Name: _____

CLASSWORK 63

1. Find this limit using the calculator. (suggestion: table function & Y1)

$$\lim_{n\to\infty} \frac{n}{\sqrt[n]{n!}}.$$

2. Find the value of each expression.

a) $\log_2 32 =$ b) $\log_4 64 =$ c) $\log_{25} 5 =$ d) $\log\ 10000 =$

3. Find the value of each expression.

a) $\ln\ 3 =$ b) $\ln\ 15 =$ c) $\ln 200 =$

Now raise **e** to each of the answer powers to show your answer is correct.

4. Find the value of each expression.

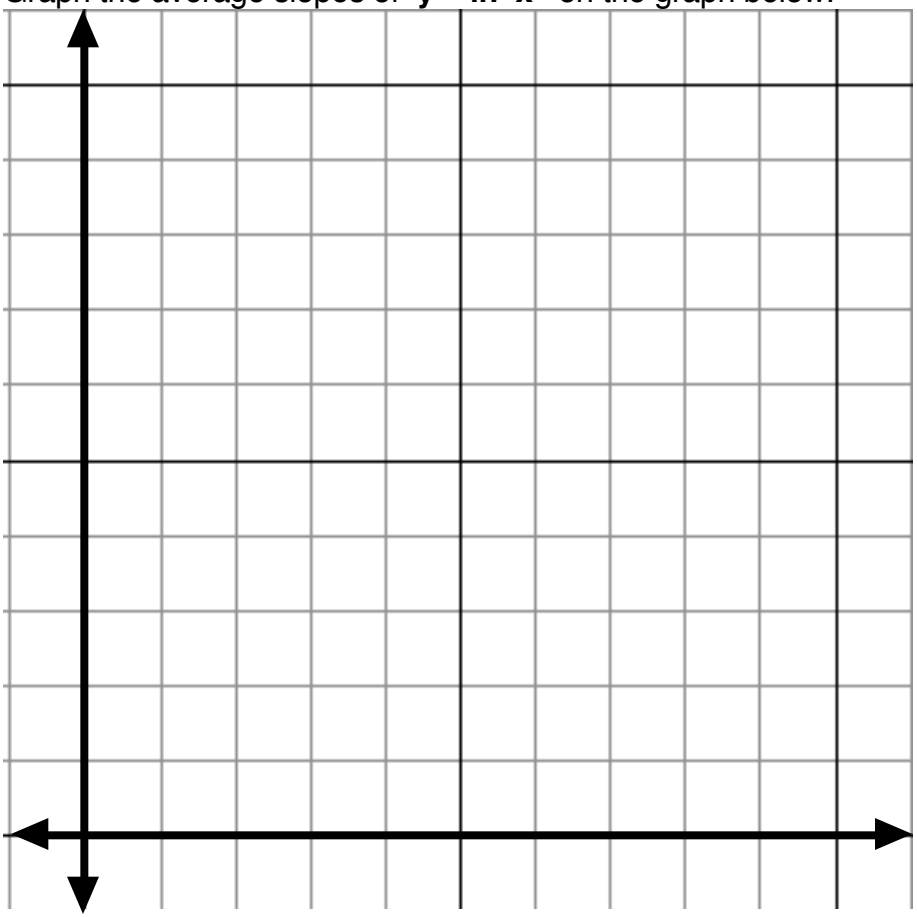
a) $\ln\ 1 =$ b) $\ln\ e =$ c) $\ln\ e^2$

Explain using an exponential expression why each answer makes sense.

5. Let's investigate the derivative of **y = ln x** . We're going to use small intervals to approximate the derivative at different points.

x	f(x) = ln x	2nd point near x	Δ y	Δ x	slope over the interval	x
10		(10.001,)				10
5		(5.001,)				5
4		(4.001,)				4
3		(3.001,)				3
2		(2.001,)				2
1		(1.001,)				1
.5		(0.5001,)				.5
.25		(0.2501,)				.25
.2		(0.2001,)				.2
.1		(0.1001,)				.1

Graph the average slopes of **y = ln x** on the graph below.



What is the derivative of y = ln x ? Use the calculator to check this answer.

Explain why no polynomial of the form Cx^n could give that derivative.

6. a) Find the derivative of $y = x \cdot \ln x$

b) Use nDeriv on the calculator and check if that function matches your answer.

c) Use the derivative to find the slope of the graph at $x = 3$

d) Find the slope of the function over the interval between $x = 3$ and $x = 3.001$

7. a) Find the derivative of $y = \frac{\ln x}{x}$

b) Use the nDeriv function on the calculator to check your answer.

Can we **proove** that the derivative of ln x is 1/x ?

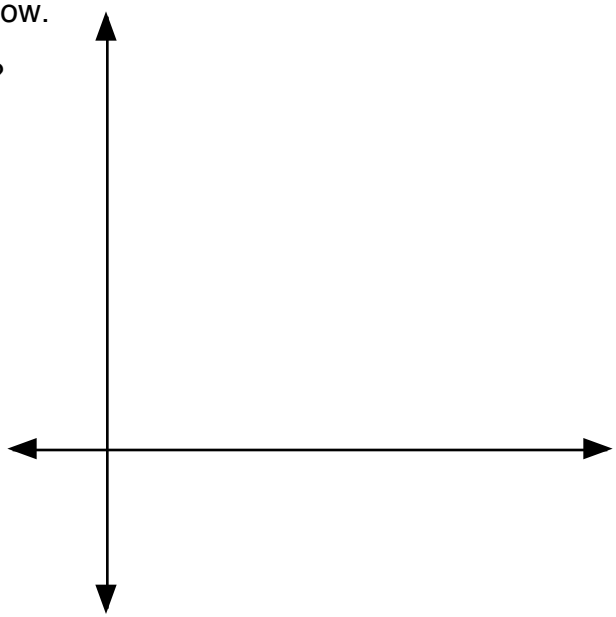
We need these properties of logarithms and natural logarithms:

1) $\log a - \log b = \log (a/b)$ 2) $\log a^b = b \cdot \log a$

8. Sketch a graph of the function $y = e^x$ on the axes below.

a) Where is the derivative positive? Where is it negative?

b) Where is the derivative the smallest?
Where is the derivative the highest?



c) Use this information to sketch a graph of the derivative on the same axes.

9. Let's investigate the derivative of $y = e^x$ with numerical methods.

x	$f(x) = e^x$	2nd point near x	Δy	Δx	slope over the interval	x
-1		(-1.001,)				-1
-0.5		(-.501,)				-0.5
0		(.001,)				0
0.5		(.501,)				0.5
1		(1.001,)				1
2		(2.001,)				2
3		(3.001,)				3
4		(4.001,)				4

What is the derivative of $y = e^x$? Use the calculator to show you are right.