

(I) Compute the following integrals using integration by parts.

(a)  $\int \ln(x) dx$

(b)  $\int (\sin x)e^x dx$

(c)  $\int (\sin \theta \cos \theta) e^{(\sin^2 \frac{\theta}{2})} d\theta$

(II) Compute the following integrals by using a trig identity and an appropriate  $u$ -substitution.

(a)  $\int (\sin x)^3 (\cos x)^2 dx$

$$(b) \int (\sin x)^4 (\cos x)^3 dx.$$

$$(c) \int (\sin x)^2 (\cos x)^4 dx. \quad \text{Hint: } \cos^2(\theta) = \frac{1}{2}(1 + \cos(2\theta)) ; \sin^2(\theta) = \frac{1}{2}(1 - \cos(2\theta)).$$

$$(d) \int t \cos^2(t) dt$$

(III) Once Matt explains how, use trig substitution to compute the following integrals.

$$(a) \int \frac{u^3}{1-u^2} du.$$

$$(b) \int \sqrt{\frac{x^2+9}{x^4}} dx$$