

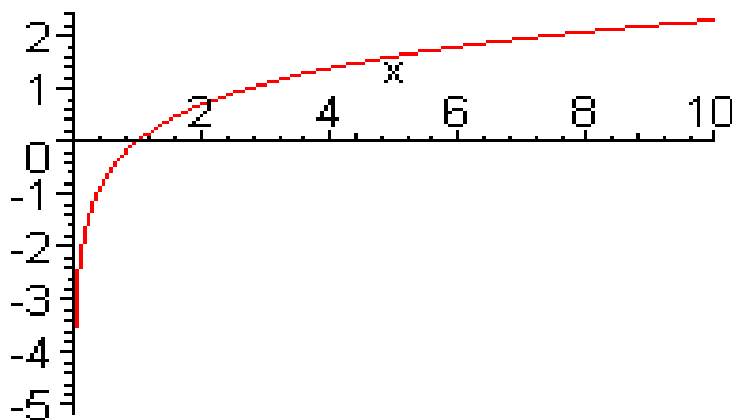
Transformations of Functions

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**Mathematics Enrichment
through Technology**



Since the $\ln 1 = 0$, a good reference point when graphing $y = \ln x$ is $(1, 0)$



Notice, when graphing $y = \ln x$, the x-intercept is 1

Given the following function,

$$y = a + \ln x$$

If: $a > 0$, then shift the graph “ a ” units up,
using the reference point $(1,0)$

If: $a < 0$, then shift the graph “ a ” units down,
using the reference point $(1,0)$

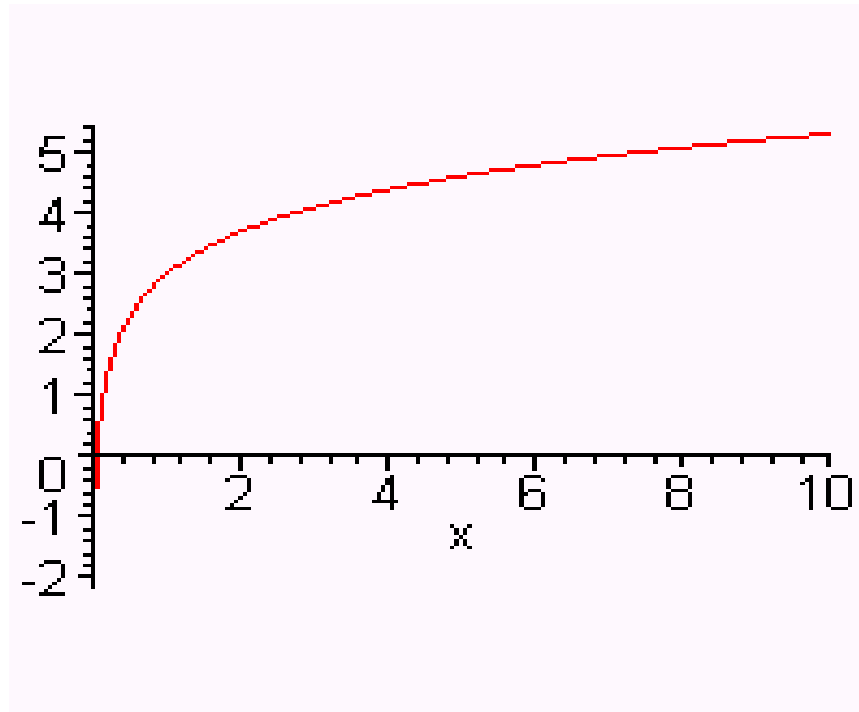
Given the following function,

$$y = 3 + \ln x$$

Since $a > 0$, then shift the graph “3” units up, using the reference point $(1,0)$

Let's Graph

$$y = 3 + \ln x$$

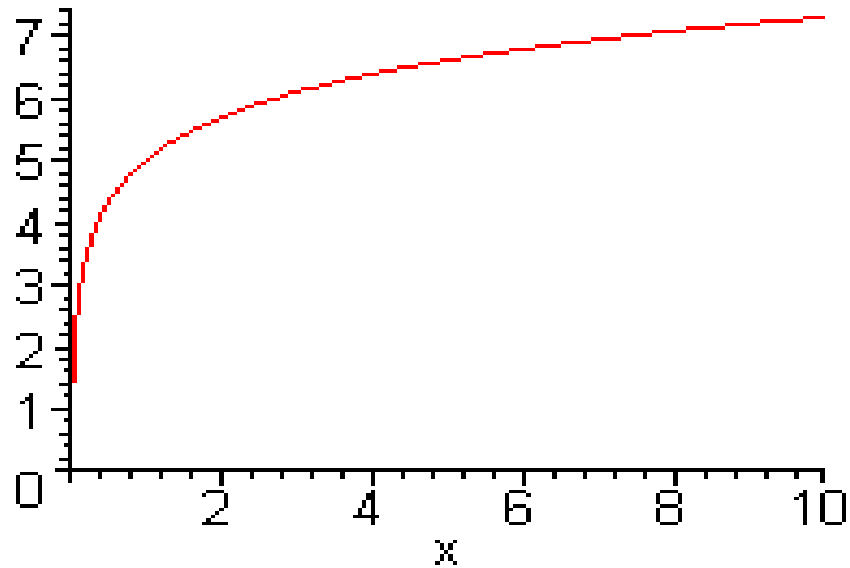


$$y = 5 + \ln x$$

How will the
graph look?

Let's Graph

$$y = 5 + \ln x$$

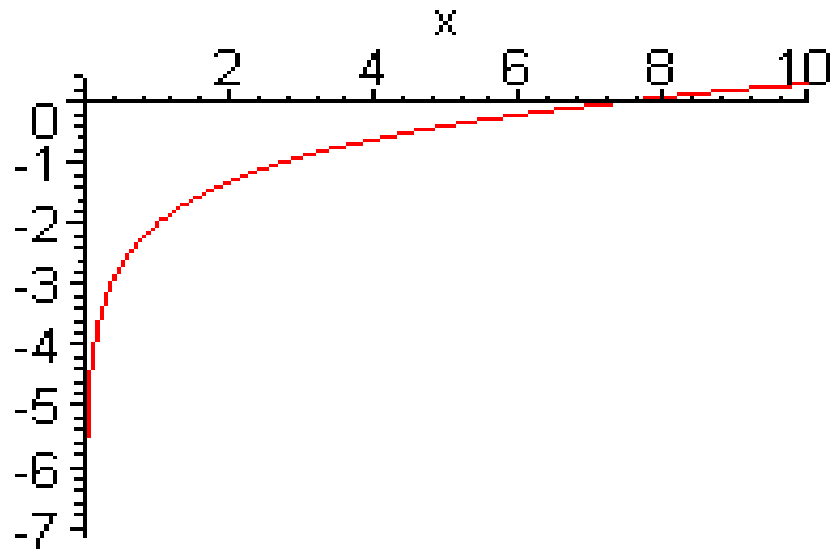


$$y = -2 + \ln x$$

How will the
graph look?

Let's Graph

$$y = -2 + \ln x$$

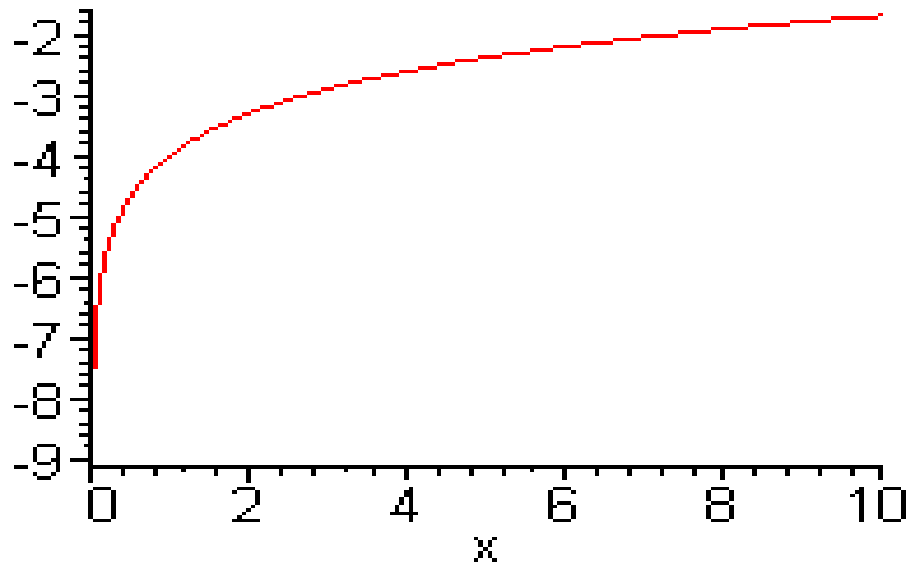


$$y = -4 + \ln x$$

How will the
graph look?

Let's Graph

$$y = -4 + \ln x$$



Given the following function,

$$y = \ln(x - b)$$

We get the expression $(x - b)$

and equal it to zero

$$x - b = 0$$

$$x = b$$

If: $b > 0$, then shift the graph “ b ” units to the right, using the reference point $(1,0)$

If: $b < 0$, then shift the graph “ b ” units to the left, using the reference point $(1,0)$

Given the following function,

$$y = \ln(x - 1)$$

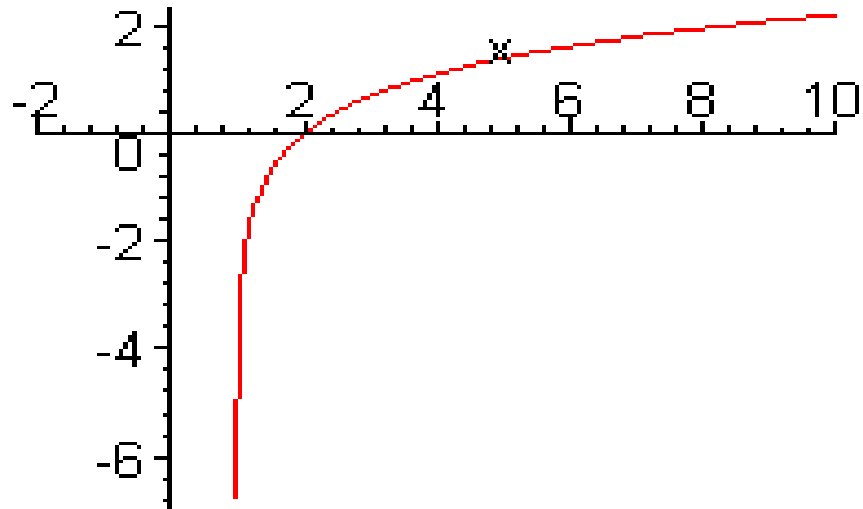
$$x - 1 = 0$$

$$x = 1$$

Since $1 > 0$, then shift the graph “1” unit right, using the reference point $(1, 0)$

Let's Graph

$$y = \ln(x-1)$$

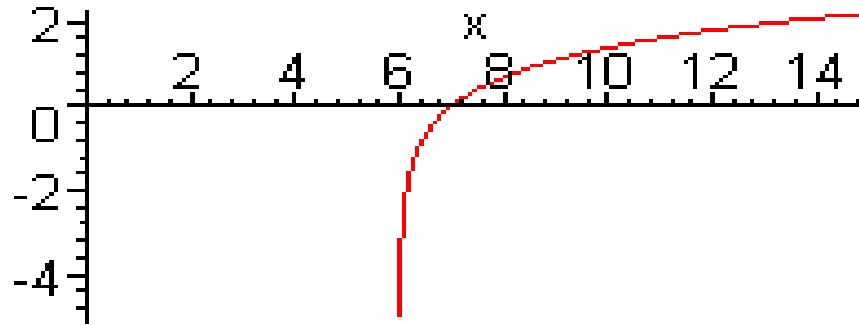


$$y = \ln(x - 6)$$

How will the
graph look?

Let's Graph

$$y = \ln(x - 6)$$

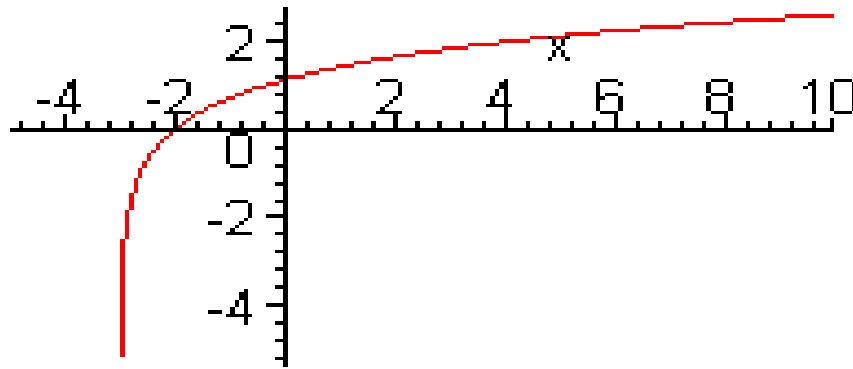


$$y = \ln(x + 3)$$

How will the
graph look?

Let's Graph

$$y = \ln(x + 3)$$

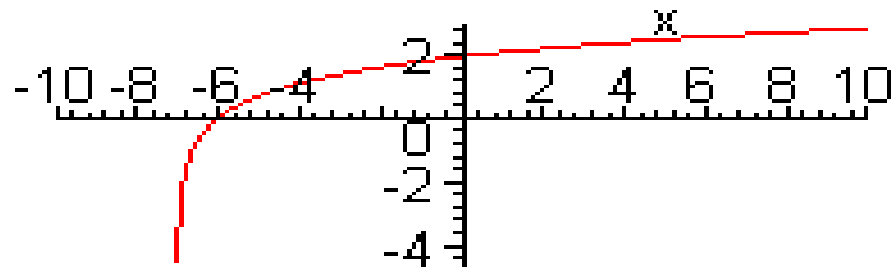


$$y = \ln(x + 7)$$

How will the
graph look?

Let's Graph

$$y = \ln(x + 7)$$



Graphing

$$y = 3 + \ln(x + 1)$$

Recall: Shift "3" units up since $3 > 0$
then we use the expression $x + 1$,
and equal it to zero

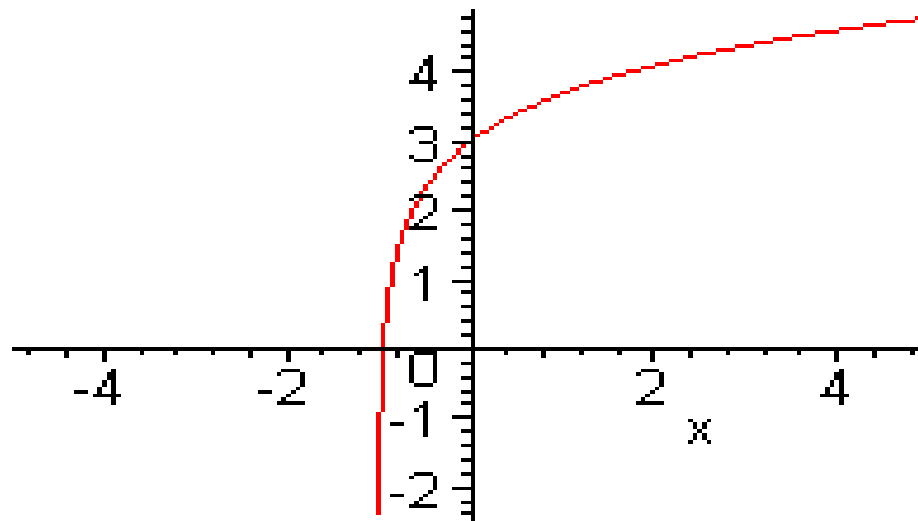
$$x + 1 = 0$$

$$x = -1$$

Since $-1 < 0$, then we shift
"1" unit to the left

Let's Graph

$$y = 3 + \ln(x + 1)$$

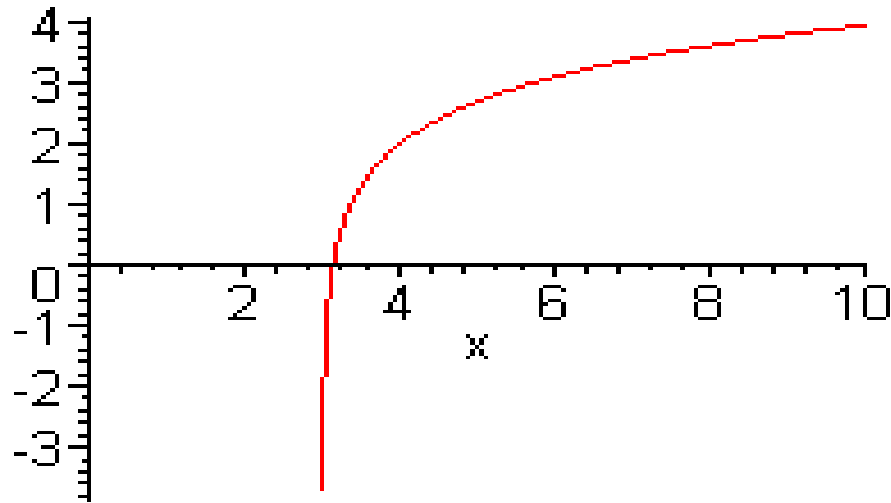


$$y = 2 + \ln(x - 3)$$

How will the
graph look?

Let's Graph

$$y = 2 + \ln(x - 3)$$

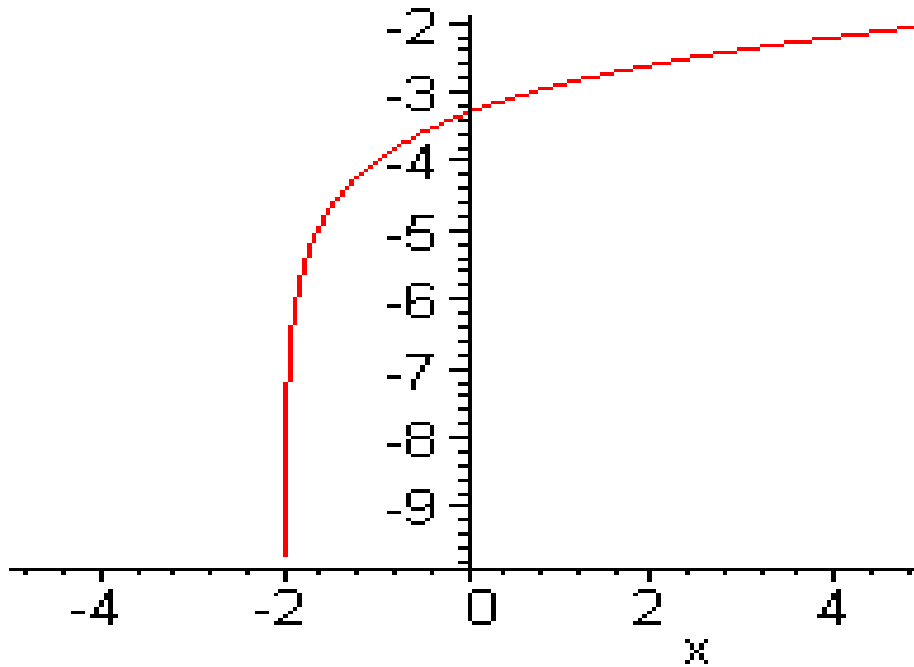


$$y = -4 + \ln(x + 2)$$

How will the
graph look?

Let's Graph

$$y = -4 + \ln(x + 2)$$

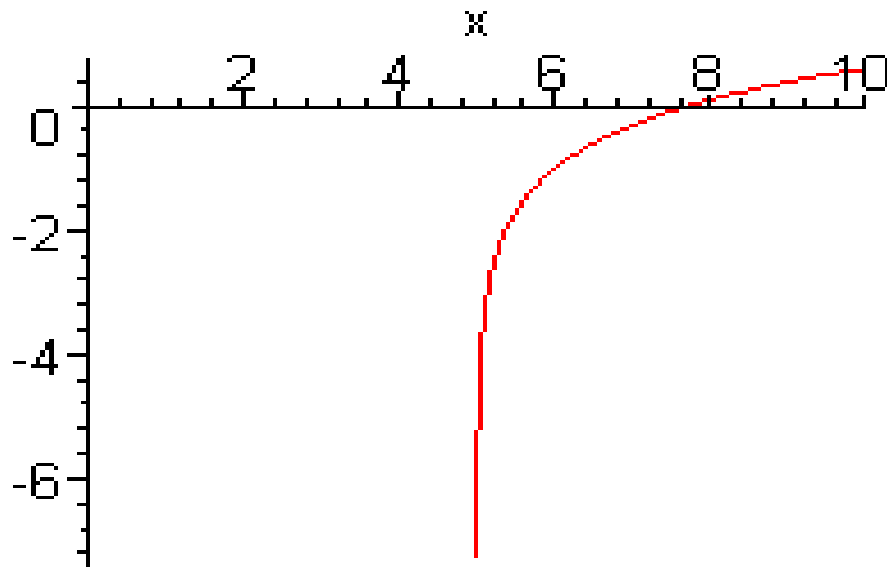


$$y = -1 + \ln(x - 5)$$

How will the
graph look?

Let's Graph

$$y = -1 + \ln(x - 5)$$



Given the following function,

$$y = c \ln x$$

For this equation, c determines
how wide or thin it will be.

if: $|c| > 1$, then the graph is closer to the y-axis

if: $|c| = 1$, then the graph remains the same

if: $0 < |c| < 1$, then the graph is further
from the y-axis

if c is a negative number, then the graph
will reflect on the x-axis

Given the following function,

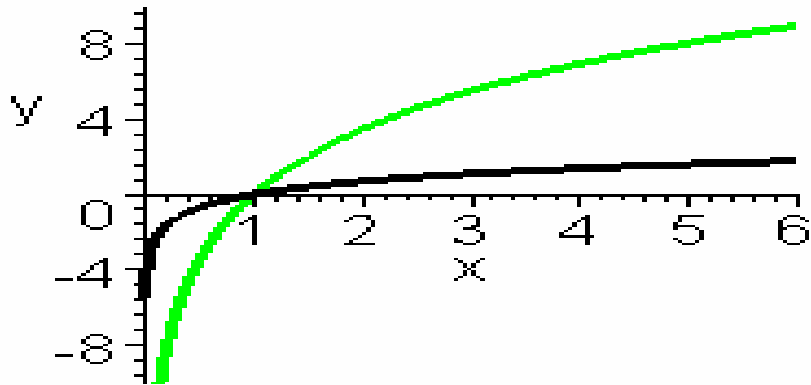
$$y = 5 \ln x$$

Since $|5| > 0$, then the graph is closer to the y-axis

Let's Graph

$$y = \ln x$$

$$y = 5 \ln x$$



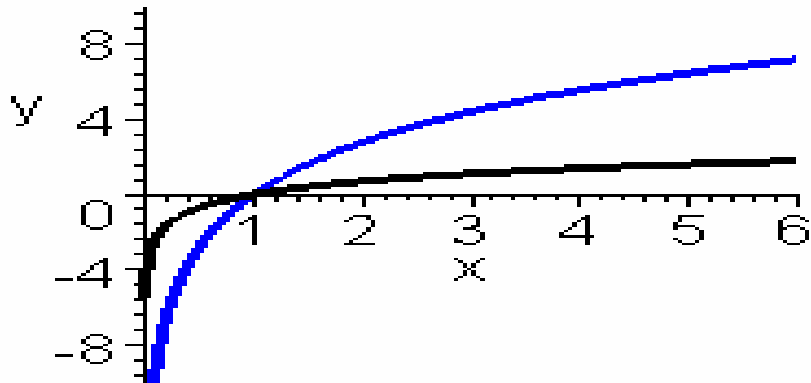
$$y = 4 \ln x$$

How will the
graph look?

Let's Graph

$$y = \ln x$$

$$y = 4 \ln x$$



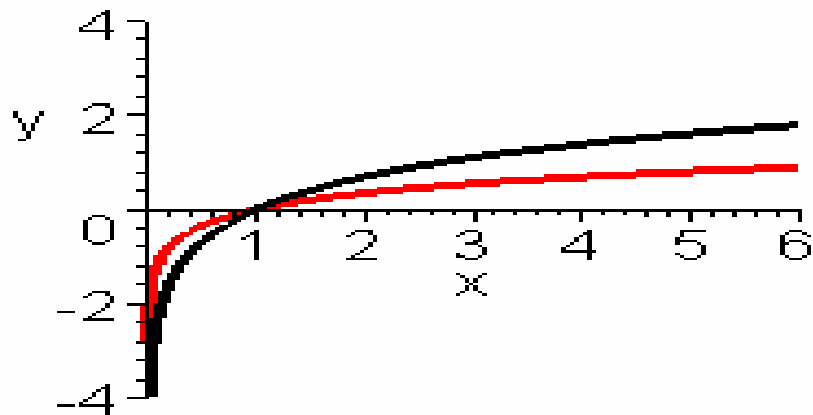
$$y = \frac{1}{2} \ln x$$

How will the
graph look?

Let's Graph

$$y = \ln x$$

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



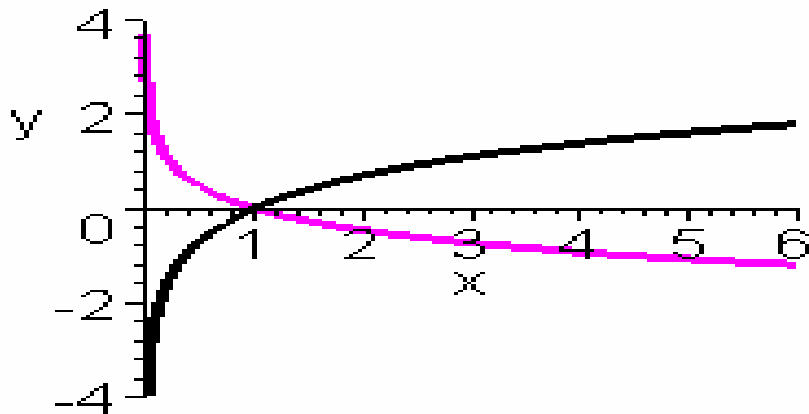
$$y = -\frac{2}{3} \ln x$$

How will the
graph look?

Let's Graph

$$y = \ln x$$

$$y = -\frac{2}{3} \ln x$$



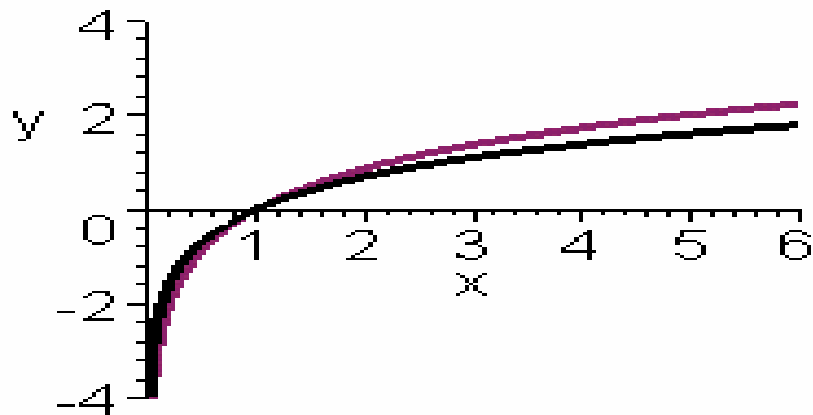
$$y = \frac{5}{4} \ln x$$

How will the
graph look?

Let's Graph

$$y = \ln x$$

$$y = \frac{5}{4} \ln x$$



Given the following function,

$$y = 4 + 5 \ln(x - 1)$$

Since $4 > 0$, shift the graph “4” units up, using the reference point $(1,0)$

$$x - 1 = 0$$

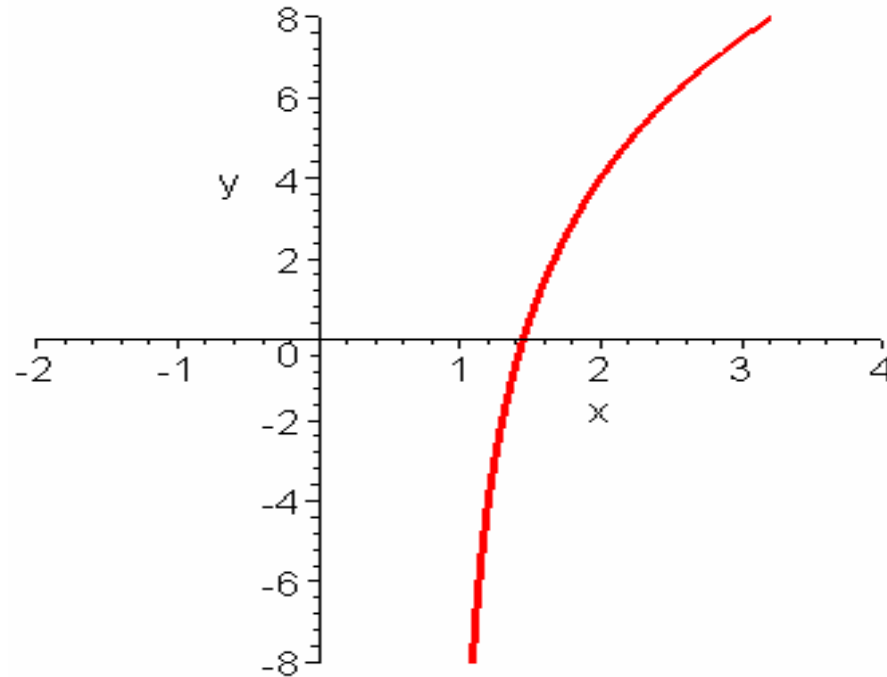
$$x = 1$$

Since $1 > 0$, then shift the graph “1” unit to the right, using the reference point $(1,0)$.

Since $|5| > 0$ shift the graph closer to the y-axis.

Let's Graph

$$y = 4 + 5\ln(x-1)$$

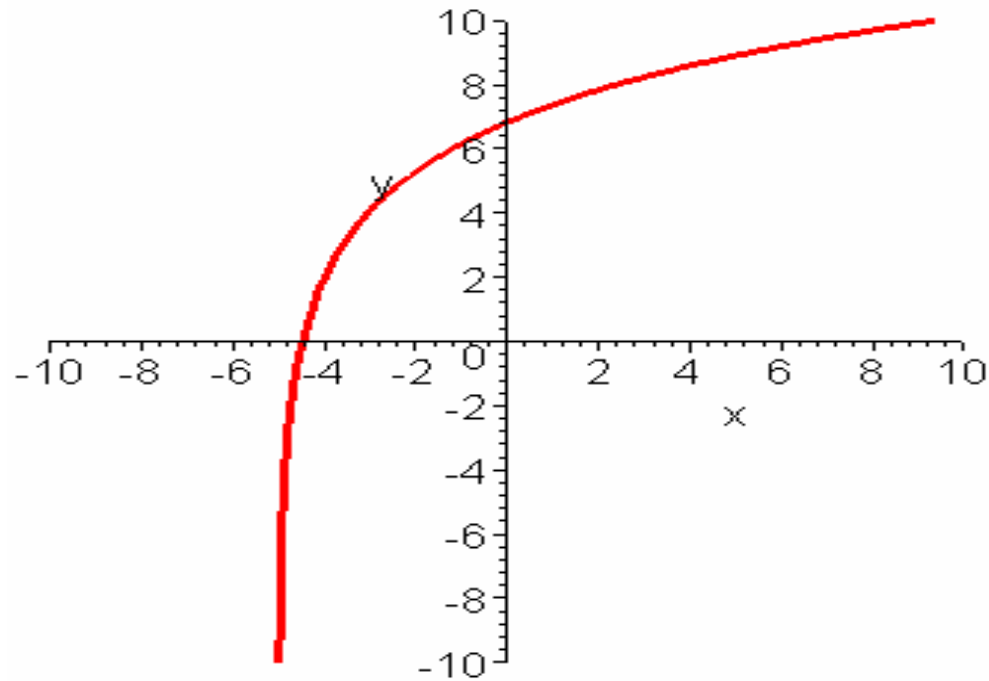


$$y = 2 + 3 \ln(x + 5)$$

How will the
graph look?

Let's Graph

$$y = 2 + 3\ln(x + 5)$$

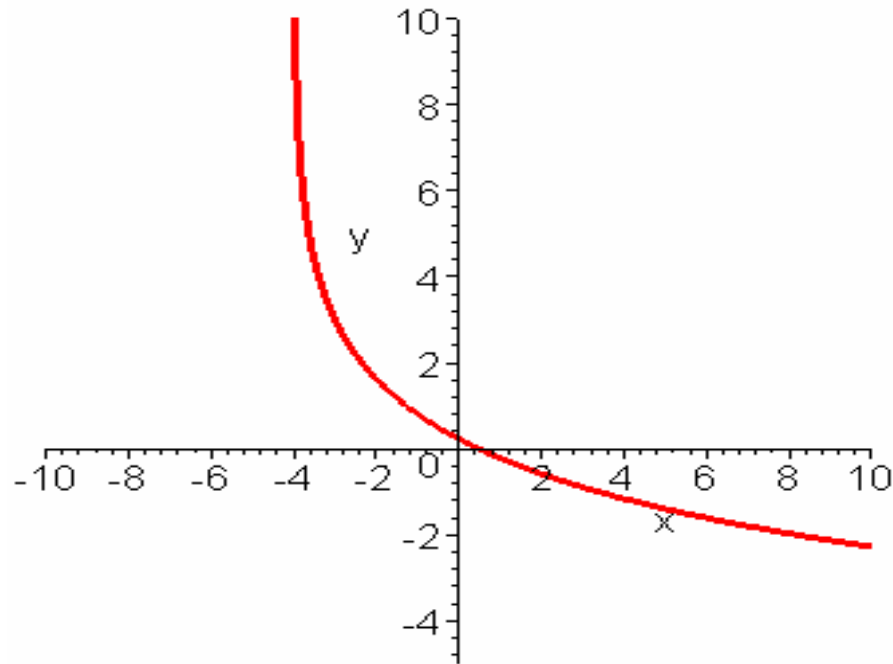


$$y = 3 - 2\ln(x + 4)$$

How will the
graph look?

Let's Graph

$$y = 3 - 2\ln(x + 4)$$

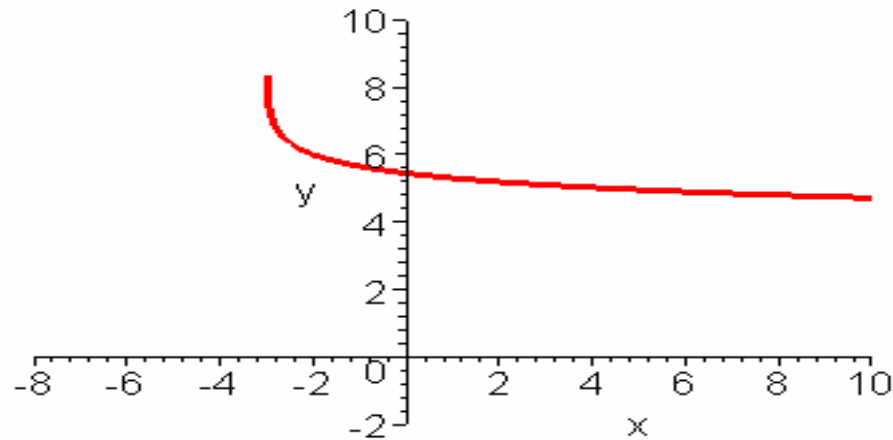


$$y = 6 - \frac{1}{2} \ln(x + 3)$$

How will the
graph look?

Let's Graph

$$y = 6 - \frac{1}{2} \ln(x + 3)$$

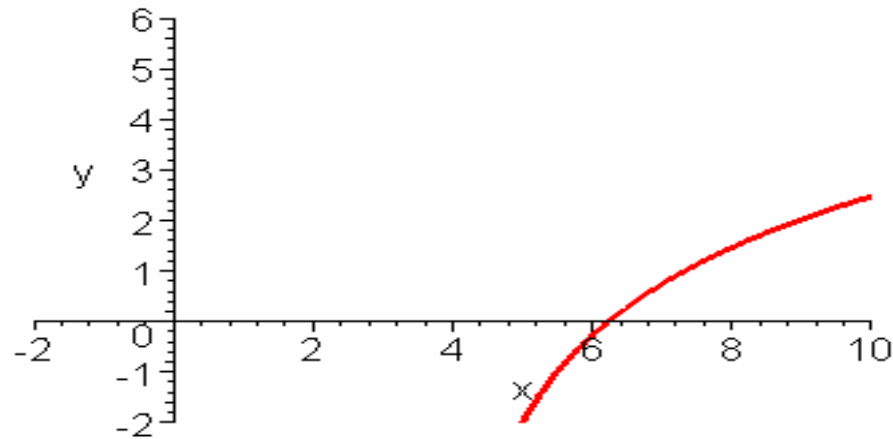


$$y = -2 + \frac{5}{4} \ln(x - 4)$$

How will the
graph look?

Let's Graph

$$y = -2 + \frac{5}{4} \ln(x - 4)$$

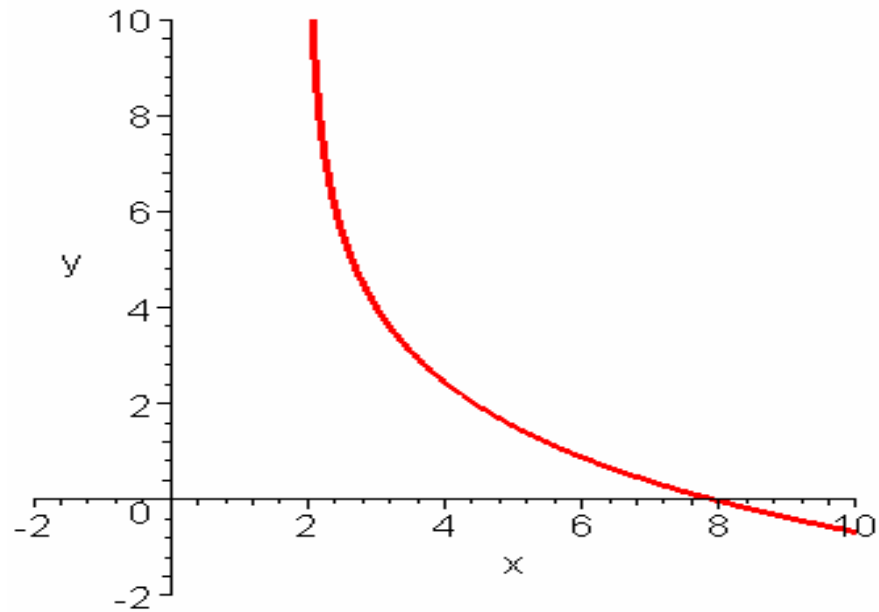


$$y = 4 - \frac{9}{4} \ln(x - 2)$$

How will the
graph look?

Let's Graph

$$y = 4 - \frac{9}{4} \ln(x - 2)$$

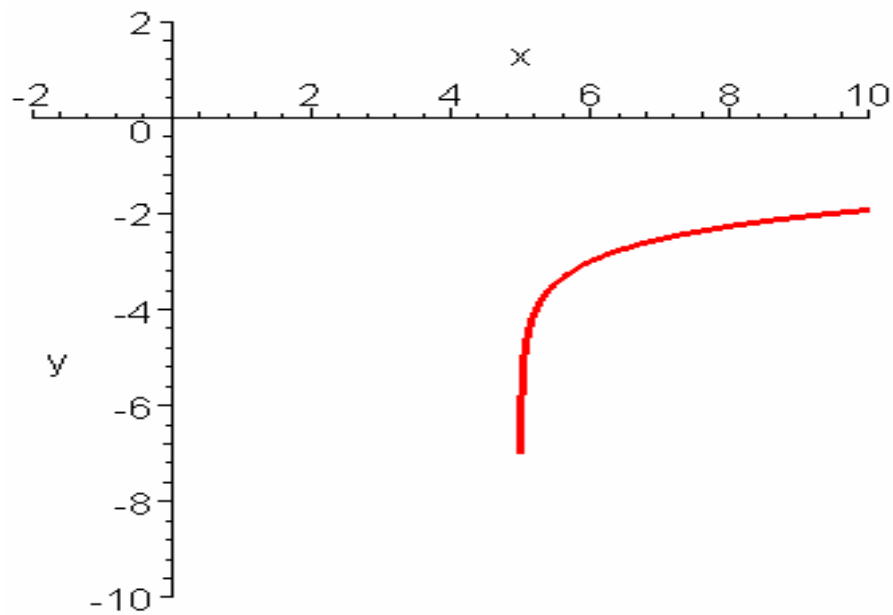


$$y = -3 + \frac{2}{3} \ln(x - 5)$$

How will the
graph look?

Let's Graph

$$y = -3 + \frac{2}{3} \ln(x - 5)$$

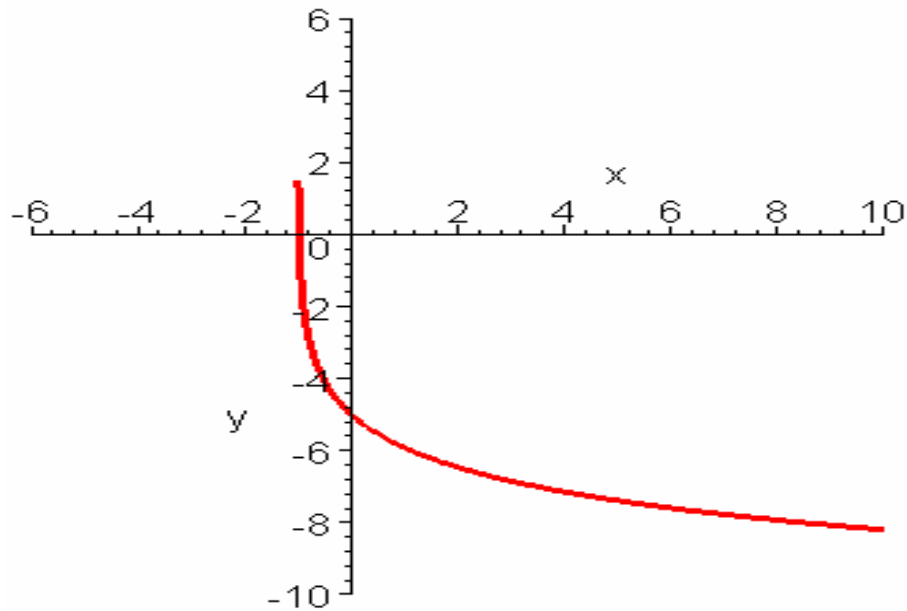


$$y = -5 - \frac{4}{3} \ln(x+1)$$

How will the
graph look?

Let's Graph

$$y = -5 - \frac{4}{3} \ln(x+1)$$



Congratulations!!

You just completed the
transformation of

$$y = \ln(x)$$