Week-in-Review 7: Chapter 3.5, 3.6, K1
(Implicit Diffentiation, Derivatives on Inverse Trigonometric, Logarithmic and Vector Functions.)

Problem 1. Find the following derivatives:

(a) $9y^4 - 12x^2y^2 + 5x^2 = 11x$

(b) $\sqrt{y}\cos x + \sin(3y) - \cot^2(3x) = 1$

(c) $f(x) = \ln(x^2 + y^2)$

(d) $f(x) = \ln(x^2 e^{-2x})$

(e) $f(x) = \tan[\log(ax + b)]$

(f) $f(x) = \log_2(x^3 + 6x)^5$

(g) $f(x) = x \ln(\sin(3x))$

(h) $f(x) = \arcsin(e^x)$

(i) $f(x) = \tan^{-1}(5x^2)$

(j) $f(x) = \ln\left(\dfrac{x^2+1}{5xe^x(x^3+11)^4}\right)$

(k) $f(x) = \left\langle \dfrac{\frac{1}{x}-\frac{1}{3}}{x-3}, 2x-3 \right\rangle$. State the domain of f and f'.

Problem 2. Use log differentiation to find the following derivatives.

a $f(x) = x^x$

b $f(x) = (\sin x)^{\cos x}$

Problem 3. Find the slope of the tangent line to the curve $\sec(x+y) - \tan(x-y) = 1$ at the point (π, π).

Problem 4. Find the equation of the tangent line to the curve $y = x^2 \ln(x)$ at the point $(1, 0)$.

Problem 5. Find a tangent vector of length 5 to the curve $\vec{r}(t) = (2t\sin t)\vec{i} + (3 - 4\cos(t))\vec{j}$ at the point where $t = \dfrac{\pi}{2}$

Problem 6. Find the velocity, acceleration and speed of the particle with the position function given by $\vec{r}(t) =< 4\cos(2t), 3\sin(2t) >$ at the time $t = \dfrac{\pi}{3}$.