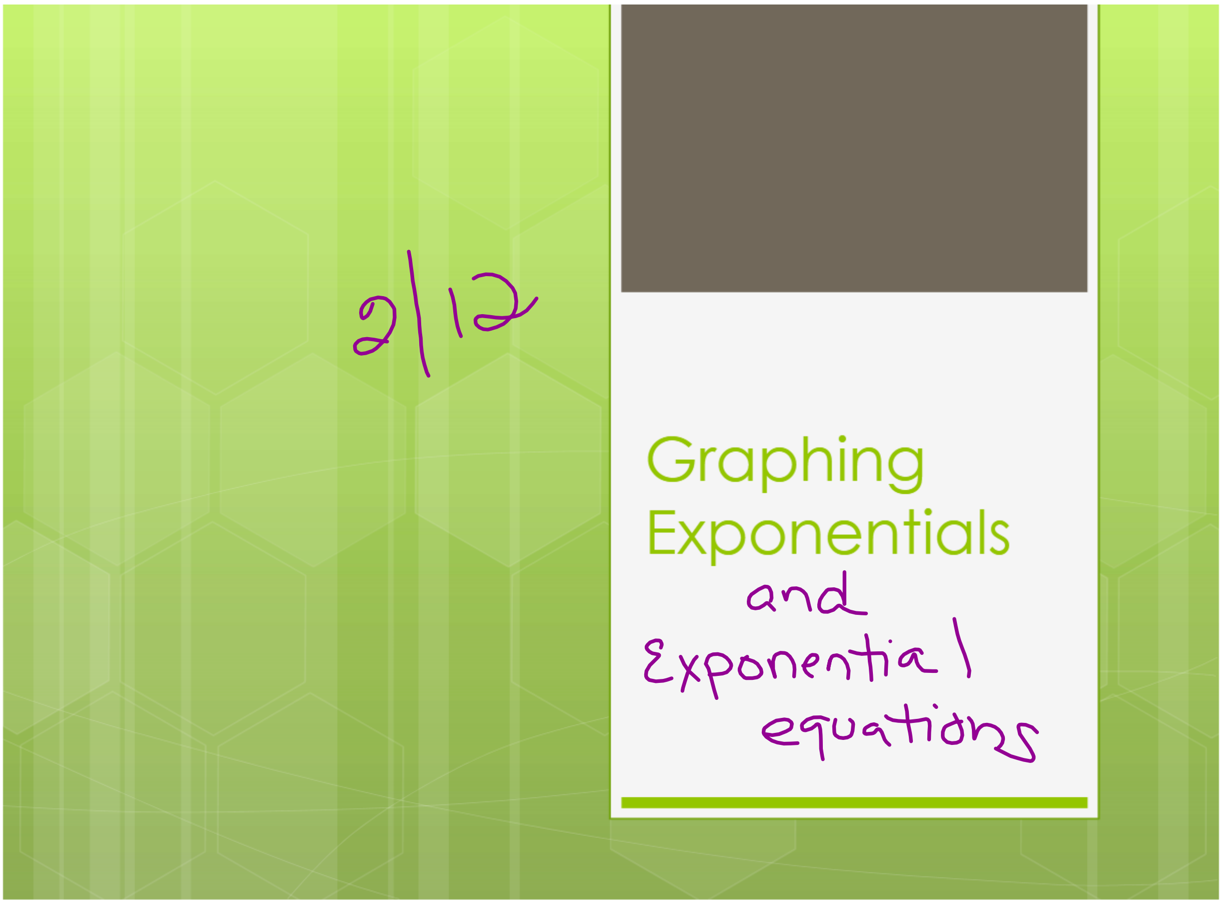
$(x^4-16)(x^4-1)=0$

$(x^2+4)(x^2-4)(x^2+1)(x^2-1)$

$(x^2+4)(x+2)(x-2)(x^2+1)(x+1)(x-1)$

Warm-Up

- Simplify:
  - $x^{-2}y^{4}$
  - $\frac{y^{3}z^{-1}}{z^{1}}$
  - $\frac{-2x^{-3}x^{-4}}{y^{-8}}$
- True or false:
  - Any number (or variable) to the zero power is 1


2/12
Graphing
Exponentials
and
Exponential
equations

Exponential Functions

- A function $f(x) = ab^x, a \neq 0, with\ b > 0, and\ b \neq 1$. The base b is a constant. The exponent x is the independent variable with domain all real numbers.

$f(x) = ab^x$

Exponential Functions

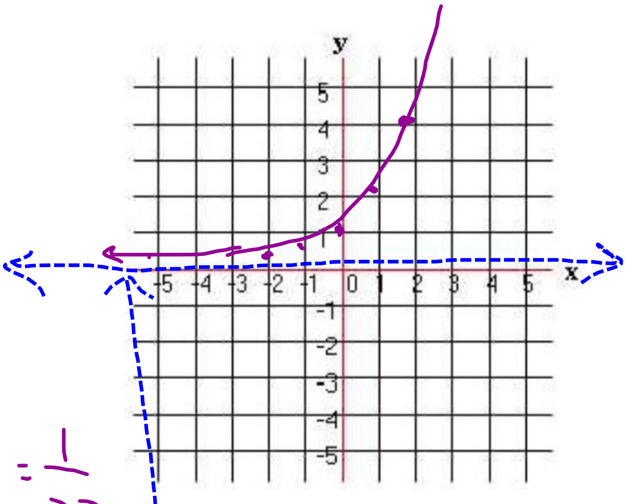
$y = 2^x$

x	y
-2	$\frac{1}{4}$
-1	$\frac{1}{2}$
0	1
1	2
2	4

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

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

$2^{-5} = \frac{1}{2^5} = \frac{1}{32}$



HA $y=0$

y-int : 1

horizontal Asymptote (line that the graph approaches but never touches)

Exponential Functions

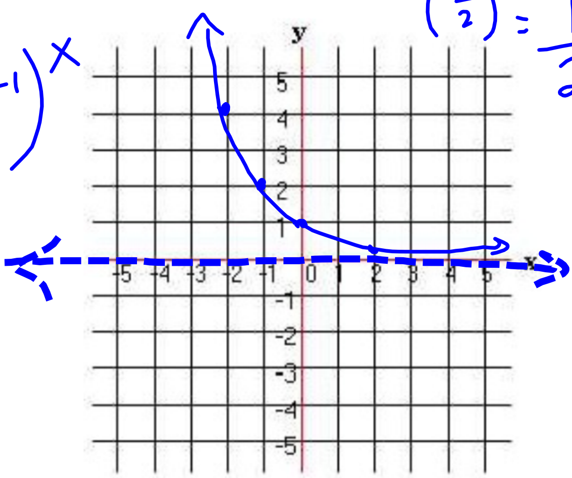
$$\left(\frac{1}{2}\right)^{-2} = \frac{1^{-2}}{2^{-2}} = \frac{2^2}{1}$$

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

Decay

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

$$= 2^{-x}$$



HA $y = 0$

y-int $= 1$

Exponential Functions

For the function $y = ab^x$

--if $a > 0$ and $b > 1,$ the function represents exponential growth.

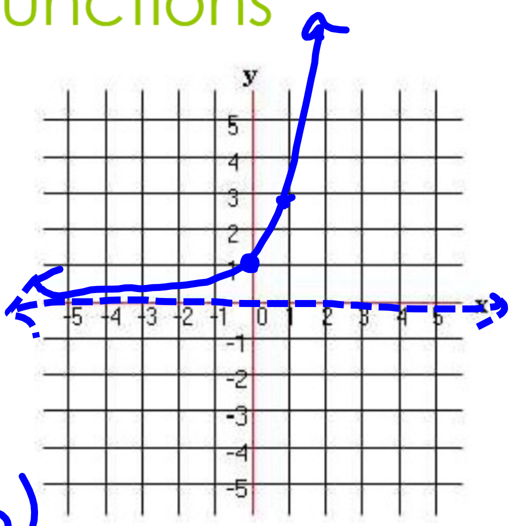
--if $a > 0$ and $0 < b < 1$, the function represents exponential decay.

In either case, the y-intercept is (0,a), the domain is all real numbers, the asymptote is $y = 0$, and the range is $y > 0$.

Exponential Functions

$y = e^x$

$(2.718)^x$



HA $y=0$

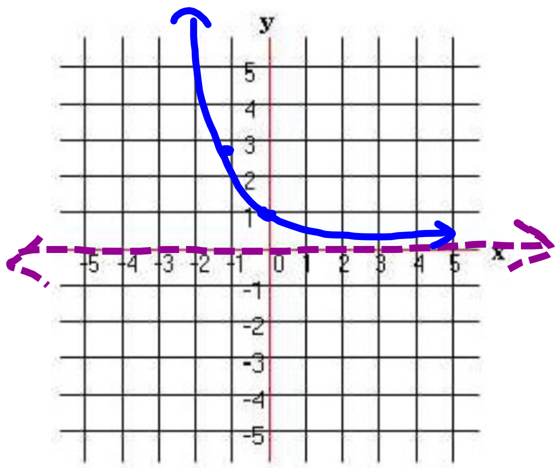
y-int $= 1$

Domain $(-\infty, \infty)$

Range $(0, \infty)$

Exponential Functions

$$y = \left(\frac{1}{e}\right)^{x}$$



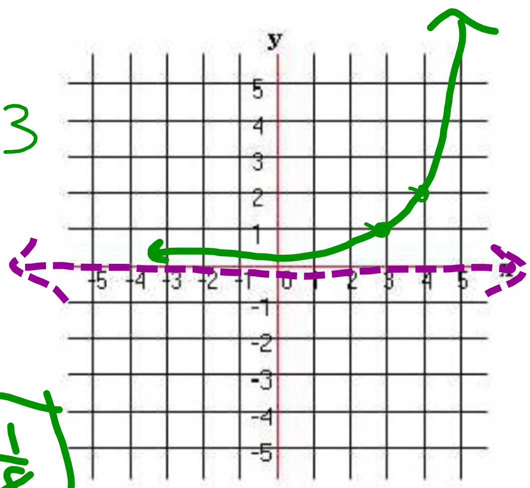
Exponential Functions-Transformations

- $y = f(x)$ 2^x Parent Function 2^x
- $y = f(x) \pm a$ up or down translation $2^x + 4$
- $y = f(x \pm a)$ left or right translation $2^{x \pm 3}$
- $y = -f(x)$ reflection across x-axis -2^x
- $y = f(-x)$ reflection across y-axis 2^{-x}
- $y = af(x); a > 1$ pull toward y-axis $3(2^x)$
- $y = af(x);\ 0 < a < 1$ pull toward x-axis $\frac{1}{2}(2^x)$

Transformations

$y = 2^{x-3}$

Right 3



HA $y=0$

y-int

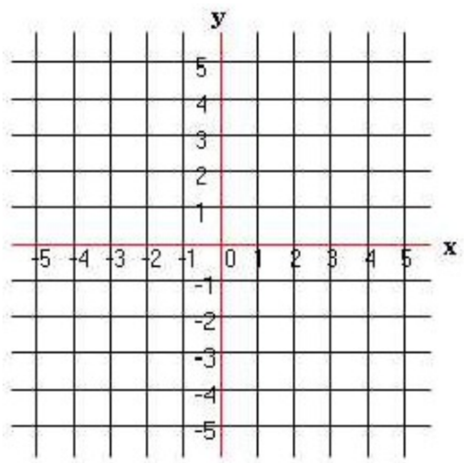
$2^{0-3} = 2^{-3} = \frac{1}{2^3} = \boxed{\frac{1}{8}}$

D: $(-\infty, \infty)$

R: $(0, \infty)$

Transformations

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



Transformations

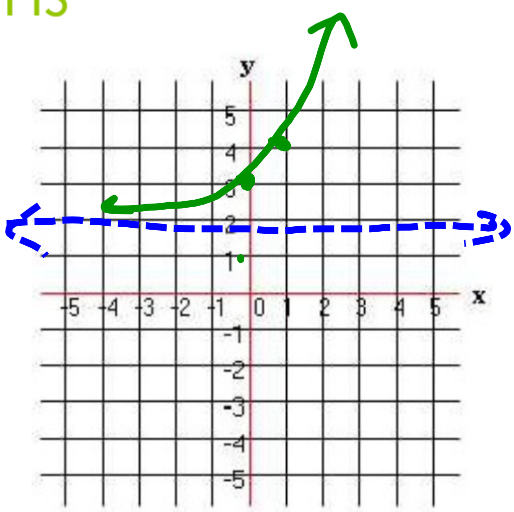
$$y = 2^x + 2$$

up

HA $y=2$

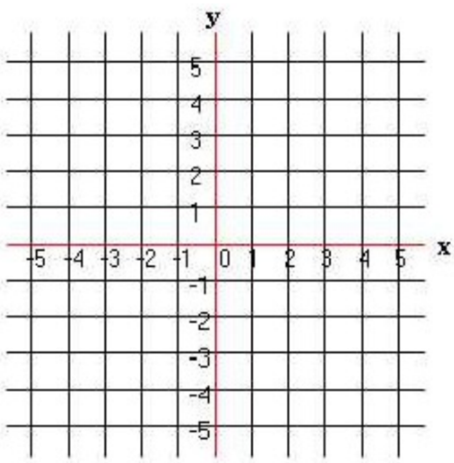
D: $(-\infty, \infty)$

R: $(2, \infty)$



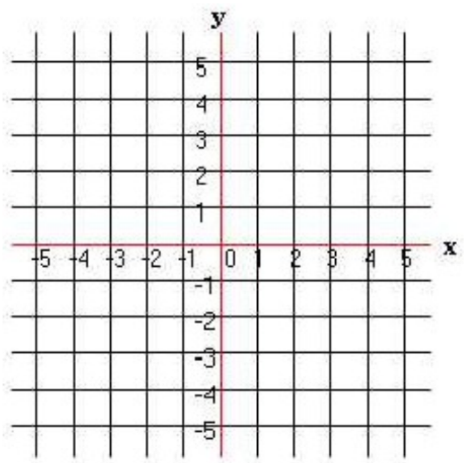
Transformations

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



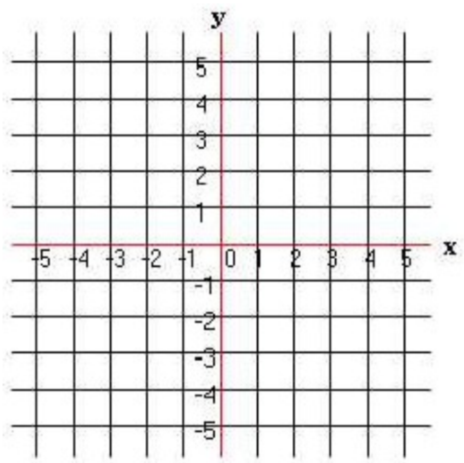
Transformations

$$y = 2(2^x)$$



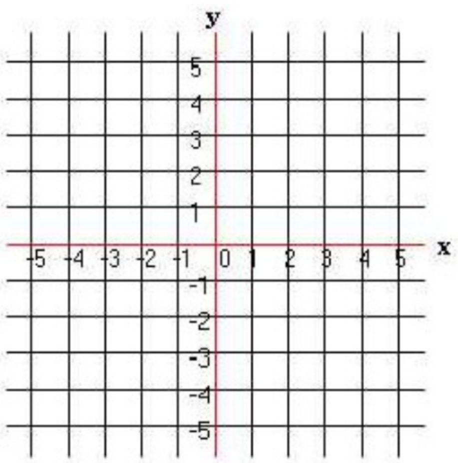
Transformations

$$y = 3\left(\frac{1}{2}\right)^x$$



Transformations

$$y = \frac{3}{4}(2)^x$$

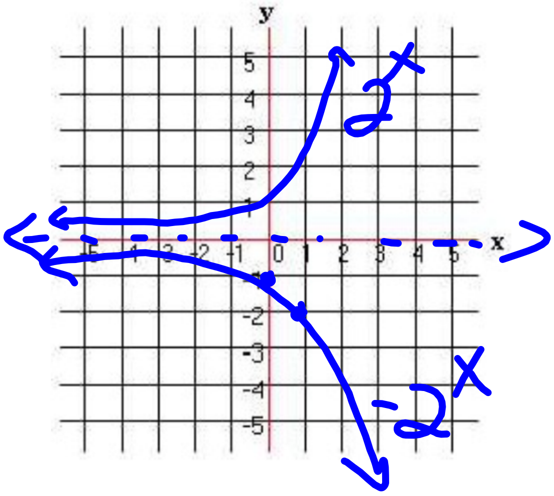


Transformations

$y = -2^x$

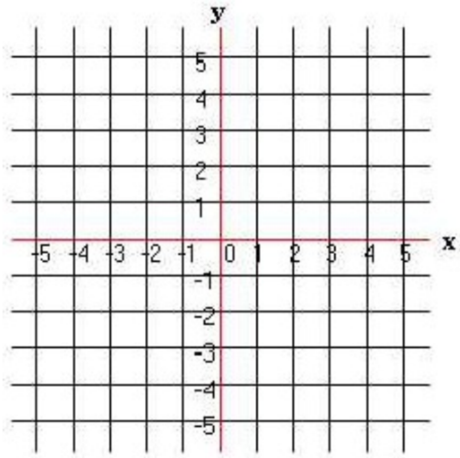
-2^0

-2^1



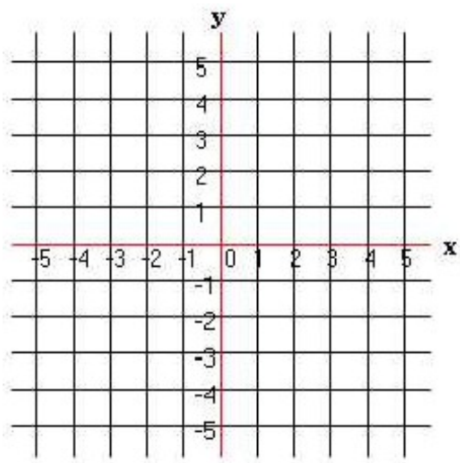
Transformations

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



Transformations

$$y = 3^{x-2} + 3$$



Transformations

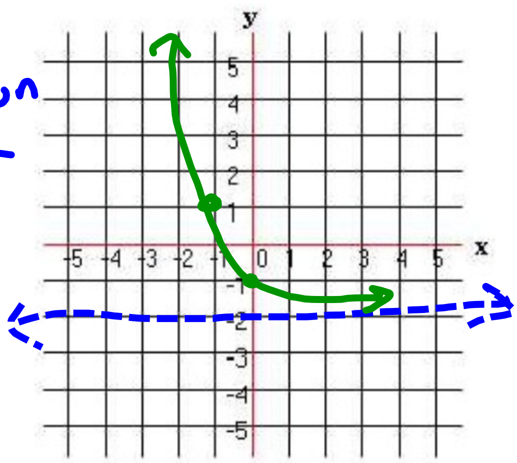
$$y = (3^{-x}) - 2$$

reflects over y

down 2

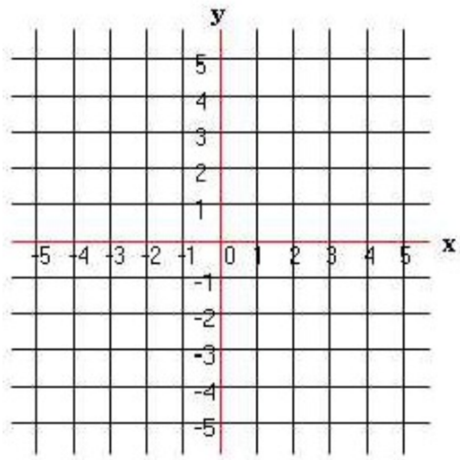
HA $y = -2$

$3^{-(-1)}$ -2



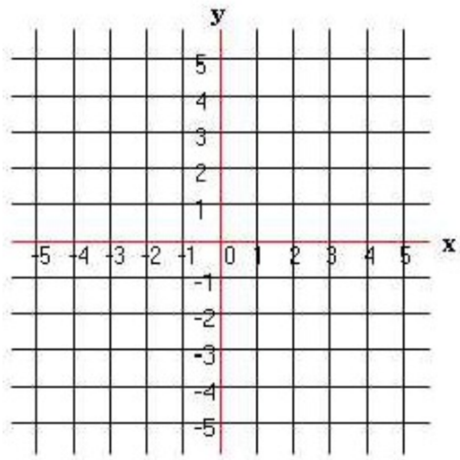
Transformations

$$y = -4(3^{x-1}) + 1$$



Transformations

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



Solving Exponential Equations

Exponential Equation—equation with the variable in the exponent

Steps to follow:

1. Match bases if possible
2. Drop bases and simplify using exponent laws.
3. Solve for the variable.

Solving Exponential Equations

$$2^x = 2^4$$

$x = 4$

1. Make the bases the Same
2. If the bases are the Same, the the exponents are equal.

Set the exponents equal to each other & solve.

Solving Exponential Equations

$$2^{x} = 2^{3x-1}$$

$x = 3x - 1$

$-3x$

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

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

Solving Exponential Equations

$$5^{3x} = 25^{x+2}$$

$$5^{3x} = (5^{2})^{x+2}$$

$$5^{3x} = 5^{2x+4}$$

$$3x = \cancel{2x} + 4$$

$$-2x$$

$$\boxed{x = 4}$$

Solving Exponential Equations

$$4^{2x-5} = 16^{3x}$$

Solving Exponential Equations

$$25^{x-4} = 125^{4x+3}$$

$$(5^2)^{x-4} = (5^3)^{4x+3}$$

$$5^{2x-8} = 5^{12x+9}$$

$$\cancel{2x} - 8 = 12x + 9$$
$$-2x$$

$$-8 = 10x \cancel{+9}$$
$$-9$$

$$-17 = 10x$$

$$\boxed{-\frac{17}{10} = x}$$

Solving Exponential Equations

$$2^{x-1} = \left(\frac{1}{8}\right)^{x+3}$$

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

$$2^{x-1} = \left(2^{-3}\right)^{x+3}$$

2

2^{-3}

$$x - 1 = -\cancel{3}x - 9$$

$+3x$

$$4x - \cancel{1} = -9$$

$+1$

$$4x = -8$$

$$x = -2$$

Solving Exponential Equations

$$\left(\frac{1}{64}\right)^{x^2} = \left(\frac{1}{16}\right)^{8}$$

Solving Exponential Equations

$$4^x \bullet \left(\frac{1}{64}\right)^{5x-3} = \left(\frac{1}{16}\right)^{x-6}$$

$$4^x \cdot \left(4^{-3}\right)^{5x-3} = \left(4^{-2}\right)^{x-6}$$

$$4^x \cdot (4)^{-15x+9} = 4^{-2x+12}$$

$$4^{x-15x+9}$$

$$4^{-14x+9} = 4^{-2x+12}$$

$$\cancel{-14x}+9 = -2x+12$$

$$+14x$$

$$9 = 12x + \cancel{12}$$

$$-12$$

$$-3 = 12x$$

$$\boxed{-\frac{3}{12} = x}$$

$$\boxed{-\frac{1}{4} = x}$$

Solve:

$$(0.25)^{7x} = 32^{x-7}$$

$$\left(\frac{1}{4}\right)^{7x} = 32^{x-7}$$

$$(2^{-2})^{7x} = (2^5)^{x-7}$$