Name: _____

Signature: _____

Show all work clearly and in order, and box your final answers. Justify your answers whenever possible. You have 20 minutes to take this 10 point quiz.

1. $\boxed{10 \text{ points}}$ Use integration by parts to evaluate

$$\int_1^2 x^3 \ln x \, dx.$$

Solution: Starting with,

$$u = \ln x \qquad \text{and} \qquad dv = x^3 \, dx,$$

then,

$$du = \frac{1}{x} \, dx \qquad \text{and} \qquad v = \frac{x^4}{4}.$$

Now carefully using these parts we finally have.

$$
\begin{aligned}
\int_1^2 x^3 \ln x \, dx &= \left. \frac{x^4 \ln x}{4} \right]_1^2 - \frac{1}{4} \int_1^2 \frac{1}{x} \cdot \frac{x^4}{4} \, dx \\
&= \left. \frac{x^4 \ln x}{4} \right]_1^2 - \frac{1}{4} \int_1^2 x^3 \, dx \\
&= \left. \frac{x^4 \ln x}{4} - \frac{x^4}{16} \right]_1^2 \\
&= \boxed{\ln 16 - \frac{15}{16}}
\end{aligned}
$$