CALCULUS PRACTICE PROBLEMS

For Test 1 in Math 141 and the Betterment of Life

1. Evaluate $\lim_{x\to 1} \dfrac{x^2-3x+2}{x^4-x^3+x^2-1}$.

2. Evaluate $\lim_{x\to 0} f(x)$ where

$$f(x) = \begin{cases} x & \text{if } x > 0 \\ 2 & \text{if } x = 0 \\ -x & \text{if } x < 0 \end{cases}.$$

Is $f(x)$ continuous at 0? Explain.

3. Evaluate $\lim_{x\to 0} \dfrac{\sin(2x)(\cos(x)-1)}{x^2}$.

4. Evaluate $\lim_{x\to 0} \dfrac{1-\cos x}{x^2}$.

5. Calculate $\dfrac{d}{dx}\sin(\sqrt{x})$.

6. Find the equation of the tangent line to $y = 3x^2 - 2x^4$ at the point $(1,1)$.

7. Using $f'(x) = \lim_{h\to 0} \dfrac{f(x+h)-f(x)}{h}$, calculate $f'(x)$ for $f(x) = \dfrac{1}{x+1}$.

8. Let $f(x) = \sin(g(x^2-1))$ where $g(x)$ is a function with $g(3) = \pi$ and with derivative $g'(x) = 2^x + 3^{x-1}$. Calculate $f'(2)$.

9. A student at the top of a 134 foot tall building throws a Calculus textbook off the ledge downward with an initial velocity of 32 feet per second. The distance the book travels after t seconds is $16t^2 + 32t$ feet. Coincidentally, an instructor 6 feet tall is walking by the building at the time and the book collides with his head. (a) How long does it take for the book to travel from the ledge to the instructor's head? (b) At what velocity is the book travelling at the time of impact?

10. Let $A = (0,0)$ and $B = (2,0)$. A small particle moves counterclockwise along the circle $x^2 + y^2 = 4$ in such a way that if P is its position at time t (in seconds) and if $\theta = \angle PAB$, then θ is increasing at the constant rate of 5 radians per second. How fast is the $y-$coordinate changing when the the particle is at the point $(1, \sqrt{3})$?