Name. _____

Applied Differential Equations 2250-1 and 2250-2
Sample Midterm Exam 1
Wednesday, 29 September 2004

Instructions: This in-class exam is 50 minutes. No calculators, notes, tables or books. No answer check is expected. Details count 75%. The answer counts 25%.

1. **(Quadrature Equation)**

   Solve for $y(x)$ in the equation $y' = xe^x - \tan x + \dfrac{x}{1+x^2} + e^{2x}$.

   [Integral tables will be supplied for anything other than basic formulae. This sample problem would require no integral table. The exam problem will be shorter.]

2. **(Separable Equation)**

   The problem $y' = 2x - x^{3/2} - 2xy^2 + x^{3/2}y^2$ may or may not be separable. If it is, then decompose the problem as $y' = F(x)G(y)$ and write formulae for F, G. Otherwise, explain in detail why it fails to be separable. Do not solve for y!

3. **(Separable Equation)**

   Given the separated form $\dfrac{y'}{1+y} = \dfrac{x^2}{1+x}$, find the non-equilibrium solution in implicit form. Do not solve for y explicitly and do not find equilibrium solutions.

4. **(Linear Equations)**

   Solve $5v'(t) = -50 - \dfrac{20}{t+5}v(t)$, $v(0) = 10$. Show all integrating factor steps.

5. **(Stability)**

   Draw a phase line diagram for the chemical reaction equation $dx/dt = (1-x)^2(3-2x)x$ and add these labels as appropriate: funnel, spout, stable, unstable, source, sink, node. Expected in the diagram are equilibrium points and flow direction markers ($<$ and $>$).