Name: ______________________________ Quiz 1

Math F252X-902, Calculus II Spring 2025

16 points possible; each part is worth 2 points. No aids (book, notes, calculator, phone, etc.) are permitted. Show all work and use proper notation for full credit. Answers should be in reasonably simplified form.

1. Compute the derivatives of the following functions.

   (a) $f(x) = x\ln(x) + \frac{\pi}{4}$ constant!

   $f'(x) = x\left(\frac{1}{x}\right) + \ln(x)$

   $= 1 + \ln(x)$

   (b) $h(\theta) = \sin(\theta)\sec(\theta)$ (Simplify as much as possible.)

   $h'(x) = \cos(\theta)\sec(\theta) + \sin(\theta)\sec(\theta)\tan\theta$

   $= 1 + \tan^2(\theta)$

   $= \sec^2\theta$

   OR

   $h(x) = \tan(\theta)$

   $h'(x) = \sec^2(\theta)$

(c) $y = \dfrac{e^{(2x)}}{x^4 + e}$ (Do not simplify.)

$$y' = \frac{2e^{2x} - 4x^3 e^{2x}}{(x^4+e)^2}$$

Use the quotient rule, not the product rule!

(d) $G(z) = \sin(z^a - b)$ where a and b are constants

$$G'(z) = az^{a-1}\cos(z^a - b)$$

2. Compute the following antiderivatives (indefinite integrals) and definite integrals.

(a) $\displaystyle\int_0^2 \frac{x}{x^2+1}\,dx$ Let $u = x^2+1$

$du = 2x\,dx$

$$\frac{1}{2}\int_1^5 \frac{1}{u}\,du$$

$$= \frac{1}{2}\ln(u)\Big|_1^5$$

$$= \frac{\ln(5)}{2} \qquad (\ln(1)=0)$$

(b) $\displaystyle\int \frac{\csc^2(x)}{\cot^2(x)}\,dx = \int \sec^2(x)\,dx$

$$= \tan(x)+C$$

OR

$u = \cot(x)$

$du = -\csc^2(x)\,dx$

$$\int \frac{\csc^2(x)}{\cot^2(x)} = -\int \frac{du}{u^2}$$

$$= \frac{1}{u} + C$$

$$= \frac{1}{\cot(x)} + C$$

$$= \tan(x) + C$$

(c) $\int \frac{1+e^{2x}-e^{5x}}{e^x}\,dx$

$$= \int (e^{-x} + e^{x} - e^{4x})\,dx$$

$$= -e^{-x} + e^{x} - \frac{e^{4x}}{4} + C$$

(d) $\int x\sqrt{x+3}\,dx$

$u = x+3 \qquad x = u-3$

$du = dx$

$$\int (u-3)\,u^{1/2}\,du$$

$$\int u^{3/2} - 3u^{1/2}\,du$$

$$\frac{2u^{5/2}}{5} - 2u^{3/2} + C$$

$$\frac{2(x+3)^{5/2}}{5} - 2(x+3)^{3/2} + C$$