1. Explained difference between derivative of $f$ at a point $x_0$

\[
(\text{def} = \lim_{\Delta x \to 0} \frac{f(x_0 + \Delta x) - f(x_0)}{\Delta x}) \quad \text{and derivative function} \quad f'(x) = \text{expression/function whose value at } x_0 \text{ is derive. Of } f \text{ at } x_0
\]

Why?!? Don’t want to see things like \[\frac{d}{dx}(x^n) = \lim_{\Delta x \to 0} \frac{f(x_0 + \Delta x) - f(x_0)}{\Delta x}\] as a function. (limits of function not covered in calculus).

2. Eq’n of tangent line. \[y = f'(x_0)(x-x_0) + y_0\]

3. Rules for computing derivative:

A. \[\frac{d}{dx}(x^n) = nx^{n-1}\] - spent some time showing how this follows from B.T.

B. Product rule/Leibnitz rule:

\[\frac{d}{dx}(uv) = \frac{du}{dx}v + \frac{dv}{dx}u\]

Derived this from definition of derivative. Used this to give a second proof of
\[\frac{d}{dx}(x^n) = nx^{n-1}\] by induction (quite quickly).

C. Quotient rule:

\[\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{\frac{du}{dx}v - \frac{dv}{dx}u}{v^2}\]

Derived from product rule: Introduce \(w = \frac{u}{v}\). Then \(u = vw\). So \[\frac{dv}{dx}(P.R.) = \frac{dv}{dx}(w + v) = \frac{dv}{dx}w + \frac{dv}{dx}v\].

Solve for \[\frac{dw}{dx} = \frac{1}{v} \left[\frac{du}{dx} - w \frac{dv}{dx}\right] = \frac{1}{v^2} \left[v \frac{du}{dx} - v \frac{dv}{dx}\right].\]

D. \[\frac{d}{dx}(u^n) = nu^{n-1} \frac{du}{dx}\]. Only indicated proof. Will do next time by the chain rule.