Math 1A: Discussion Exercises

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Find two or three classmates and a few feet of chalkboard. As a group, try your hand at the following exercises. Be sure to discuss how to solve the exercises — *how* you get the solution is much more important than *whether* you get the solution. If as a group you agree that you all understand a certain type of exercise, move on to later problems. You are not expected to solve all the exercises: in particular, the last few exercises may be very hard.

Many of the exercises are from *Single Variable Calculus: Early Transcendentals for UC Berkeley* by James Stewart; these are marked with an §. Others are my own, or are independently marked.

u-substitutions

1. § Evaluate the indefinite integral by making the suggested substitution:

   (a) $\int e^{-x}\,dx$, $u = -x$

   (b) $\int x^2\sqrt{x^3+1}\,dx$, $u = x^3+1$

   (c) $\int \cos^3\theta\,\sin\theta\,d\theta$, $u = \cos\theta$

   (d) $\int \dfrac{\sec^2(1/x)}{x^2}\,dx$, $u = 1/x$

2. § Evaluate the indefinite integral:

   (a) $\int x\sin(x^2)\,dx$

   (b) $\int (3x-2)^{20}\,dx$

   (c) $\int (3t+2)^{2.4}\,dx$

   (d) $\int (x+1)\sqrt{2x+x^2}\,dx$

   (e) $\int \dfrac{dx}{5-3x}$

   (f) $\int \sin\pi t\,dt$

   (g) $\int \dfrac{x}{x^2+1}\,dx$

   (h) $\int \dfrac{a+bx^2}{\sqrt{3ax+bx^3}}\,dx$

3. § Evaluate the definite integral:

   (a) $\int_0^2 (x-1)^{25}\,dx$

   (b) $\int_0^1 x^2(1+2x^3)^5\,dx$

   (c) $\int_0^{\sqrt{\pi}} x\cos(x^2)\,dx$

   (d) $\int_0^\pi \sec^2(t/4)\,dt$

   (e) $\int_{1/6}^{1/2} \csc\pi t\,\cot\pi t\,dt$

   (f) $\int_{-\pi/6}^{\pi/6} \tan^3\theta\,d\theta$

4. Find the indefinite integral: $\int \dfrac{ax+b}{x^2+1}\,dx$

5. § Evaluate $\int_{-2}^2 (x+3)\sqrt{4-x^2}\,dx$ by writing it as the sum of two integrals: interpret one as an area and evaluate the other using a substitution.