1. Suppose $f'(a)$ exists for some function $f$. What is the “new, improved” formula we developed in class for approximating $f'(a)$?

When $f'(a)$ exists, then

$$f'(a) \approx \frac{f(a+h) - f(a-h)}{2h}$$

(but be warn! it's possible that $\lim_{h \to 0} \frac{f(a+h) - f(a-h)}{2h}$ exists but $f'(a)$ doesn't... consider $f(x) = |x|$ at $a = 0$. The point is, only use this formula when you already know $f'(a)$ exists)

2. What is the formula we’ve developed for $\frac{d}{dx} b^x$?

$$\frac{d}{dx} (b^x) = (\ln b) b^x$$

3. Using the answer to problem (2), what is the slope of the graph of the function $f(x) = 2.5^x$ at $a = 3.5$?

$$f'(x) = (\ln 2.5) 2.5^x$$

$$\therefore f'(3.5) = (\ln 2.5) 2.5^{3.5} \approx 22.63723...$$

4. Using $h = 0.01$, what is the approximation given by the formula in problem (1) to the answer to problem (3)?

$$\frac{f(3.51) - f(3.49)}{2(0.01)} = 22.63754...$$

5. What is the formula we found for the derivative of $\log_b(x)$?

$$f'(x) = \frac{1}{(\ln b) \cdot x}$$

6. At what $x$ coordinate on the graph of $y = \log_3(x)$ is the slope exactly 1?

So we want $y'(x) = 1$.

ie. $\frac{1}{\ln 3} \cdot \frac{1}{x} = 1$.

$$x = \frac{1}{\ln 3} \approx \frac{1}{1.0986} = 0.91023...$$

We are NOT finding $y'(1)$ here! We're showing that $y'(0.91023...) = 1$ – put the "1" in the right place! 