Your Name

Student ID #

1. Compute $\int x \ln x \, dx$.

Solution: Use integration by parts. Let $u = \ln x$, $dv = x\,dx$, so $du = \frac{dx}{x}$ and $v = \frac{x^2}{2}$, giving

$$\int x \ln x \, dx = \frac{x^2}{2} \ln x - \int \frac{x^2}{2x} \, dx = \frac{x^2}{2} \ln x - \frac{x^2}{4} + c.$$

2. Compute $\int \tan t \, dt$ directly. (Hint: $\tan t = \frac{\sin t}{\cos t}$.)

Solution: Use u-substitution. Let $u = \cos t$, so $-du = \sin t \, dt$, giving

$$\begin{aligned} \int \tan t \, dt &= \int \frac{\sin t}{\cos t} \, dt = -\int \frac{1}{u} \, du \\ &= -\ln|u| + c = -\ln|\cos t| + c. \end{aligned}$$

(Since $\sec t = (\cos t)^{-1}$, this is also written $\ln|\sec t| + c$.)

3. (Partial Fraction Decomposition) Find the constants A and B where

$$\frac{s+3}{s(s-2)} = \frac{A}{s} + \frac{B}{s-2}.$$

Solution: We can use the cover-up method and probably will later in the course, though we can also multiply both sides by $s(s-2)$ and compare coefficients:

$$s + 3 = A(s-2) + Bs = (A+B)s + (-2A),$$

so $-2A = 3$ gives $A = -3/2$ and $A + B = 1$ gives $B = 5/2$.