Logarithmic and Exponential Functions

So let's recap…

$$\log_5 125 = x$$

$$\log_a M + \log_a N = \log_a MN$$

$$\log_a M - \log_a N = \log_a \frac{M}{N}$$

$$\log_a M^n = n \log_a M$$

$$\log_a a^x = x$$

$$a^{\log_a x} = x$$

And for the calculator…

$$\log_a M = \frac{\log_b M}{\log_b a}$$

Which can be done using the two programmed bases

$$\log_{10} \ and \ \ln$$

More on this one soon…

Ex 4 $$\log_3(x+4)+\log_3(2x-7)=3$$

$$\log_3(x+4)(2x-7)=3$$

$$(x+4)(2x-7)=3^3$$

$$2x^2+x-28=27$$

$$2x^2+x-55=0$$

$$(2x+11)(x-5)=0$$

$$x=-\frac{11}{2},5$$

$x = 5$ can be shown clearly to be a solution but…

try this other solution on your calculator

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$x = 5$ can be shown clearly to be a solution but…

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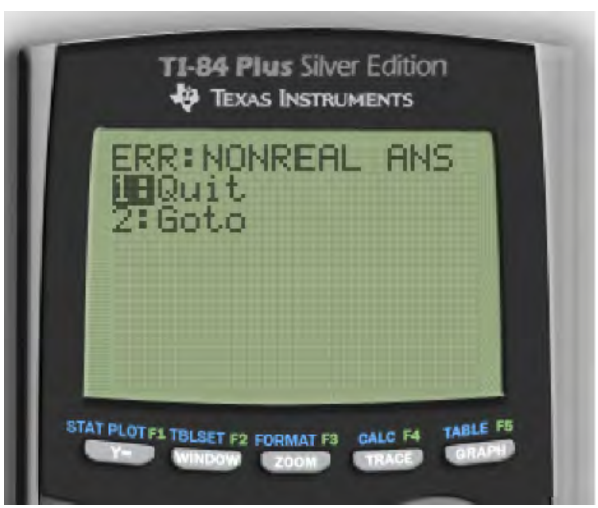
$$\log_3(-\frac{11}{2}+4)+\log_3(-11-7)=3$$

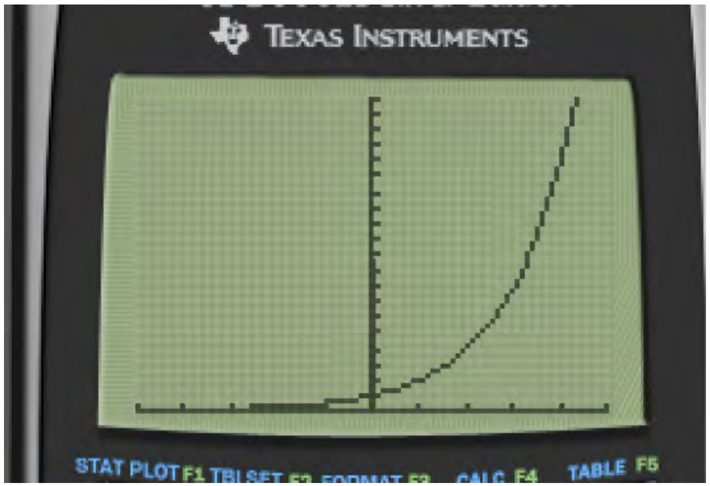
$$\log_3(-\frac{3}{2})+\log_3(-18)=3$$



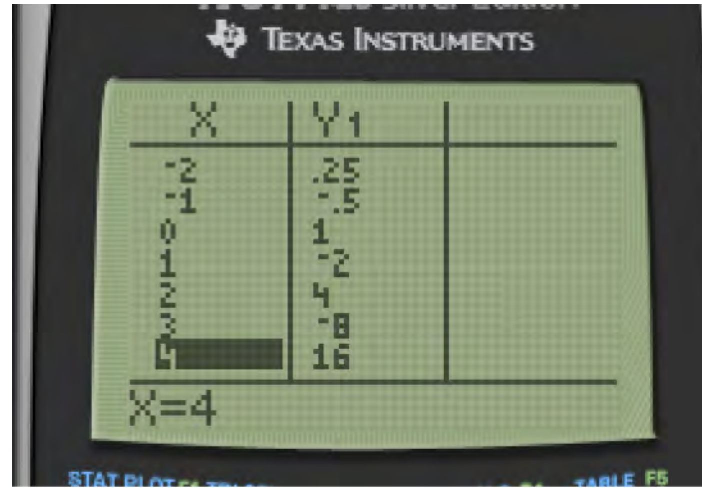
Why did this happen?

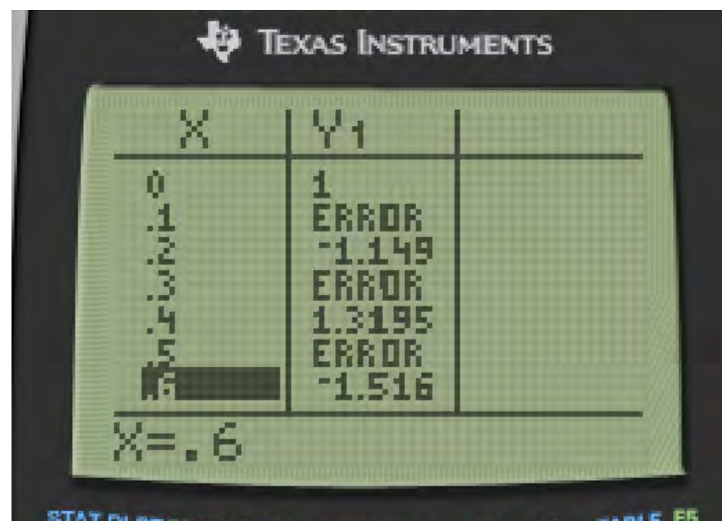
Enter these two functions in your calculator

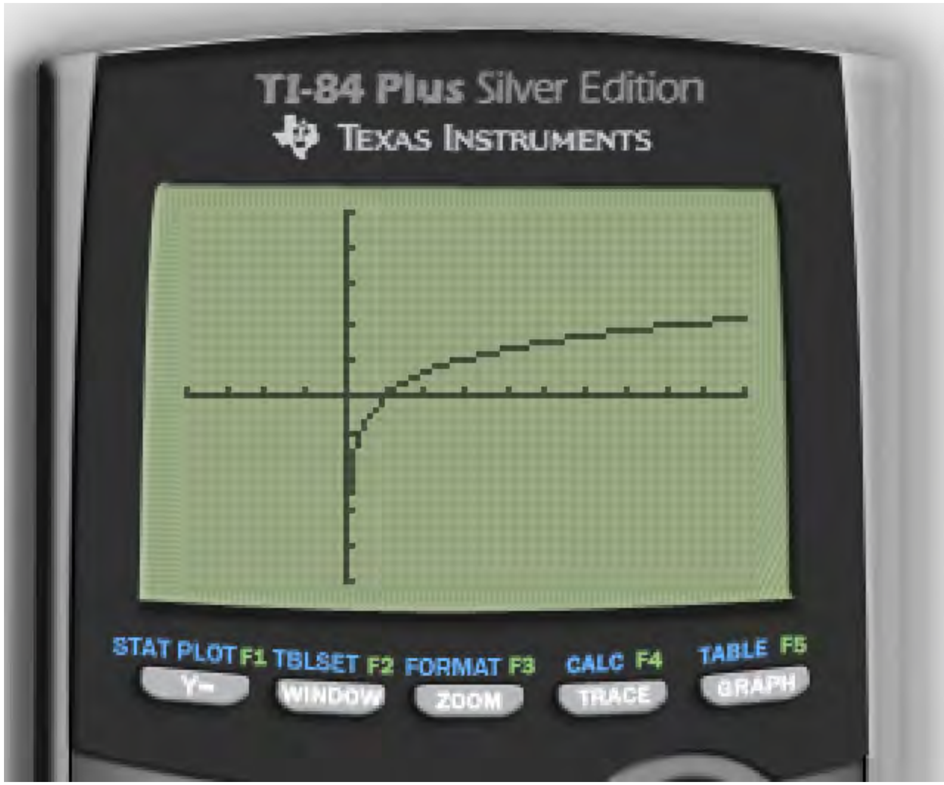
$$y = 2^x$$



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



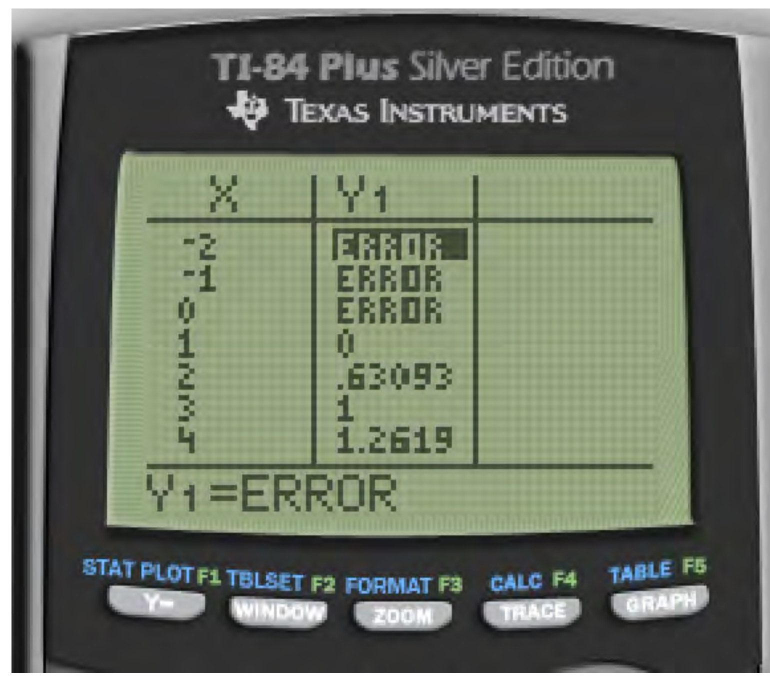




$$y = \log_3 x$$

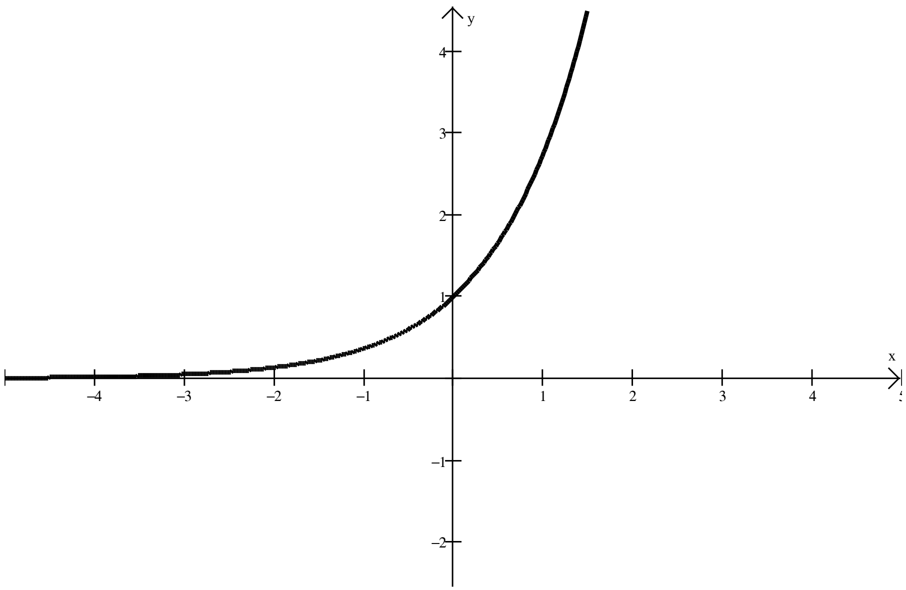
Notice that the graph seems to have the y axis as a vertical asymptote

Now look at some of the table values on the calculator



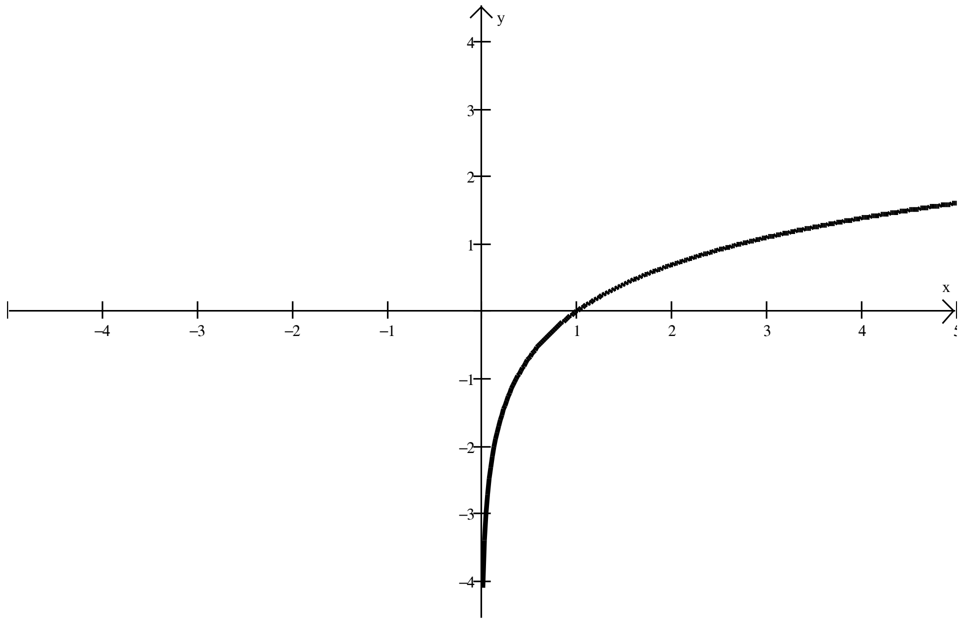
$$y = a^x \quad a > 0$$

The traits are:



1. Domain: All Reals
2. Range: $y > 0$
3. Zeros: None, unless there is a vertical shift
4. y-intercept: $y = 1$
5. Horizontal Asymptote: $y = 0$
6. Extreme Points: Usually none

The traits are:

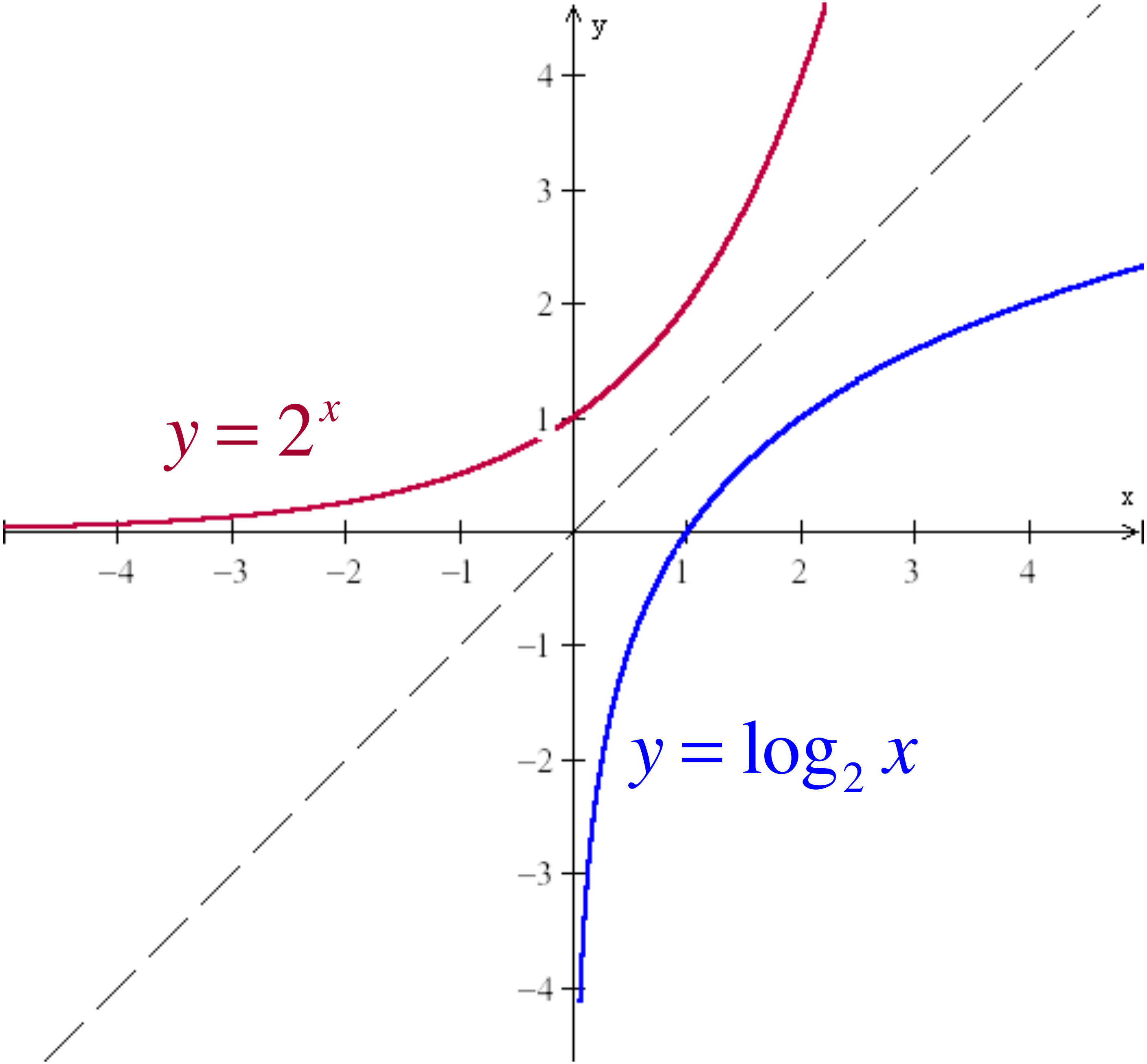


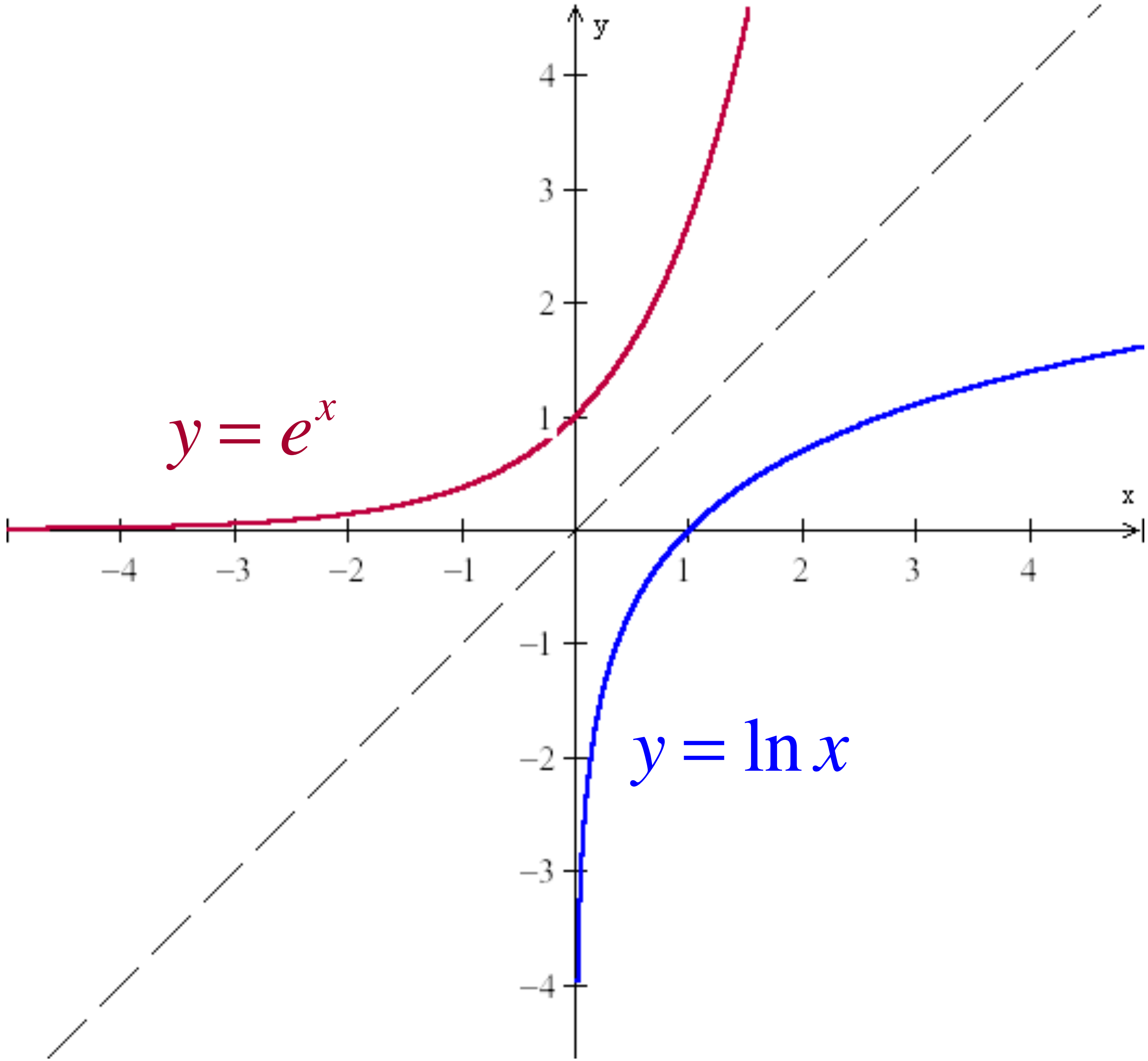
1. Domain: $x > 0$
2. Range: All Reals
3. Zeros: $x = 1$, unless there is a vertical shift
4. y-intercept: None
5. Vertical Asymptote: $x = 0$
6. Extreme Points: Usually none

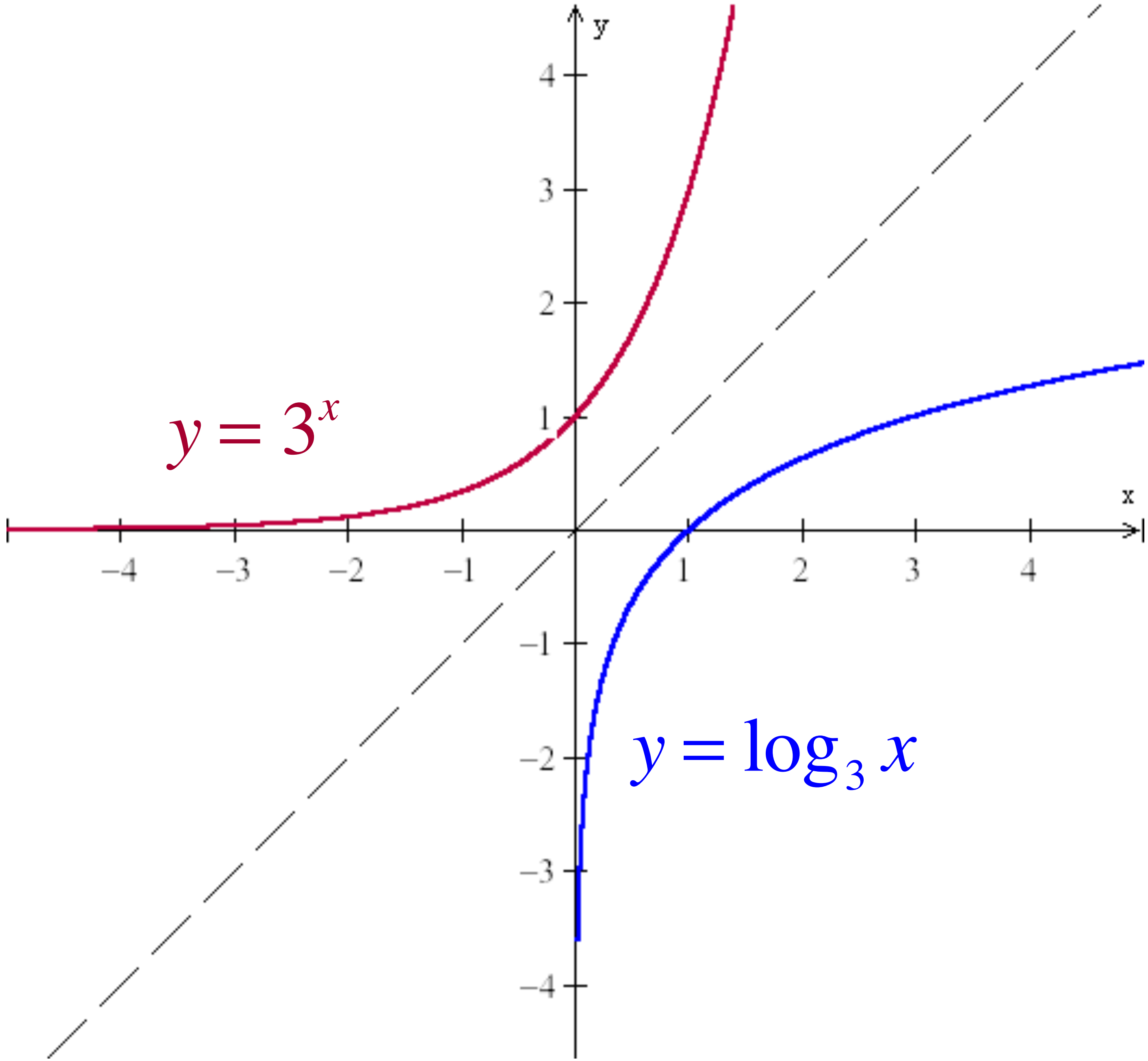
The logarithmic function is the inverse of the exponential function. Inverses are functions that cancel each other, like $y = x^2$ and $y = \sqrt{x}$.

The general graph of a logarithm can be guessed because all inverses have graphs that are symmetric about the line $y = x$.

Like this…


y
4
3
2
1
x
−4
−3
−2
−1
1
2
3
4
−1
−2
−3
−4
$y = 2^x$
$y = \log_2 x$


y
x
4
3
2
1
−1
−2
−3
−4
−4
−3
−2
−1
1
2
3
4
$y = e^x$
$y = \ln x$


y
x
4
3
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1
−1
−2
−3
−4
−4
−3
−2
−1
1
2
3
4
$y = 3^x$
$y = \log_3 x$