

Name (Last, First Middle): _____

Use of books, notes or calculators is **NOT** permitted. **Show all your work!** Answers without appropriate supporting work may not receive full credit. Clearly indicate your answers to each problem by underlining them or placing a **box** around your answers!

1. [50] Find $\int x \cos \pi x \, dx$.

$$u = x \quad \rightarrow u' = 1$$

$$v' = \cos \pi x \quad \rightarrow v = \frac{1}{\pi} \sin \pi x$$

$$= \frac{x}{\pi} \sin \pi x - \frac{1}{\pi} \int \sin \pi x \, dx =$$

$$= \frac{x}{\pi} \sin \pi x + \frac{1}{\pi^2} \cos \pi x + C$$

2. [50] Calculate $\int_1^e \sqrt{t} \ln t \, dt$

$$u = \ln t \quad \rightarrow u' = \frac{1}{t}$$

$$v' = \sqrt{t} \quad \rightarrow v = \frac{2}{3} t^{3/2}$$

$$= \frac{2}{3} \ln t \cdot t^{3/2} \Big|_1^e - \frac{2}{3} \int_1^e \frac{1}{t} t^{3/2} \, dt$$

$$= \frac{2}{3} \left[\underbrace{\ln e}_{=1} e^{3/2} - \underbrace{\ln 1}_{=0} 1^{3/2} \right] - \frac{2}{3} \int_1^e t^{1/2} \, dt$$

$$= \frac{2}{3} e^{3/2} - \frac{2}{3} \cdot \frac{2}{3} t^{3/2} \Big|_1^e$$

$$= \frac{3}{3} e^{3/2} - \frac{4}{9} e^{3/2} + \frac{4}{9}$$

$$= \boxed{\frac{2}{9} e^{3/2} + \frac{4}{9}}$$