Mathematics 1110H – Calculus I: Limits, Derivatives, and Integrals
TRENT UNIVERSITY, Fall 2025
Workshop Problems for 2025-11-21

Problems like these could turn up on Test #5.

- $\displaystyle\int_1^e \frac{\ln(x)}{x}\,dx$ *[Substitute for ln(x).]*
- $\displaystyle\int_1^e x\ln(x)\,dx$ *[Parts with $u = ln(x)$ and $v' = x$.]*
- $\displaystyle\int \frac{\sec^2(x)}{1+\tan^2(x)}\,dx$ *[Substitute for tan(x) or – better! – simplify using the identity* $\sec^2(x) = 1 + \tan^2(x)$*.]*
- $\displaystyle\int_0^{\pi/2} x^2\sin(x)\,dx$ *[Parts with $u = x^2$ and $v' = -sin(x)$, and parts again with $s = 2x$ and* $t' = -\cos(x)$*.]*
- $\displaystyle\int x^3 e^{x^2}\,dx$ *[Substitute for x^2 and then do parts . . .]*
- $\displaystyle\int_0^1 x\arctan(x)\,dx$ *[Parts with $u = \arctan(x)$ and $v' = x$, followed by the algebraic trick* $\dfrac{x^2}{1+x^2} = \dfrac{1+x^2}{1+x^2} - \dfrac{1}{1+x^2}$*.]*
- $\displaystyle\int_{-\ln(2)}^0 \frac{e^{-x}}{2+e^{-x}}\,dx$ *[Substitute for $2 + e^{-x}$ or (less efficient) for e^{-x}.]*
- $\displaystyle\int \frac{(\ln(x))^2 - 4}{x\,(\ln(x) - 2)}\,dx$ *[Factor the numerator, cancel what you can, then substitute for $ln(x) + 2$ or for $ln(x)$.]*
- $\displaystyle\int \frac{e^{2x}}{\sqrt{e^x+1}}\,dx$ *[Lots of possibilities, the most efficient is probably the "whole hog" substitution* $w = \sqrt{e^x+1}$*, though you have to put in some effort to rewrite e^{2x} and dx in terms of w.]*
- $\displaystyle\int_{-\pi/2}^{\pi/2} \big(\cos(x) - \cos^3(x)\big)\,dx$ *[Factor out a* $\cos(x)$*, rewrite* $1 - cos^2(x)$ *as* $\sin^2(x)$*, and substitute for* $\sin(x)$*.]*