KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
Department of Mathematical Sciences
Dhahran, Saudi Arabia

Math 202   First Major Examination.   Monday, March 14, 2005.

Time Allowed: 90 min.

Instructor: Y. A. Fiagbedzi

STUDENT ID _____

Student Name: _____ Sect. _____

1. Solve the IVP:

$$y' + y \tan x = \cos x$$
$$y(0) = 0$$

Specify the interval of validity.

2. Consider the initial value problem:

$$\frac{dy}{dx} = -(y-1)^2(y+2)$$
$$y(x_0) = y_0$$

- The equilibrium points are $c_1 = $ _____ , $c_2 = $ _____ .

- Classify each equlibrium point as stable, semi-stable, or unstable.

- If $y(\cdot)$ is the solution of the inital value problem for $x_0 = 1$, $y_0 = 0$, what is $\lim_{x \to \infty} y(x)$?

3. Obtain a one parameter family of solutions for the differential equation:

$$y\frac{dy}{dx} = 4xe^{2x+y}$$

4. Solve the differential equation:

$$(x^3 + y\sin x)dx + (2y - \cos x)dy = 0$$

5. Determine an integrating factor, $\mu = \mu(y)$, which will make the differential equation,

$$y \cos x \, dx + \left(1 + \frac{2}{y}\right) \sin x \, dy = 0,$$

exact.

6. Fill in the gaps:

- The differential equation, $y = xy' - (y')^2$ has a one parameter family of solutions given by $y = cx - c^2$. It is the case that $y = \frac{x^2}{4}$ is also a solution. $y = \frac{x^2}{4}$ is an

  example of a ....solution.

- $xy' = y + \sqrt{x^2 - y^2}$ is a first order ode which can be solved with the substitution

  $y =$ ....

- $y = 0$ is a .... solution of $3x^2 y'' + 4xy' + 5y = 0$.

- $(\sin x) \, y'' + 4x \, y' + 5y = |y|$ is a nonlinear ode because ....