WARMUP

1) Fill in the chart to the nearest thousandth.

a)

h	$\frac{(2^h-1)}{h}$
1	1
0.1	0.718
0.01	0.696
0.001	0.693
0.0001	0.693

$\lim_{h\to 0}\frac{2^h-1}{h} = \ln 2$

b)

h	$\frac{(3^h-1)}{h}$
1	1
0.1	
0.01	
0.001	
0.0001	1.099

$\lim_{h\to 0}\frac{3^h-1}{h} = \ln 3$

2) What is the value to the nearest thousandth of:

a) $\ln 2$? 0.693 b) $\ln 3$? 1.099

Section 3.2 The Exponential Function

$f(x) = 2^x$

$$f'(x) = \lim_{h\to 0}\frac{2^{x+h}-2^x}{h} = \lim_{h\to 0}\frac{2^x\cdot 2^h - 2^x}{h}$$

$$= \lim_{h\to 0}\frac{2^x(2^h-1)}{h} = 2^x\cdot\lim_{h\to 0}\frac{2^h-1}{h}$$

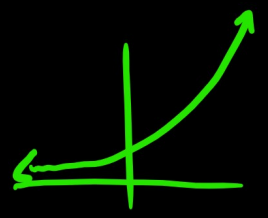
$$f'(x) = 2^x\cdot\ln 2$$

$f(x) = 3^x$

$f'(x) = 3^x\cdot\ln 3$

In general $\frac{d}{dx}\left[a^x\right] = a^x \cdot \ln a$

In general $\frac{d}{dx}\left[e^x\right] = e^x \cdot \ln e = e^x \cdot 1 = e^x$



$\frac{d}{dx}\left[x^n\right] = nx^{n-1}$

ex: $f(x) = \pi^x + x^\pi$ (a^x: $a = \pi$; x^n: $n = \pi$)

$f'(x) = \pi^x \cdot \ln \pi + \pi x^{\pi - 1}$

ex: $f(x) = e^2 + x^e$

e^2: constant

$f'(x) = 0 + ex^{e-1}$

$f'(x) = ex^{e-1}$

ex: $f(x) = (\ln 4) \cdot 4^x$

$f(x) = \ln 4 + 4^x$

$\frac{d}{dx}\left[c f(x)\right] = c \cdot f'(x)$

$\frac{d}{dx}\left[c + f(x)\right] = f'(x)$

$f'(x) = (\ln 4) \cdot 4^x \ln 4$

$f'(x) = (\ln 4)^2 \cdot 4^x$

$f'(x) = 0 + 4^x \cdot \ln 4$

$f'(x) = 4^x \cdot \ln 4$

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10) $f(x) = ax^n$

$f'(x) = anx^{n-1}$

$f'(2) = an \cdot 2^{n-1} = 3$

$f'(4) = an \cdot 4^{n-1} = 24$

$\frac{an \cdot 4^{n-1}}{an \cdot 2^{n-1}} = \frac{24}{3}$

$\left(\frac{4}{2}\right)^{n-1} = 8$

$2^{n-1} = 8$

$2^{n-1} = 2^3$

$n = 4$

$a \cdot 4 \cdot 2^{4-1} = 3$

$a \cdot 4 \cdot 8 = 3$

$a = \frac{3}{32}$

9) $y = \frac{3^x}{3} + \frac{33}{\sqrt{x}}$

$y = \frac{1}{3} \cdot 3^x + 33x^{-1/2}$

$y' = \frac{1}{3} \cdot 3^x \cdot \ln 3 - \frac{33}{2} x^{-3/2} = \frac{1}{3} \cdot 3^x \ln 3 - \frac{33}{2\sqrt{x^3}}$