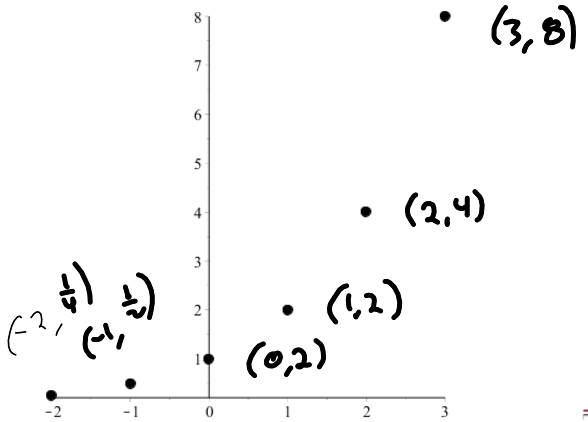
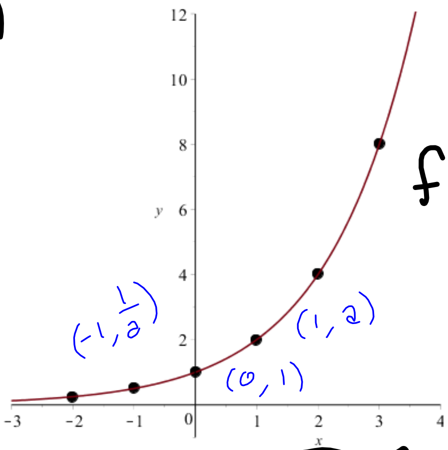




$f(x) = 2^x$

$f(x) = 2^x$

$f(-2) = 2^{-2} = \frac{1}{2^2} = \frac{1}{4}$

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

$f(3) = 2^3 = 8$

power → 2^x ← Base

$2 > 1$ → Exponential Growth

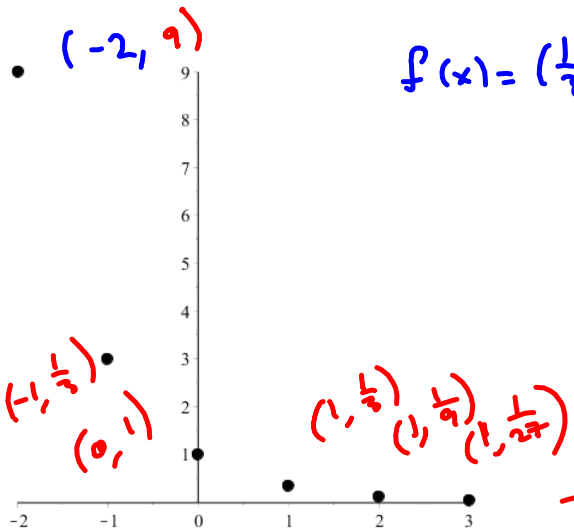
Base never be 0 or negative.

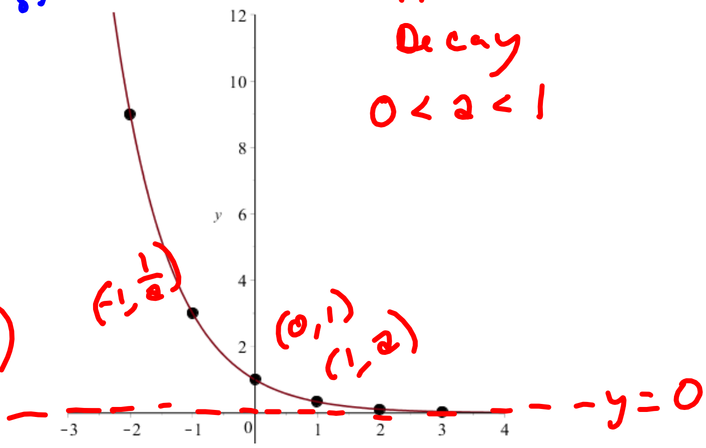
$2^{-1000} = \frac{1}{2^{1000}} > 0$

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

Exponential Decay

$0 < a < 1$





$$\left(\frac{1}{3}\right)^{-2} = \frac{1^{-2}}{3^{-2}} = \frac{1}{\frac{1}{3^2}} = 3^2 = 9$$

$a = \frac{1}{3} < 1$

2^x is monotone increasing (growth) or decreasing (decay).

This means it's 1-to-1

" " it has an inverse function,

$f^{-1}(x) = \log_2(x)$

$2^x = 7$

$\log_2(2^x) = \log_2(7)$

$x = \log_2(7) = \frac{\log(7)}{\log(2)} = \frac{\ln(7)}{\ln(2)}$

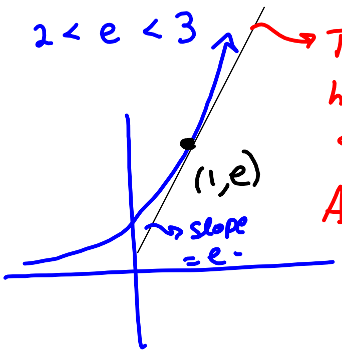
Calculator doing a $\log_2(x)$, via Change-of-base.

The Natural base, named for Euler,

e — For continuous growth/decay

$2 < e < 3$

$f(x) = e^x$



Tangent line @ $x = 1$ (or anywhere else) has has exactly the same slope as the function

AND, for e^x, the slope is the height

e^x is as steep as it is tall.

$y = e^{bx}$

'b' is relative growth rate.

A pop. is 10,000, today, and is growing continuously at a rate of 7%, annually.

$P(t)$ = Population as func of time

t = years from present

$= 10000 e^{.07t}$

$P(0) = P(\text{now}) = 10000 e^{.07(0)}$

$= 10000 \cdot 1 = 10{,}000.$

E3 #5 c $f(x) = 4x^5 - 9x^3 + 8x^2 - 9x + 6$

$\pm 1, \pm 2, \pm 3, \pm 6, \pm \frac{1}{2}, \pm \frac{2}{2}, \pm \frac{3}{2}, \pm \frac{6}{2},$

$\pm \frac{1}{4}, \pm \frac{2}{4}, \pm \frac{3}{4}, \pm \frac{6}{4}$

$\pm 1, \pm 2$

1	4	0	-9	8	-9	6
		4	4	-5	+3	-6
1	4	4	-5	3	-6	0
		4	8	3	6	
-2	4	8	3	6	0	
		-8	0	-6		
	4	0	3	0		

$x = 1, 1, -2$

$(x-1)^2(x+2)(4x^2+3)$

$4x^2+3$ is irreducible over the reals:

$a = 4, b = 0, c = 3$

$b^2 - 4ac = 0^2 - 4(4)(3)$

$= -48$

No real roots

$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

$= \frac{0 \pm \sqrt{-48}}{2(4)}$

$= \pm \frac{4i\sqrt{3}}{8}$

$= \pm \frac{i\sqrt{3}}{2}$

(7)

$4x^2 + 3 = 0$

$4x^2 = -3$

$x^2 = -\frac{3}{4}$

$x = \pm\sqrt{-\frac{3}{4}}$

$= \pm i\frac{\sqrt{3}}{2}$

$48 = 2 \cdot 24 = 2 \cdot 2 \cdot 12 = 2 \cdot 2 \cdot 2 \cdot 6 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3$

Don't LLC. Don't lose leading coefficient.

(7) $f(x) = 4(x-1)^2(x+2)\left(x - \frac{i\sqrt{3}}{2}\right)\left(x + \frac{i\sqrt{3}}{2}\right)$

$= 4x^5 +$ smaller stuff