Due date: _____   **Name:** _____

1. Differentiate the following functions.

a) $f(x) = (5x^3 - x^4)^7$

b) $y = \sin^6 x$

c) $f(x) = \frac{1}{(1-2x)^3}$ (Use the Chain Rule for practice, though you can check your work with the Quotient Rule.)

d) $f(x) = \frac{5}{\sqrt{3x+4}}$ (Use the Chain Rule for practice, though you can check your work with the Quotient Rule.)

e) $f(x) = e^{\sqrt{3x+1}}$

f) $f(x) = e^{\cosh(x^2 - 4)}$

g) $y = x^2 e^{3x}$

h) $y = (x^2 + x)e^{\sin x}$

i) $f(x) = \sin^{-1}(\sqrt{x}\cos x)$

j) $f(x) = \csc\left(\frac{\log_2 x}{x}\right)$

k) $y = e^{\cosh^{-1} 5x}$

l) $y = x^2 e^{\cos^2 3x}$

m) $f(x) = \sin(\cos(\tan x))$

n) $f(x) = \log_2(\csc(e^x))$

o) $y = \sqrt{\sec(x^3)}$

p) $f(x) = \sqrt{\ln(\sec x)}$

q) $f(x) = \sqrt[3]{\cos^{-1}(2x + 1)}$

r) $f(x) = \sin^{-1}\left(\sqrt{\tanh x}\right)$

s) $f(x) = \dfrac{\cosh\sqrt{x}}{\log_3 x}$

t) $f(x) = \dfrac{\sinh\sqrt{x}}{\ln x}$

u) $y = \sinh^{-1}(\tan 3x)$

v) $y = 3^{\sin \sqrt{x}}$

2. Find an equation for the tangent line of $f(x) = \sin(5x)$ at $x = \frac{\pi}{10}$.

3. Find an equation for the tangent line of $y = \sqrt[3]{4x - 9}$ at $x = 2$.

4. Find an equation for the tangent line of $y = \sqrt{9 - x^2}$ at $x = 1$.

5. Find an equation for the tangent line of $f(x) = \ln(e^{2x} + 1)$ at $x = 0$.

6. Find the second derivative of $y = \cos(2x)$.

7. Find the second derivative of $y = \sqrt{x^2 + 1}$.

8. Find all points where $f(x) = e^{-x^2}$ has a horizontal tangent line.

9. Find all points where $f(x) = 2\cos x + \cos^2 x$ has a horizontal tangent line.

Review

10. Find the following limits.

    a) $\displaystyle\lim_{x\to\pi/2^+} 2^{\tan x}$

    b) $\displaystyle\lim_{x\to 0^-} (\cot x + \ln|x|)$

Challenge: Find the 1000th derivative of $y = \cos(2x)$.

Q: If you wrote all of the numbers from 300 to 400 on a piece of paper, how many times would you have written the number 3?

Optional exercises from the Stewart textbook if you'd like more practice:
3.4 (p.204) #7-41 odd, 45-53 odd, 59
3.6 (p.223) #3-25 odd, 31, 33
3.11 (p.264) #31-45 odd