

# MATH 334 FALL 2011 HOMEWORK 1

## BASIC

**Problem 1.** Go to <http://www.math.rutgers.edu/~sontag/JODE/JOdeApplet.html>, plot the slope fields of the following equations, and then imagine what the integral curves should look like.

a)  $y' = 3x - 5y$ ;

b)  $\dot{x} = (x - 2t)(x + t)$ ;

c)  $\frac{dy}{dx} = \ln|x - y|$  (type “ln(abs(x-y))”)

**Problem 2.** Check solutions.

a)  $y = C_1 e^{-2x} + C_2 e^x + \sin 3x$  solves

$$y'' + y' - 2y = -11 \sin 3x + 3 \cos 3x. \quad (1)$$

b)  $y = x^3$  solves

$$x^2 y'' - x y' - 3y = 0. \quad (2)$$

**Problem 3.** Solve the following differential equations.

a)  $\frac{dy}{dx} = e^x \sin x$ ;

b)  $\dot{y} = t \sin t$ ;

c)  $3y^2 y' = x^2$ .

## INTERMEDIATE

**Problem 4.** Find the values of  $\alpha$  such that  $e^{\alpha x}$  solves

$$y'' + 2y' + 4y = 0. \quad (3)$$

**Problem 5.** Find the values of  $r$  such that  $x^r$  solves

$$x^2 y'' + 6x y' + 4y = 0. \quad (4)$$

## ADVANCED

## CHALLENGE

See next page for answers.

## ANSWERS

Problem 3:

a)  $y = \frac{1}{2}(e^x \sin x - e^x \cos x) + C.$

b)  $y = -t \cos t + \sin t + C.$

c)  $y^3 = \frac{1}{3}x^3 + C.$

Problem 4:  $-1 \pm \sqrt{3}i.$ Problem 5:  $-4, -1.$