DIRECTIONS:

- **STAPLE** this page to the front of your homework (don't forget your name!).

- Show all work, clearly and in order **You will lose points if you work is not in order**.

- When required, **do not forget the units!**

- Circle your final answers. **You will lose points if you do not circle your answers**.

Question	Points	Score
1	3	
2	3	
3	1	
4	2	
5	1	
Total	10	

Problem 1: (3 points) Are the following differential equations linear or nonlinear? What order are they? What techniques would you use to solve them?

(a) (1 point) $\sin^2 xy' = \arctan xe^{\frac{x^3}{2}}y + 100\pi\frac{x^4}{x^2+1}$.

(b) (1 point) $(1 + \cos x)\,dy = (e^{-y} + 1)\sin x dx$.

(c) (1 point) $2x + y^2 + 2xyy' = 0$.

Problem 2: (3 points) Find a family of solutions to

$$\frac{dy}{dx} = xy^{1/2},$$

using separation of variables. Now find a particular solution to this problem subject to $y(0) = 0$.

Problem 3: (1 points) Consider the solution you found from problem 2 above. Does the family of solutions you found represent all solutions to this problem? Support your answer.

Problem 4: (2 points) Is the particular solution you found in problem 2 above unique? If not, why does this not contradict the following theorem guaranteeing uniqueness:

Theorem Consider the initial value problem $y' = f(x, y)$ subject to $y(x_0) = y_0$, and a rectangle, R, in the xy-plane such that $(x_0, y_0) \in R$. If f and $\frac{\partial f}{\partial y}$ are continuous on R, then there exists an interval, I, centered at x_0, and a unique solution $y(x)$ on I such that y satisfies the initial value problem.

Problem 5: (1 point) List your project group member names (including your own), email addresses, and phone numbers. Remember groups must consist of 3-4 people.

1. Name: Email: Phone Number

2. Name: Email: Phone Number

3. Name: Email: Phone Number

4. Name: Email: Phone Number