Algebra IIB Math
Lesson: April 8, 2020

**Learning Target:**
Students will graph logarithmic functions

**Let's Get Started:**
Watch Video: Graphing a Logarithm - Made Easy

https://www.youtube.com/watch?v=q9DhlR43P7A

# That was easy?!?!!!!

## Key Points:

$$y = \log_b x$$

- Logarithmic functions are INVERSES of Exponential functions
- The ASYMPTOTE of a logarithmic function is VERTICAL
- If the base (b)>1 then the graph will be INCREASING (GROWTH)
- If the base 0<(b)<1 then the graph will be DECREASING (DECAY)

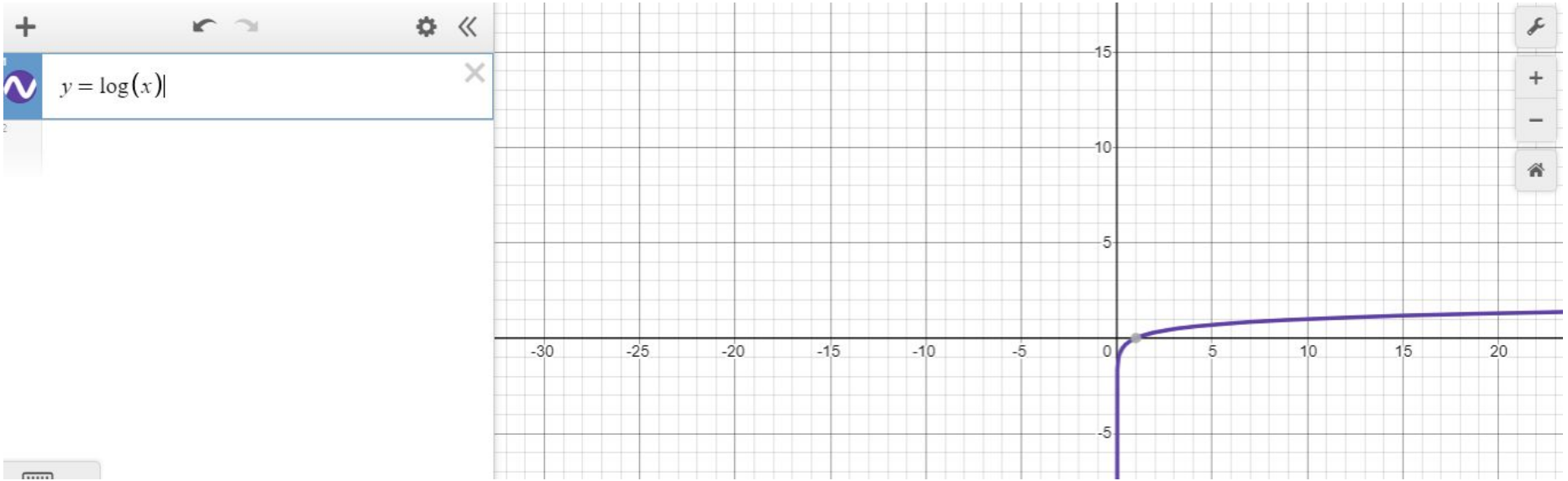
## Other standard notation:

If no base is given (y=log30) then the base is assumed to be 10.

$\text{Log}_{e(}x)$ is the same as ln(x). Ln is used for natural logs which are logs with base e. Remember that e is an irrational number approximately equal to 2.718281828459.

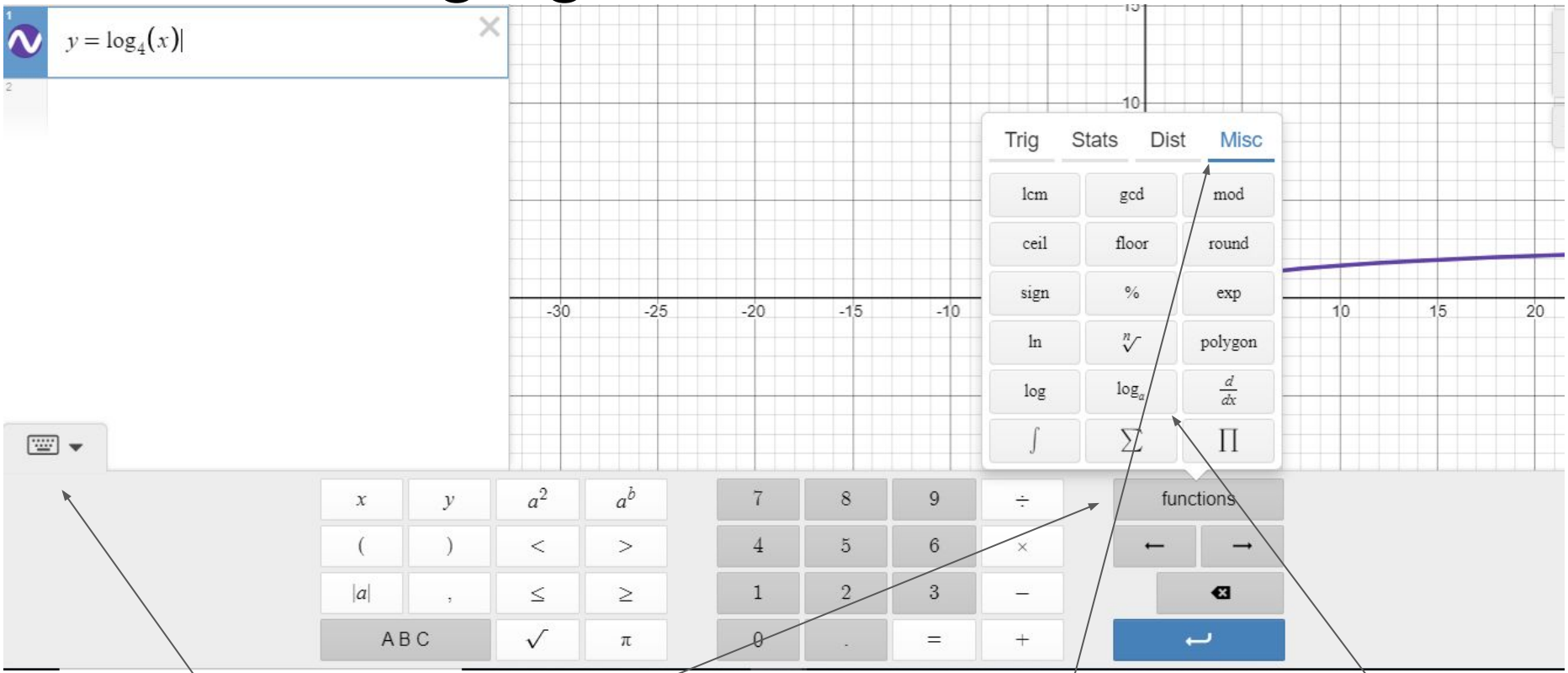
# Let's make it easier by using a graphing calculator. Go to www.desmos.com and click Start Graphing.

Type in the parent function y=log(x)




Notice:
The vertical asymptote is at x=0
The x-intercept is at (1,0)

# Changing the base in Desmos

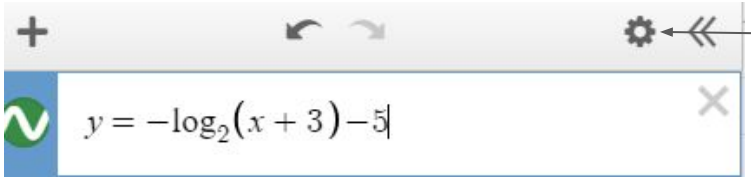



Hit the Keyboard icon, select the “functions” button, click on the “Misc” button and select “loga”

**How did changing the base to 4 change the graph? How is it the same as the parent function?**

# Making Tables in Desmos

Graph $y = -\log_2(x+3) - 5$




Click on the gear icon


Click on the table icon

| $x$ | $-\log_2(x+3)$ |
|---|---|
| −2 | −5 |
| −1 | −6 |
| 0 | −6.5849625 |
| 1 | −7 |
| 2 | −7.3219281 |
| −3 | undefined |

You can add numbers to the bottom of the x column.

- List 3 points that can be easily graphed.
- Can you tell from the table where the vertical asymptote is going to be?
- Is that number anywhere in the equation?

You should have noticed that the vertical asymptote is the number inside the parentheses with the x but has the opposite sign.  If you add that number to the bottom of your table, the y-value is “undefined”.

**Graph each logarithm and identify**

a. **3 points that you can easily graph**
b. **The vertical asymptote**
c. **The approximate x-intercept**
d. **The approximate y-intercept (if there is one)**

SUPER IMPORTANT HINT!
To type in a fractional base like on the first problem

1. Type in: y=3log(1/3)(x)+2
2. Highlight (1/3)
3. Press shift underscore

**1)** $3\log_{\left(\frac{1}{3}\right)}(x)+2$

**2)** $-\log_3\left(-\frac{1}{3}x\right)$

**3)** $-2\log_{\left(\frac{1}{2}\right)}(x-3)-3$

**4)** $-\log_3(3x-6)$

**5)** $2\log_2(-x)+5$

**6)** $\log_4(-4x-8)-4$

**7)** $\log_4(-4(x+2))-4$

**8)** $\ln(x+2)$

**9)** $-2\ln(x)+4$

# Answer to number 1

$$3\log_{\left(\frac{1}{3}\right)}(x)+2$$

| | |
|---|---|
| 0 | undefined |
| 1 | 2 |
| 2 | 0.10721074 |
| 3 | −1 |
| 4 | −1.7855785 |
| 5 | −2.3949206 |
| 6 | −2.8927893 |
| 7 | −3.3137312 |
| 8 | −3.6783678 |
| 9 | −4 |

a. (1,2) (3,-1) (9,-4)

b. x=0

c. (2.08, 0) hover over intercept

d. none