

# MATH 190, Lab 11: Nov 20 and 22, 2018

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Work through the following problems while TAs circulate. When you have completed the problems (to the satisfaction of the facilitators) you can spend the rest of the lab working on the weeks homework.

**Warm-up:** Compute the following integrals.

(a)  $\int \sqrt[4]{x} dx$

(b)  $\int \frac{1}{t^3} dt$

(c)  $\int \cos z dz$

(d)  $\int e^y dy$

**Problems.**

1. Compute the following integrals.

(a)  $\int x^2 \sqrt[4]{6x^3 + 5} dx$

(b)  $\int \frac{2}{(t-4)^3} dt$

(c)  $\int \frac{\cos(\ln z)}{3z} dz$

(d)  $\int e^{-6y} dy$

(e)  $\int \frac{e^x}{e^x + 1} dx$

2. Compute the following definite integrals using substitution technique in two ways: (a) Apply the substitution on the integral bounds as well and evaluate the integral by FTC and (b) Find the indefinite integral first (in terms of  $x$ ) and evaluate the integral by applying FTC with the original bounds.

(a)  $\int_{e^2}^{e^5} \frac{(\ln x)^3}{x} dx$

(b)  $\int_{-\pi}^{\frac{\pi}{2}} \sin(x) \sin(\cos(x)) dx$

3. There are many integrals that on the surface look very similar and yet will use a completely different substitution or will yield a completely different answer when using the same substitution. Compute the following integrals with a proper substitution.

(a)  $\int \frac{3}{5x+4} dx$

(b)  $\int \frac{3x}{5x^2+4} dx$

(c)  $\int \frac{3x}{(5x^2+4)^2} dx$