

Full Name: SOLUTIONS Student #: _____TA: Maddie

Please provide detailed solutions to the problems below. Correct responses without justification may not receive full credit. The use of a calculator is permitted.

[4 marks] (1.) Make the appropriate substitution to evaluate the following integral.

$$\int_e^{e^4} \frac{(\ln x)^2}{x} dx$$

$u = \ln x \quad du = \frac{1}{x} dx$
 when $x = e^4, u = 4$
 $x = e, u = 1$

$$= \int_1^4 u^2 du$$

$$= \left. \frac{u^3}{3} \right|_1^4 = \frac{1}{3} (4^3 - 1^3) = \frac{63}{3} = 21.$$

[6 marks] (2.) Evaluate the integral using integration by parts.

$$\int \arctan x dx$$

$u = \arctan x \quad dv = dx$
 $du = \frac{1}{1+x^2} dx \quad v = x$

$$= x \arctan x - \int \frac{x}{1+x^2} dx \rightarrow \text{use substitution}$$

$u = 1+x^2 \quad du = 2x dx$

$$= x \arctan x - \frac{1}{2} \int \frac{1}{u} du$$

$$= x \arctan x - \frac{1}{2} \ln(1+x^2) + C$$