Chain Rule Practice Problems
Calculus I, Math 111

Name:______________________________

1. **Find the derivative of the given function.**
   (a) $F(x) = \sqrt[4]{1 + 2x + x^3}$
   (b) $g(t) = \dfrac{1}{(t^4 + 1)^3}$
   (c) $y = \cos(a^3 + x^3)$ where a is a constant.
   (d) $y = xe^{-x^2}$
   (e) $g(x) = (1 + 4x)^5(3 + x - x^2)^8$
   (f) $y = e^{x \cos x}$
   (g) $F(z) = \sqrt{\dfrac{z - 1}{z + 1}}$
   (h) $y = (\sec x)^2 + (\tan x)^2$
   (i) $y = \dfrac{r}{\sqrt{r^2 + 1}}$
   (j) $y = 2^{\sin \pi x}$
   (k) $(\cot(\sin \theta))^2$
   (l) $y = \sin(\tan(\sqrt{\sin x}))$
   (m) $y = \arctan(\sqrt{x})$
   (n) $y = \arcsin(2x + 1)$
   (o) $y = \arcsin(\tan \theta)$
   (p) $f(\theta) = \ln(\cos \theta)$
   (q) $f(x) = \sqrt[5]{\ln x}$
   (r) $f(x) = \ln(1 - 3x)$
   (s) $f(x) = (\sin x) \cdot (\ln(5x))$
   (t) $F(t) = \ln \dfrac{(2t + 1)^3}{(3t - 1)^4}$
   (u) $f(u) = \dfrac{\ln u}{1 + \ln(2u)}$
   (v) $y = \ln(e^{-x} + xe^{-x})$

   (Hint on part (d): Use algebraic rules for logarithms to simplify first!)

2. **Find the line tangent to the given curve at the specified point.**
   (a) $y = (1 + 2x)^{10}$ at $(0, 1)$
   (b) $y = \ln(x^2 - 3)$ at $(2, 0)$

3. **Finally, a differential equations problem:**

   Show that for any constant c, $y = (c - x^2)^{-1/2}$ is a solution to the differential equation $y' = xy^3$. Then find a solution to the initial value problem $y' = xy^3$, $y(0) = 2$.

This problem set is adapted from a worksheet created by Bob Milnikel.