

Name: \_\_\_\_\_

Please show all work and box the answers.

1. (20 pts.) Without using the rules of differentiation, find the derivatives of the following functions:

$$(a) f(x) = x^2 \quad (b) f(x) = \frac{1}{x}$$

2. (30 pts.) Find the derivatives of the following functions:

$$(a) f(x) = x^3 - 5x^2 + 1 \quad (b) f(x) = x \cos x \quad (c) f(x) = \sin^3 x^2$$

3. (20 pts.) Find the equation of the tangent line to the graph of  $y = \sqrt{x}$  at  $x = 4$ . Sketch.

4. (20 pts.) Let  $f(x) = \begin{cases} -1 & \text{for } x \leq 0 \\ mx + b & \text{for } 0 < x < 1 \\ 1 & \text{for } x \geq 1 \end{cases}$

For which values of  $m$  and  $b$  is  $f(x)$  continuous? Sketch.  
Is  $f(x)$  differentiable? Explain.

1	2	3	4	total (90)	%