

Math 16B: Short Calculus II
 Winter 2018, Section 3
 Homework Sheet 7
 Due: Monday, March 5, 2018

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.

$$\begin{aligned}
 \text{(a)} \quad \int \frac{\ln(2x)}{x^2} dx &= \int x^{-2} \ln(2x) dx = -x^{-1} \ln(2x) - \int -x^{-1} \frac{1}{x} dx \\
 & \quad u = \ln(2x) \quad v = -x^{-1} \\
 & \quad \frac{du}{dx} = \frac{1}{2x} \cdot 2 \quad \frac{dv}{dx} = x^{-2} \\
 & \quad du = \frac{1}{x} dx \quad dv = x^{-2} dx \\
 & = -x^{-1} \ln(2x) + \int x^{-2} dx \\
 & = \boxed{-x^{-1} \ln(2x) - x^{-1} + C}
 \end{aligned}$$

$$\begin{aligned}
 \text{(b)} \quad \int e^{2x} \cos(e^{2x}) dx &= \int \frac{1}{2} \cos(u) du = \frac{1}{2} \sin(u) + C = \boxed{\frac{1}{2} \sin(e^{2x}) + C} \\
 \text{let } u &= e^{2x} \\
 \frac{du}{dx} &= 2e^{2x} \\
 \frac{1}{2} du &= e^{2x} dx
 \end{aligned}$$

oops... please ignore

$$\begin{aligned}
 \text{(c)} \quad \int \frac{1}{x \ln(x)} dx &= \int \frac{1}{u} du = \ln|u| + C = \boxed{\ln|\ln(x)| + C} \\
 \text{let } u &= \ln(x) \\
 \frac{du}{dx} &= \frac{1}{x} \\
 du &= \frac{1}{x} dx
 \end{aligned}$$

$$\begin{aligned}
 \text{(d)} \quad \int_1^{\infty} \frac{2}{\sqrt{x}} dx &= \lim_{b \rightarrow \infty} \int_1^b 2x^{-1/2} dx = \lim_{b \rightarrow \infty} 4x^{1/2} \Big|_{x=1}^{x=b} \\
 &= \lim_{b \rightarrow \infty} (4\sqrt{b} - 4\sqrt{1}) = \lim_{b \rightarrow \infty} (4\sqrt{b} - 4) \\
 &= 4(\infty) - 4 = \infty \quad \boxed{\text{diverges}}
 \end{aligned}$$