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HOMEWORK 6

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1. Compute the first derivative of the following functions

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

vi)  $f(x) = x\sqrt{1+x^2}$

ii)  $f(x) = \frac{\sqrt{x}}{1+x}$

vii)  $f(x) = \frac{1}{\tan(x)}$

iii)  $f(x) = \frac{\cos(x)}{2x^2+3}$

viii)  $f(x) = e^{\sqrt{x}}$

iv)  $f(x) = e^{-3x}(x^2 + 2x - 1)$

ix)  $f(x) = \sin^3(x)$

v)  $f(x) = e^{2x}(2\sin(3x) - 4\cos(3x))$

x)  $f(x) = \exp\left(\frac{x^3-1}{x^2+5}\right)$

2. Let  $f(x)$  be a differentiable function such that  $f(1) = 2$  and  $f'(1) = 1$ . Let  $g(t)$  be another differentiable function such that  $g(0) = 1$  and  $g'(0) = 3$ . Compute  $h'(0)$ , where  $h(t) = f(g(t))$ .

3. A book publisher has a cost function given by  $C(x) = \frac{x^3+2x+3}{x^2}$ , where  $x$  is the number of copies in thousands and  $C(x)$  is the cost in dollars per book. The publisher produces now 2000 copies of a book. Decide whether the publisher should increase or decrease the production.

4. Garfield loves lasagna. Let  $W(t)$  be Garfield's weight in pounds as a function of time (in weeks).

(a) What are the units of  $W'(t)$ ?

(b) Suppose that  $W'(10) = 2$ . What can you say about Garfield's weight?

(c) Jon decides that Garfield is eating too much lasagna and needs to go on a diet. He says : "for Garfield, the goal of a diet isn't losing weight, it's slowing down the gain". How would you express this concept using  $W'(t)$  or  $W''(t)$ ?

5. Find the equation of the line tangent to the circle  $x^2 + y^2 = 4$  at the point  $(1, \sqrt{3})$ .

6. Find a polynomial  $P(x)$  of degree three such that  $P(0) = P(1) = -2$ ,  $P'(0) = -1$  and  $P''(0) = 10$ .