- $\frac{d}{dx}[f(x)g(x)] = f'(x)g(x) + g'(x)f(x)$
- $\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{g(x)f'(x)-f(x)g'(x)}{[g(x)]^2}$
- $\frac{d}{dx}f(g(x)) = f'(g(x))g'(x)$ and $\frac{d}{dx}x^r = rx^{r-1}$, for all r
- $\frac{d}{dx}\sin(x) = \cos(x)$, $\frac{d}{dx}\cos(x) = -\sin(x)$
- $\frac{d}{dx}\tan(x) = \sec^2(x)$, $\frac{d}{dx}\sec(x) = \tan(x)\sec(x)$
- $\sin^2(x) + \cos^2(x) = 1$ and $\tan^2(x) + 1 = \sec^2(x)$
- $\tan(x) = \frac{\sin(x)}{\cos(x)}$, $\cot(x) = \frac{1}{\tan(x)}$, $\sec(x) = \frac{1}{\cos(x)}$, $\csc(x) = \frac{1}{\sin(x)}$

Good Luck! ∼∼ *Yuling* ◡̈

1. (30 points) Find an equation of the tangent line to the given graph at the given point.

   $(a)\ f(t) = (t^2-9)\sqrt{t+2}$; at $(-1,-8)$ $(b)\ f(x) = \dfrac{(3x-2)(6x+5)}{2x-3}$; at $(-1,-1)$

   $(c)\ y^2(x^2+y^2) = 2x^2$; at $(1,1)$

2. (20 points) (a) Find $\frac{dy}{dx}$, $y = \cot(8x^2+3)$ (b) Find $f''(1)$, $f(x) = (x^3-2x)^3$

3. (10 points) Find the point(s), if any, at which the graph of

   $$f(x) = \frac{x}{\sqrt{2x-1}}$$

   has a horizontal tangent line.

4. (20 points) Find all relative extrema and points of inflection of

   $(a)\ g(x) = x\sqrt{x+3}$ $(b)\ f(x) = \dfrac{4}{1+x^2}$

5. (10 points) You are given $f'(x) = -x^2+2x-1$. Find the intervals on which (a) $f'(x)$ is increasing or decreasing, (b) the graph of f is concave upward or concave downward, and (c) find the x-values of the relative extrema and inflection points of f.

6. (10 points) Find the absolute extrema of

   $$f(x) = \frac{4}{3}\sqrt{3-x}$$

   on the closed interval $[0,3]$.