Product and Quotient Rules Practice Problems
Calculus I, Math 111

Name:_____

1. **Find the derivative of the given function.**

   (a) $g(x) = \sqrt{x}e^x$

   (b) $y = \dfrac{e^x}{1+x}$

   (c) $f(t) = \dfrac{2t}{4+t^2}$

   (d) $R(t) = \left(\frac{1}{t} + e^t\right)\left(4 - \sqrt[3]{t}\right)$

   (e) $y = \dfrac{t^3 + t}{t^4 - 2}$

   (f) $y = \dfrac{1}{s + ke^s}$ where k is a constant.

   (g) $z = w^{3/2}(w + ce^w)$ where c is a constant.

   (h) $f(x) = \dfrac{1 - xe^x}{x + e^x}$

   (i) $f(x) = \dfrac{ax + b}{cx + d}$ where a, b, c and d are constants.

   (j) $y = e^u(\cos u + cu)$ where c is a constant.

   (k) $y = \dfrac{x}{\cos x}$

   (l) $y = \dfrac{1 + \sin x}{x + \cos x}$

   (m) $y = \dfrac{1 - \sec x}{\tan x}$

   (n) $y = \csc\theta(\theta + \tan\theta)$

2. **Find the line tangent to the given curve at the specified point.**

   (a) $y = \dfrac{\sqrt{x}}{x + 1}$, $\quad (4, 0.4)$

   (b) $y = \dfrac{1}{1 + x^2}$, $\quad (-1, \frac{1}{2})$

3. **Finally, some differential equations problems:**

   (a) Show that $y = -\frac{1}{2}x\cos x$ is a solution to $y'' + y = \sin x$.

   (b) Show that $y = \dfrac{(\ln x) + C}{x}$ is a solution to the differential equation $x^2 y' + xy = 1$.

   (c) Use your answer to the previous question to find a solution to the IVP $x^2 y' + xy = 1$, $y(1) = 2$.

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