

# Math 1B Discussion Section Problems

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You should work on the following problems in groups of 3 or 4. Try to get through as many as you can, but you aren't expected to finish everything. Instead, you should make sure everyone in your group knows **how** to solve all the problems, and not just the answers.

## Trig Subs I

1. Find each of the following:

(a)  $\int \frac{dx}{x^2\sqrt{16-x^2}}$

(b)  $\int \frac{dx}{x^3\sqrt{x^2-9}}$

(c)  $\int_0^{\pi/2} \frac{\cos t}{\sqrt{1+\sin^2 t}} dt$

2. Consider the integral  $\int \frac{x}{\sqrt{9-x^2}} dx$

(a) Find this integral using an appropriate trig substitution

(b) Find this integral using an ordinary u-substitution

(c) Are your answers the same?

## Trig Subs II

1. Complete the square:  $6t^2 - 18t + 13$ . Your answer should be in the form  $a(x+b)^2 + c$

2. Sketch the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  and find its area. What happens if you plug in  $a = b = r$  into your formula? Does this make sense?

3. Evaluate the integral  $\int \frac{dt}{\sqrt{t^2 - 6t + 13}}$

4. Evaluate  $\int_0^{2/3} x^3 \sqrt{4-9x^2}$

5. Prove the formula  $A = \frac{1}{2}r^2\theta$  for the area of a sector of circle with radius  $r$  of  $\theta$  radians. Hint: the area is the sum of the area of the triangle POQ and the the region PQR. By using trig, you can find the lengths of the line segments OQ and QP.

**Extra Problems** (if you finish some section early, take a stab at these.)

1. Find  $\int \tan^4 x dx$

2. Let  $S$  be a sphere of radius 1. Now take a plane a distance  $d < 1$  away from the center and slice the sphere into two pieces. What is the volume of each piece? Hint: the formula for the volume of a revolved solid is  $\int_a^b \pi f(x)^2$

3. Find  $\int x\sqrt{x^4+1} dx$