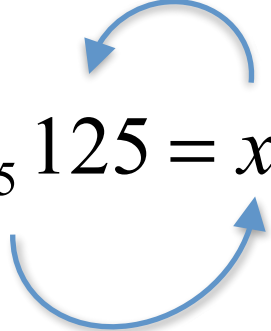


Logarithmic and Exponential Functions

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

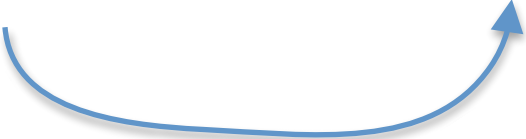


More on this one soon...

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



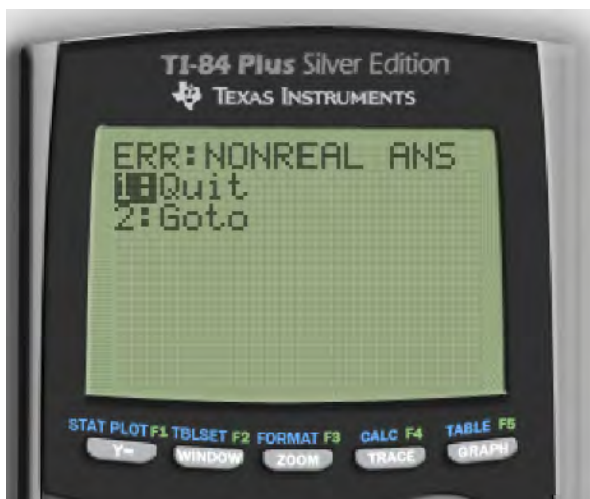
Ex 4 $\log_3(x + 4) + \log_3(2x - 7) = 3$

$x = -\frac{11}{2}, 5$ $x = 5$ can be shown clearly to be a solution but...

try this other solution on your calculator

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

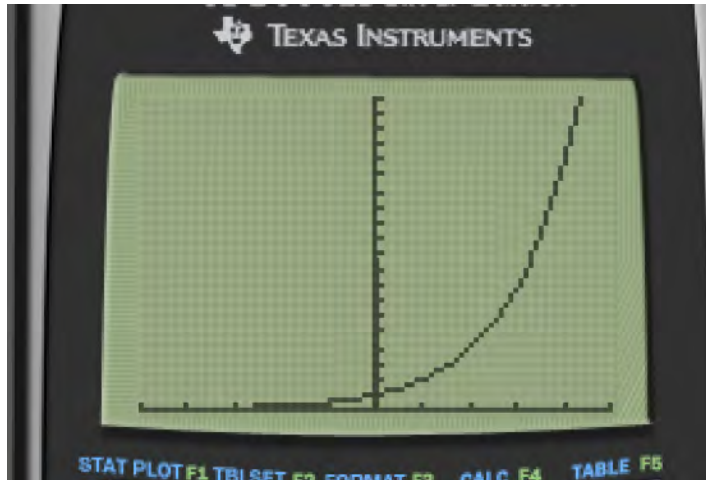
$$\log_3\left(-\frac{3}{2}\right) + \log_3(-18) = 3$$



Why did this happen?

Enter these two functions in your calculator

$$y = 2^x$$



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

A TI-84 Plus calculator screen showing a table of values for the function $y = (-2)^x$. The table has two columns: X and Y1. The x-values range from -2 to 4, and the corresponding y-values are 0.25, -0.5, 1, -2, 4, -8, and 16. The calculator screen shows the Texas Instruments logo at the top and menu options at the bottom: STAT PLOT F1, TBLSET F2, FORMAT F3, CALC F4, and TABLE F5. The current X value is 4.

X	Y1
-2	.25
-1	-.5
0	1
1	-2
2	4
3	-8
4	16

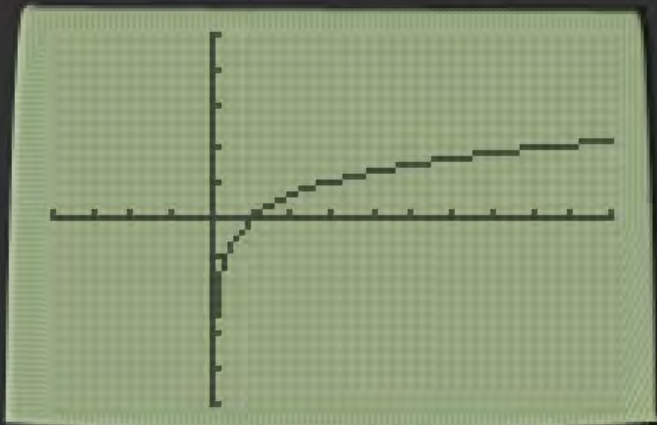
X=4

A TI-84 Plus calculator screen showing a table of values for the function $y = (-2)^x$ with decimal increments. The table has two columns: X and Y1. The x-values range from 0 to 0.6, and the corresponding y-values are 1, ERROR, -1.149, ERROR, 1.3195, ERROR, and -1.516. The calculator screen shows the Texas Instruments logo at the top and menu options at the bottom: STAT PLOT F1, TBLSET F2, FORMAT F3, CALC F4, and TABLE F5. The current X value is 0.6.

X	Y1
0	1
.1	ERROR
.2	-1.149
.3	ERROR
.4	1.3195
.5	ERROR
.6	-1.516

X=.6

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$$y = \log_3 x$$

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

TI-84 Plus Silver Edition
TEXAS INSTRUMENTS

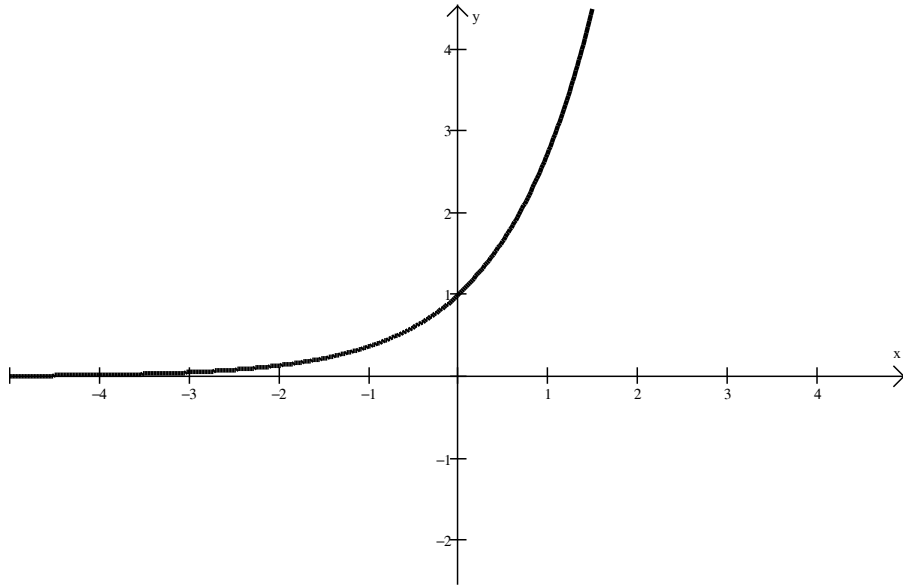
X	Y1
-2	ERROR
-1	ERROR
0	ERROR
1	0
2	.63093
3	1
4	1.2619

Y1=ERROR

STAT PLOT F1 TBLSET F2 FORMAT F3 CALC F4 TABLE F5
Y- WINDOW ZOOM TRACE GRAPH

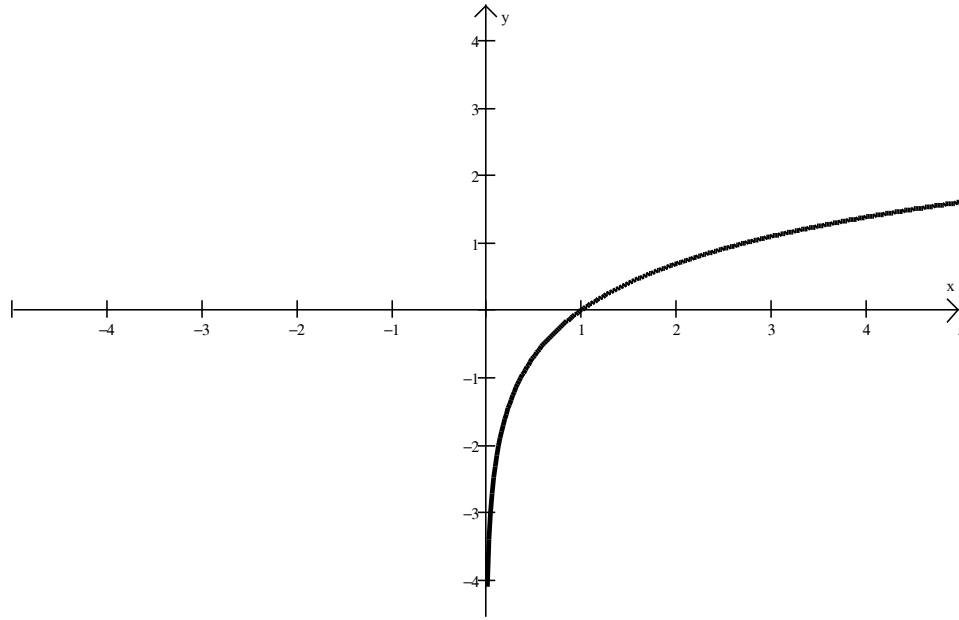
$$y = a^x \quad a > 0$$

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...

