1. Find the first derivative for the following functions:
   - **a**. $f(x) = \sqrt[3]{1+\cot x}$.
   - **b**. $f(x) = \tan^2(3x-1)$.
   - **c**. $f(x) = \sqrt[3]{x} + 2\sqrt{x}$,
   - **d**. $f(x) = \dfrac{2x-x^2}{x^2-1}$,
   - **e**. $f(x) = \sqrt[3]{x}\,(x-1)^3$,
   - **f**. $f(x) = \left(\dfrac{x+1}{2x-1}\right)(3x-1)$,
   - **g**. $f(x) = 3^x x^3$,
   - **h**. $f(x) = \dfrac{3^x}{x^3}$.
2. Use the product or quotient rule to find $(\csc x)'$.
3. Find the followings:
   - **a**. $\dfrac{d^{10}}{dx^{10}}(\cos x)$,
   - **b**. $\dfrac{d^{25}}{dx^{25}}(x\sin x)$
4. If $f(x) = e^{2x}\cos x$. Find $f'(x)$ by hand.
5. If $f'(x) = \dfrac{x-1}{x^2+3}$, then
   - **a**. use the signs of f' to find the intervals where f is increasing or decreasing,
   - **b**. find the relative maximum and minimum for f.
   - **c**. find f'',
   - **d**. use the signs of f'' to find the intervals where f is concave upward or downward.
6. Find the length and the width of the rectangle which has the largest area among those rectangles which have perimeter 100 feet.
   - **a**. Set up the area function $A(x)$. (by hand; hint: Let the length and width be x and y respectively then we have $2x+2y = 100$ and set up $A(x) = x * (50-x)$.)
   - **b**. Find the derivative function for A. (by hand)
   - **c**. Plot $y = A'(x)$ (tool)
   - **d**. Use the plot of $y = A'(x)$ to find the maximum of $A(x)$. (tool).
7. The revenue (in millions of dollars per year) for Hershey Foods for the years 1990-1996 can be modeled by

$$R(t) = 6.59t^4 - 76.46t^3 + 258.22t^2 - 8.71t + 2716.3,$$

   where $t = 0$ corresponds to 1990.
   - **a**. Find $R'(t)$ (by hand)
   - **b**. Plot $y = R'(t)$ and use the plot to estimate the years which result in maximum revenue and minimum revenue. (tool-hint: properly select your view windows)
   - **c**. Find the year which the revenue increases the most during 1990

and 1994. (tool).

d. Find the year which the revenue increases the most during 1990 and 1996. (tool).

8. The number N of bacteria in a culture after t days is modeled by

$$N = 300\left[1 - \frac{3}{(t^2+2)^2}\right].$$

a. Find $N'(t)$. (by hand)

b. Find $N'(0)$, $N'(1)$, $N'(3)$, $N'(4)$. (by hand)

c. What can you conculude from the answer above? (by hand)

d. Plot $y = N'(t)$ and use the plot of $y = N'(t)$ to explain $N(t)$. (tool).