

3. Evaluate the following integrals.

a. $\int \sin^2 x \tan x \, dx = \int \sin^2 x \cdot \frac{\sin x}{\cos x} \, dx = \int \frac{1 - \cos^2 x}{\cos x} \sin x \, dx$

$$= \int \frac{1 - u^2}{u} \cdot (-du) = \int \left(u - \frac{1}{u}\right) du = \frac{1}{2} u^2 - \ln|u| + C$$

$u = \cos x$
 $du = -\sin x \, dx$

$$= \frac{1}{2} \cos^2 x - \ln|\cos x| + C$$

b. $\int_0^{\sqrt{\ln 3}} \frac{x e^{x^2/2}}{e^{x^2} + 1} \, dx = \int_1^{\sqrt{3}} \frac{du}{u^2 + 1} = \arctan u \Big|_1^{\sqrt{3}} = \arctan(\sqrt{3}) - \arctan(1)$

$u = e^{x^2/2}$
 $du = x e^{x^2/2} \, dx$

$$= \frac{\pi}{3} - \frac{\pi}{4} = \frac{\pi}{12}$$