Your name:_____

TA's name:_____

Problem #1: Use the definition of the derivative to find $f'(x)$

if $f(x) = 3x^2 - 5x + 1$.

Problem #2: Find $\frac{dy}{dx}$.

a) $y = \frac{x^2 - 3x + 5}{\ln x}$

b) $y = e^{\tan 2x}$

c) $y = \sqrt{\dfrac{2x+3}{2x-3}}$

d) $y = \tan^{-1}(\pi x)$

Problem #3: Find the equation of the tangent line to $x^2 - 2xy + y^2 = 0$ at the point $(1,1)$.

Problem #4: Graph $y = x^3 + 3x^2 - 24x + 12$. Be sure to label all extrema and points of inflection. You do not need to graph the x-intercepts.

Problem #5: Sand is falling from a chute onto a pile that is shaped like a right circular cone at a rate of $48\pi\, ft^3/min.$ If the radius of the pile is always 3 times the height, how fast is the height of the pile growing, when the height is 6 feet?

Problem #6: An open-top box with a square base and rectangular sides is to have a volume of 9 ft^3 . The cost of the material to make the base is $2/$ft$ and the cost of the material to make the sides is $3/$ft$. Find the dimensions of the box that minimize the cost.

Problem #7: Evaluate the following limits:

a) $\lim\limits_{x\to 0} \dfrac{3\sin 4x}{2\tan 5x}$

b) $\lim\limits_{x\to\infty} \dfrac{2x^3 + 4x^2 - 1}{6x^3 + x - 8}$

c) $\lim\limits_{x\to 6} \dfrac{3x^2 - 12x - 36}{x^2 - x - 30}$

d) $\displaystyle\lim_{x\to 0}\frac{4e^{-x}}{5e^{x}+1}$

e) $\displaystyle\lim_{h\to 0}\frac{\left(9+h\right)^{2}-81}{h}$