Dust off your calc books and try to solve the following

1. Find $\frac{df}{dx}$ for the following by using the chain rule:

   (a) $f = (1-x)^3$
   (b) $f = (x^2-4)^6$
   (c) $f = \cos^4 x$
   (d) $f = \sin^2 x \cos x$

2. Differentiate $y = 1/(x^2-2)$ first by the quotient rule and then by writing $y = 1/(x^2-2) = (x^2-2)^{-1}$ and using the chain rule.

3. Prove the quotient rule by applying the product and chain rule to $\frac{f}{g} = fg^{-1}$.

4. Find $\frac{dy}{dx}$ and $\frac{dx}{dy}$ via *implicit differentiation* for the following equations: (does $\frac{dy}{dx} = \frac{1}{\frac{dx}{dy}}$?)

   (a) $xy - y - x = 0$
   (b) $2x^2 - 2xy + y^2 = 5$
   (c) $y - x\sin y + 1 = \tan x$

5. Find $\frac{\partial f}{\partial x}$, $\frac{\partial f}{\partial y}$, and df (the total differential) for the following:

   (a) $f(x,y) = xy - y - x$
   (b) $f(x,y) = 2x^2 - 2xy + y^2$
   (c) $f(x,y) = y - x\sin y + 1$

Note: for $f(x,y)$

$$df = \frac{\partial f}{\partial x}dx + \frac{\partial f}{\partial y}dy$$

6. Find and classify the ~~extrema~~ critical points for the follow functions:

   (a) $f(x) = x^2 + 2x$
   (b) $f(x) = x^3$
   (c) $f(x) = x$
   (d) $f(x,y) = x^2 - y^2$

7. Expand the following functions in a Taylor series about the origin. Make sure to include the *radius of convergence.*

   (a) $f(x) = 1/(1+x)$
   (b) $f(x) = \sin x$
   (c) $f(x) = \cos x$

8. Integrate the following functions from $x = a$ to $x = b$.

   (a) $f(x) = x^2 + c$
   (b) $f(x) = \sin x$
   (c) $f(x) = \cos x$

9. Integrate the Taylor series of $\cos x$ and $\sin x$. What functions do the resulting series represent.