NAME:

Show ALL your work CAREFULLY.

(a) Use the method of substitution to find the following indefinite integral. Be sure to indicate the substitution you use.

\[ \int \frac{\ln x}{x} \, dx \]

Let \( u = \ln x \) so that \( du = \frac{1}{x} \, dx \). It follows that

\[ \int \frac{\ln x}{x} \, dx = \int u \, du = \frac{u^2}{2} + C = \frac{(\ln x)^2}{2} + C. \]

(b) Use the method of substitution to evaluate the following definite integral. Be sure to indicate the substitution you use.

\[ \int_{0}^{\sqrt{\pi/2}} x \sin(x^2) \, dx \]

Let \( u = x^2 \) so that \( du = 2x \, dx \) or \( x \, dx = \frac{du}{2} \). Moreover, when \( x = 0 \), \( u = 0 \) and when \( x = \sqrt{\pi/2}, u = \pi/2 \). It follows that

\[ \int_{0}^{\sqrt{\pi/2}} x \sin(x^2) \, dx = \int_{0}^{\pi/2} \sin u \, \frac{du}{2} = \frac{1}{2} \left( -\cos \frac{\pi}{2} \right) - \left( -\cos 0 \right) = \frac{1}{2} + 1 = \frac{3}{2}. \]

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