Homework 2

Due January 16, 2017

1. (4 points) Using the limit definition of derivatives, calculate the derivative of $f(x) = \cos(x)$.
2. Calculate the derivatives of the following functions, where they are defined.
   (a) (3 points) $\sin^4(x) - \cos^4(x)$.

   (b) (3 points) $\dfrac{\sec^2(10x)}{1 + \tan^2(10x)}$.

   (c) (3 points) $\cos(\cos(\sin(x)))$.

   (d) (3 points) $\dfrac{(1 + x^5)\cos(x)}{\sin(4x)}$.

   (e) (3 points) $\cot^3(x)$.

   (f) (3 points) $\tan(x)\csc(x)(1 + \tan^2(x))$.

   (g) (3 points) $\cot(\tan(x))$.

   (h) (3 points) $(1 + x^2)\sec(x)$.

   (i) (3 points) $\tan\left(\dfrac{1}{1 + x^2}\right)$.

   (j) (3 points) $\cos(x\sin(x))$.

3. Approximate the following values using differentials. Do not use a calculator.
   (a) (2 points) $\tan\left(\dfrac{99\pi}{300}\right)$ using $\dfrac{99\pi}{300} \approx \dfrac{\pi}{3}$.

   (b) (2 points) $\cos\left(\dfrac{7\pi}{12}\right)$ using $\dfrac{7\pi}{12} \approx \dfrac{\pi}{2}$.

(c) (2 points) $\sin\left(\frac{\pi}{1000}\right)$ using $\frac{\pi}{1000} \approx 0$.

4. (2 points) Approximate $\cos\left(\frac{7\pi}{12}\right)$ using $\frac{7\pi}{12} \approx \frac{2\pi}{3}$. What is the exact value of $\cos\left(\frac{7\pi}{12}\right)$? Compare this value to the value you obtained from problem 3b. Which approximation is better? Why? (*Hint: Second derivatives.*)