**Math 231, Introduction to Differential Equations,    Fall 2011**

**Queen's University, Department of Mathematics**

**Homework 1, Due Thursday September 23**

**1.** Find the solution of the following initial value problem

$$\frac{dy}{dt} + y\cos(t) = 4\cos(t), \quad y(\pi) = -1.$$

**2.** Consider the following initial value problem

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

**a).** Show that this equation is homogeneous (see page 49 Boyce and DiPrima, 8th or 9th edition).

**b).** Substituting the homogeneous variable $v = \frac{y}{x}$, calculate $\frac{dv}{dx}$, and find the general solution of the new differential equation in the $x - v$ plane. Graph some of the solution curves in the variables x,v, indicating carefully where vertical tangencies might occur.

**c).** Find the unique solution (in the x,y variables) to the initial value problem given at the beginning.

**3.** Find the family of curves which are the *orthogonal trajectories* for the family of hyperbolas

$$x^2 - 2y^2 = c$$