§4.1, 4.2 stuff is up

§4.1 due Friday

¶4 - Exponentials & Logarithmics are inverse functions.

Solve an equation with variable inside log?
Exponential extracts it

Solve an equation with variable inside exponential?
Log extracts it.

$\log_2 x$ says "x, show me your power! (of 2)."
what power of 2 is x?

$\log_2(16) = 4$, because $2^4 = 16$

Some say logs ARE exponents.
Logs "stripping away & writing as an exponent."

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$(a^b)^c = a^{bc}$ multiply powers

$(2^3)^4 = 2^{12}$

	128
2^8	
	256
2^7.5	
	181.019336
2^7.75	
	215.2694823

	215.2694823
2^8.5	
	362.038672
2^7.9	
	238.8564458
2^7.92	
	242.1907576

$\log_a(b^c) = c\log_a(b)$

$\log_2(3^5) \approx 7.924812504$

$\log_2(3) \approx 1.584962501$

what's $5(1.584962501) \approx$

$3^5 = 243$

See? $\log_2(243)$ is writing 243 as a power of 2.

$2^2 = 4$

$2^3 = 8$

$2^4 = 16$

$2^5 = 32$

$2^6 = 64$

$2^7 = 128$

$3^5 \to$

$2^8 = 256$

So $\log_2(3^5)$ is between 7 & 8

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$a^{b+c} = a^b a^c$

$\log_2(bc)$

$= \log_2(b) + \log_2(c)$

$2^{3+4} = 2^7$

$2^3 2^4 = 2^7$

$3.584962501 \approx \log_2(12) = \log_2(3 \cdot 4)$

$= \log_2(3) + \log_2(4)$

$\approx 1.584962501 + 2$

$= 3.584962501$

$\log_3(5x^2y^{\frac{1}{3}})$

$= \log_3(5) + \log_3(x^2) + \log_3(y^{1/3})$

$= \log_3(5) + 2\log_3(x) + \frac{1}{3}\log_3(y)$

Log turns products into sums

Log turns powers into products

Because of properties of exponents.

Oct 29-8:07 AM

Exponential growth
uninhibited growth

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

$2^0 = 1$

$2^1 = 2$

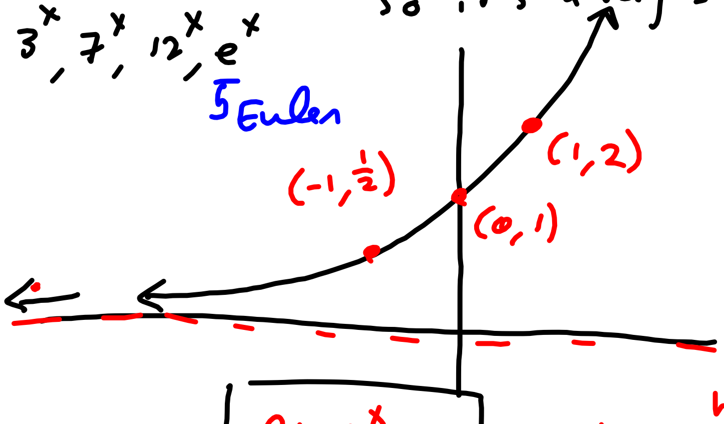
```
      362.038672
2^7.9
     238.8564458
2^7.92
     242.1907576
2^-5000
               0
```

2^{-50000} is NOT zero, but my calculator thinks it is.

$\frac{1}{2^{5000}} > 0$

so it's a very small positive #

$3^x, 7^x, 12^x, e^x$
Euler



THE BASIC Exponential Growth function

y=0 is horizontal asymptote

We say $\boxed{\lim_{x \to -\infty} 2^x = 0}$ which means
it approaches, but we know it never touches,

"Limit as x approaches infinity, of 2^x is zero."

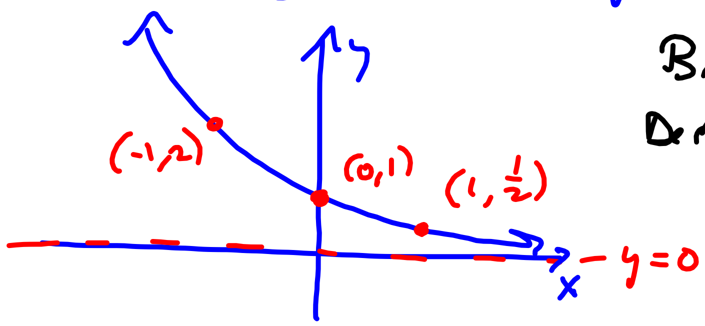
$2^x \xrightarrow{x \to -\infty} 0$

$2^x \xrightarrow{x \to \infty} \infty$

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

So if $f(x) = 2^x$, then $\left(\frac{1}{2}\right)^x$ is $f(-x)$.

Reflect 2^x in the y-axis (Horizontal Flip)



BASIC EXPONENTIAL Decay model/picture.

Graph $3 \cdot 2^{5x-10} - 11$

$5x-10$
$= 5(x-2)$

1. $a f(x)$
2. $f(ax)$
3. $f(x-a)$
4. $f(x) + a$

0. 2^x
1. $3 \cdot 2^x$
2. $3 \cdot 2^{5x}$
3. $3 \cdot 2^{5(x-2)}$
4. $3 \cdot 2^{5(x-2)} - 11$

$$\boxed{\begin{array}{l} 2^x - 11 \\ 3 \cdot (2^x - 11) \end{array}}$$

out of sequence.
This is
$3 \cdot 2^x - 33$

2^x down 5, stretch vertically by factor of 4

write it

$2^x - 5$

$4(2^x - 5) = \boxed{4 \cdot 2^x - 20}$

$4 \cdot 2^x \neq 8^x$

2^x stretch vertically by factor of 4, down 5

$4 \cdot 2^x$

$\boxed{4 \cdot 2^x - 5}$

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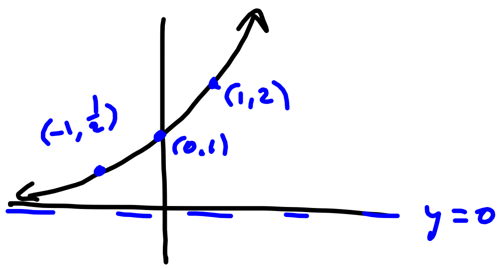
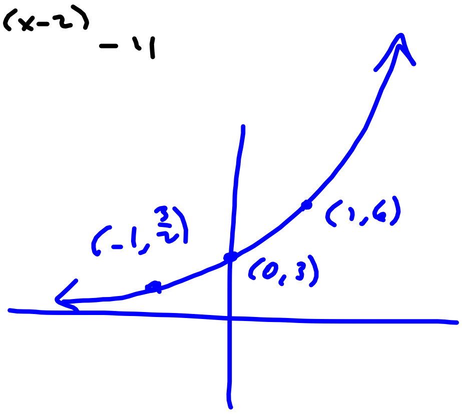
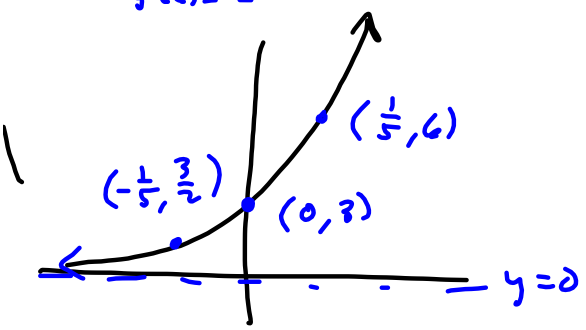
$$3\cdot 2^{5x-10}-11 = 3\cdot 2^{5(x-2)}-11$$



$f(x)=2^x$

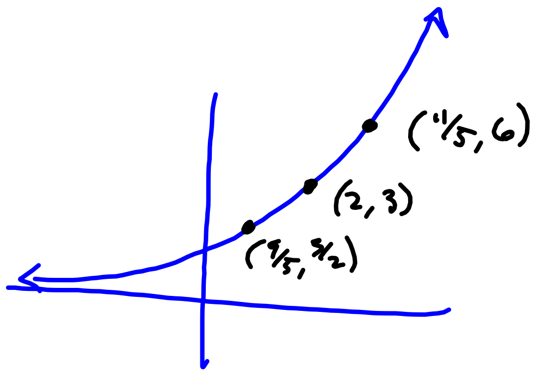


$3f(x)=3\cdot 2^x$

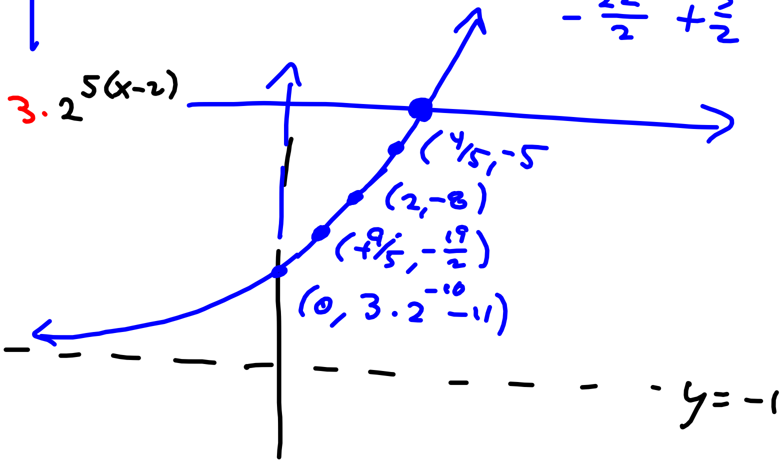


$3\cdot 2^{5x}=3f(5x)$

$-\frac{1}{5}+\frac{10}{5}$



$-\frac{22}{2}+\frac{3}{2}$



$3\cdot 2^{5(x-2)}-11$

$3\cdot 2^{5(2)}-11$

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#25

S4.1 questions I asked $4000 change to $5000 in question.

& did $5000 on homework