Submit your solutions to the following problems in lecture on the due date above. Present your work in a clean and organized fashion, either on a printed copy of this document (preferred) or a separate sheet of paper. As stated in the syllabus, late submissions will **not** be accepted.

1. Evaluate the following integrals using U-substitution.

(a) $\int \cos(x) e^{\sin(x)} \, dx$ $\int e^u \, du = e^u + C$

$\text{let } u = \sin(x)$
$= \boxed{e^{\sin(x)} + C}$
$\frac{du}{dx} = \cos(x)$
$du = \cos(x) \, dx$

(b) $\int x^2 \sin(x^3 + 3) \, dx \quad = \int \frac{1}{3} \sin(u) \, du = -\frac{1}{3} \cos(u) + C$

$\text{Let } u = x^3 + 3$
$= \boxed{-\frac{1}{3} \cos(x^3 + 3) + C}$
$\frac{du}{dx} = 3x^2$
$\frac{1}{3} du = x^2 \, dx$

(c) $\int \frac{x^2 + 3}{\sqrt[3]{x^3 + 9x}} \, dx \quad = \int \frac{1/3}{u^{1/3}} \, du = \frac{1}{3} \cdot \frac{3}{2} u^{2/3} + C$

$\text{let } u = x^3 + 9x$
$= \boxed{\frac{1}{2} (x^3 + 9x)^{2/3} + C}$
$\frac{du}{dx} = 3x^2 + 9$
$\frac{1}{3} du = (x^2 + 3) \, dx$

(d) $\int_{\pi/4}^{\pi/2} \cot(x) \, dx = \int_{\pi/4}^{\pi/2} \frac{\cos(x)}{\sin(x)} \, dx = \int_{x = \pi/4}^{x = \pi/2} \frac{1}{u} \, du = \ln|u| \Big|_{x = \pi/4}^{x = \pi/2}$

$\text{Let } u = \sin(x)$
$= \ln|\sin(x)| \Big|_{x = \pi/4}^{x = \pi/2}$
$\frac{du}{dx} = \cos(x)$
$du = \cos(x) \, dx$
$= \boxed{\ln\left|\sin\left(\frac{\pi}{2}\right)\right| - \ln\left|\sin\left(\frac{\pi}{4}\right)\right|}$