Math 252: Quiz 4 **5 February 2026**

Name: _____ | _____ / **25**

30 minutes. No aids (book, notes, calculator, internet, etc.) are permitted. Show all work and use proper notation for full credit. Put answers in reasonably-simplified form. 25 points possible.

1. **[3 points]** Compute the total work done by a force $F(x) = cos(\pi x)$ on an object which moves from $x = 0$ to $x = \frac{1}{2}$.

2. **[6 points]** A 1-dimensional rod is 3 meters long and has linear mass density $\rho(x) = 1 + \dfrac{2}{(1+x)^2}$ kilograms per meter (starting at $x = 0$). Find its mass. Simplify your answer and include units.

3. [8 points] A spring has natural length of 3 meters. It requires 6 J of work to stretch the spring from its natural length to a length of 4 meters. How much work would it take to stretch the spring from 4 meters to 5 meters?

4. [8 points] Find the derivative, indefinite integral, or definite integral. Put your answers in reasonably simplified form and write "$+C$" if appropriate.

a. Find $\dfrac{dy}{dx}$ if $y = \dfrac{\ln(x^2)}{x}$.

b. $\displaystyle\int_0^{\pi/4} \tan x\, dx =$

c. Find $\dfrac{dy}{dx}$ if $y = 2^{5x} + \log_2(5x)$.

d. $\displaystyle\int \frac{dx}{x \ln x} =$

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