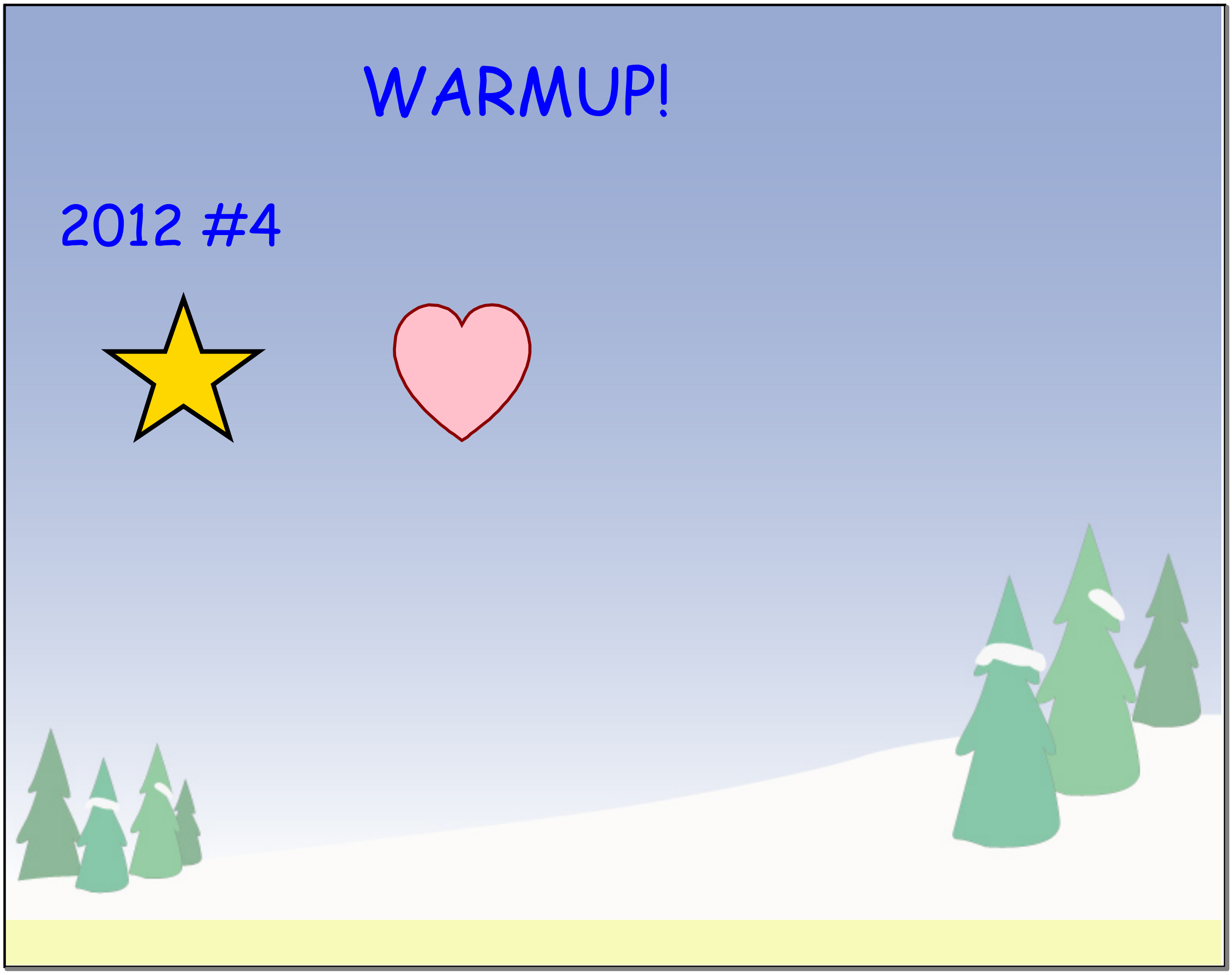
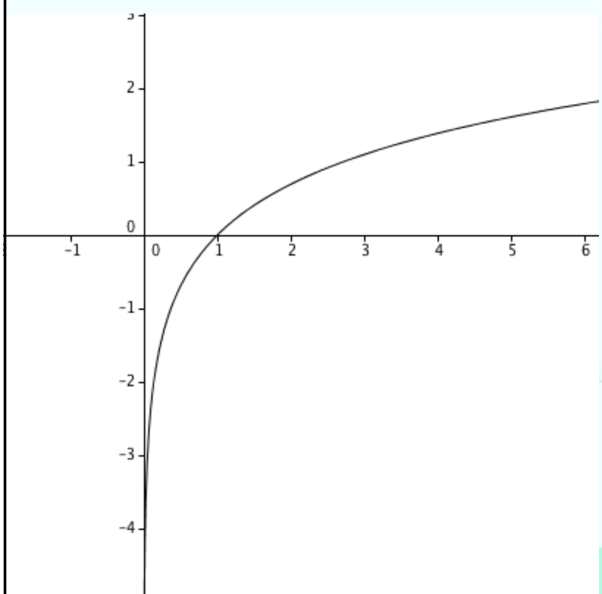

WARMUP!
2012 #4

WARMUP #2!!

Based on the graph of y = lnx below, state the following:



a) domain of y = lnx

$(0, \infty)$

b) range of y = lnx

$(-\infty, \infty)$

c) $\lim_{x \to 0^+} \ln(x) =$ $-\infty$

d) $\lim_{x \to 0^-} \ln(x) =$ DNE

e) $\lim_{x \to 0} \ln(x) =$ DNE

f) $\lim_{x \to \infty} \ln(x) =$ ∞

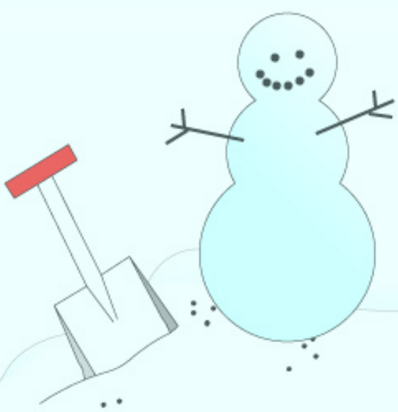
5.1a Logarithm Review!

At the end of this lesson you will be able to:

> Use the properties of logs to expand and condense logarithmic expressions

> Sketch simple graphs of log functions

> Evaluate limits involving log functions



John Napier, 1550 - 1617

Born in Edinburgh, Scotland, John Napier was the first to 'discover' logarithms. He created 90 pages of tables of numbers which were basically the reverse of exponentials.

These tables allowed mathematical calculations to be done much more quickly and easily and became known as Napier's logarithms which were later converted to natural logarithms. He also created a multiplication algorithm known as Napier's bones.

Napier loved studying the book of Revelation, and published his own book in which he claimed that the current pope at the time was the anti-Christ, that the 7th trumpet had sounded in 1541, and that the apocalypse would occur in either 1688 or 1700. He also loved studying magic and the occult, and carried a small black spider around in a little box.

Napier was contracted to search for a treasure within Fast Castle, which was never found.

What is a logarithm??

A logarithmic function is the inverse of an exponential function.

So if: $a = b^c$ then $\log_b a = c$

ex) $2^3 = 8$ then $\log_2 8 = 3$

$\log 100 = 2$

if there is no base, it's 10

"common log"

$\ln 100 = ?$

if ln, base is e

"natural log", $e \approx 2.718281\ldots$

Properties of Logs!

1) $\ln(1) = 0$

2) $\ln(e) = 1$

BTW:
$\ln(e^2) = 2$
$\ln(e^3) = 3$
$\ldots$

3) $\ln(ab) = \ln a + \ln b$

4) $\ln(a / b) = \ln a - \ln b$

5) $\ln(a^n) = n \ln a$

GOTCHAS!

$\ln(a) / \ln(b) \neq \ln\left(\frac{a}{b}\right)$

$(\ln(a))^n = \ln^n(a) \neq \ln(a^n)$

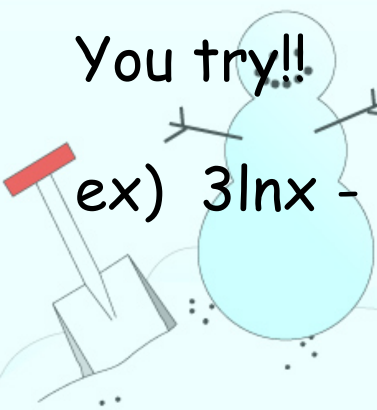
$\ln(a+b) \neq \ln a + \ln b$

If it's too tense, let's condense!

ex) $2(\ln x - \ln(x + 1) + \ln(x - 1)) =$

$$= \ln\left(\frac{x(x-1)}{x+1}\right)^2$$

You try!!



ex) $3\ln x - (2\ln y + 4\ln z) = \ln\left(\frac{x^3}{y^2 z^4}\right)$

Life's so grand, let's expand!!

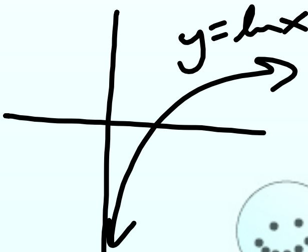
ex) $\ln(3e^2) = \ln 3 + \ln e^2 = \ln 3 + 2$

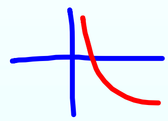
You try!

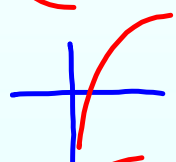
ex) $\ln(ab\sqrt{c+5}) = \ln a + \ln b + \frac{1}{2}\ln(c+5)$

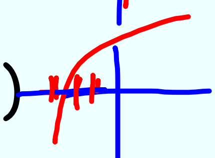
Let's have a laugh with some fun with a graph!

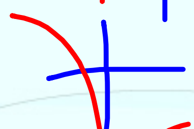
Use your knowledge of the graph of $y = \ln x$ to sketch quick graphs of the following:

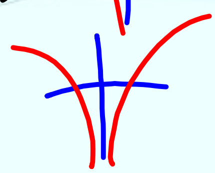


a) $y = -\ln x$ 

b) $y = \ln x + 3$ 

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

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

e) $y = \ln|x|$ 

$y = \ln x$

$e^y = x$

Let's do some review! (calculators permitted)

$-8x^2 + 5xy + y^3 = -149$

a) Find dy/dx

b) Write an equation for the line tangent to the curve at (4, -1)

c) There is a number, k, so that the point (4.2, k) is on the curve. Using the tangent line found in part b, approximate the value of k.

d) Write an equation that can be solved to find the actual value of k so that the point (4.2, k) is on the curve.

e) Solve the equation found in part d) for k.

a) $dy/dx = (16x - 5y) / (5x + 3y^2)$

b) $y + 1 = 3(x - 4)$ or $y = 3x - 13$

c) $y = -.4$

d) $-8(4.2)^2 + 5(4.2)k + k^3 = -149$

e) $k \approx -.373$

What have we learned?

- Can I expand and condense logarithmic expressions?
- What does the graph of $y = \ln x$ look like?