

# Spring 2009 Math 152

## Week in Review 5

*courtesy: Amy Austin*

(covering sections 8.8, 9.1, 9.2)

### Section 8.9

1. Determine whether the following improper integrals converge or diverge. If it converges, find the value of the integral. If it diverges, explain why.

a.)  $\int_2^{\infty} \frac{x}{x^2 + 1} dx$

b.)  $\int_e^{\infty} \frac{1}{x(\ln x)^4} dx$

c.)  $\int_{-\infty}^0 xe^x dx$

d.)  $\int_{-\infty}^{\infty} \frac{dx}{x^2 + 9}$

e.)  $\int_{-3}^0 \frac{dx}{(x + 3)^2}$

f.)  $\int_{-1}^{32} \frac{1}{\sqrt[5]{x}} dx$

2. Determine whether the following integrals converge or diverge using the comparison theorem:

a.)  $\int_0^{\infty} \frac{1}{x^{10} + e^{5x}} dx$

b.)  $\int_2^{\infty} \frac{x}{x^{3/2} - x} dx$

c.)  $\int_1^{\infty} \frac{\cos^2 x}{x^4} dx$

d.)  $\int_1^{\infty} \frac{\arctan x + 5}{x^2} dx$

3. For what value(s) of  $p$  does  $\int_1^{\infty} \frac{dx}{x^p}$  converge?

### Section 9.1

4. Solve the equation  $\frac{dy}{dx} = \frac{x - e^{3x}}{3y^2}$

5. Solve  $\frac{dy}{dx} = \frac{xy}{2 \ln y}$

6. Solve  $y' = e^{3x-y}$ ,  $y(0) = 2$ .

7. Solve  $y' = 1 + y^2 - 2x - 2xy^2$ ,  $y(0) = 0$

8. A tank contains 200 liters of water with 5 kg of dissolved salt. Pure water enters the tank at a rate of 10 liters per minute. The solution is kept mixed and drains from the tank at the same rate. How much salt is in the tank after 8 minutes?

### Section 9.2

9. Solve  $\frac{dy}{dx} + 3y = x$ .

10. Solve  $y' - \frac{y}{x} = 2$ ,  $y(8) = 2$

11. Solve  $x \frac{dy}{dx} + 2y = \sin(x^2)$ ,  $y(\sqrt{\pi}) = 1$

12. A tank contains 1000 liters of pure water. Brine that contains 0.1 kg of salt per liter enters the tank at a rate of 5 liters per minute. The solution is kept mixed and drains from the tank at the same rate. How much salt is in the tank at time  $t$  minutes?