Quiz 1
MATH 112-017 and 112-019
New Jersey Inst. Tech.
Prof. Nicholas Dubicki

Name: ______________________

Date: ____________
Section: ____________

1. State the definition of the derivative. [2]

$$\frac{df}{dx} = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

2. Let $g(x)$ represent a continuous and smooth function for all x. Calculate the derivative of $f(x)$. (You need not use the definition.) [4]

$$f(x) = e^{xg(x)} \tag{1}$$

$$f'(x) = \frac{d}{dx}\left(e^{xg(x)}\right) = e^{xg(x)} \cdot \frac{d}{dx}\left(xg(x)\right)$$
$$= \left(e^{xg(x)}\right)\left(g(x) + xg'(x)\right)$$

3. A basic property of definite integrals is their invariance under translation. For some function f, and constants $a,\ b,\ c$, begin with the following integral [4]

$$\int_{a-c}^{b-c} f(x+c)dx \tag{2}$$

Use u-substitution to show this is equal to

$$\int_a^b f(x)dx \tag{3}$$

let $u = x + c$, then $du = dx$

the bounds become:

x	$u = x + c$
$b - c$	b
$a - c$	a

the result is

$$\int_{a-c}^{b-c} f(x+c)dx = \int_a^b f(u)du$$

this proves the translation property

Q.E.D.