
Homework 1

Last name: _____

First name: _____

Due at the beginning of the class on Wednesday October 5th, 2013.

1. For (a) and (b), determine whether the given function is a solution to the given differential equation.

(a) $x = \cos 2t$, $\frac{dx}{dt} + tx = \sin 2t$.

(b) $y = x^2 - x^{-1}$, $x^2 \frac{d^2y}{dx^2} = 2y$.

2. Determine for which values of m the function $\phi(x) = x^m$ is a solution to the differential equation

$$3x^2 \frac{d^2y}{dx^2} + 11x \frac{dy}{dx} - 3y = 0$$

3. Given the differential equation

$$ty' + y = t^2$$

(a) Show that for any values of C , the function $y(t) = \frac{t^2}{3} + \frac{C}{t}$ is solution to the differential equation.

(b) Find the solution to the initial value problem

$$ty' + y = t^2, \quad y(1) = 2$$

4. Given a function y solution to the differential equation $y' - x^2y = 0$, prove that $y'' - (x^4 + 2x)y = 0$.

5. Solve the following initial value problems:

(a) $\frac{dy}{dt} = x^2 + y^2x^2, \quad y(0) = 1$

(b) $\frac{dy}{dx} = \frac{3x^2 - 1}{2y + 1}, \quad y(0) = -1.$

(c) $t^3 \frac{dy}{dt} + 3t^2y = 2t \quad y(2) = 0$