$\boxed{\textbf{221 Calculus, Fall 2007, Section 306/308}}$

Homework 3 (Due in class October 9)

1 Exercise Calculate the following derivative.

$$\frac{d}{dx}\left(\frac{x}{x^2+1}+\frac{3}{x^5}+x^{17}+1\right)$$

2 Exercise Suppose a car's position $s(t)$ over time t is measured and then the data is seen to approximately be described by

$$s(t)=\frac{5t^2}{1+t^4}.$$

According to this model, what are the position, velocity, acceleration, and jerk at time $t=1$?

3 Exercise Calculate the following derivative.

$$\frac{d}{dx}\left(\frac{\cos x}{x}+\sin x\cos x\right)$$

4 Exercise Calculate the following derivative.

$$\frac{d}{dx}\sin^2(x^2+1)^3$$

5 Exercise Consider the spiral curve described by the parametric equations $x=(\cos t)/t$ and $y=(\sin t)/t$. Find the slope of this curve as a function of t. The distance from a point on this curve to the origin is given by $r(t)=\sqrt{x^2(t)+y^2(t)}$. Find $\frac{dr}{dt}$ as a function of t.

6 Exercise Find the equations for the lines tangent and normal to the curve described by

$$x^4+y^4+\frac{1}{xy}=3$$

at the point $(x_0,y_0)=(1,1)$.

7 Exercise What is the linearization of $\tan(x-\frac{\pi}{3})$ at $x=\pi/2$?

8 Exercise (Optional) Let $f(x)=(\sin x)/x$ for $x\neq 0$ and $f(0)=1$. Show that f is everywhere differentiable and find f'. Then show that f' is everywhere differentiable and find f''.