MAP 3306 eMath2 **Test 0** 31 Aug 2007

Directions: Show **ALL** work for credit; Give **EXACT** answers when possible; Start each problem on a **SEPARATE** page; Use only **ONE** side of each page; Be neat; Leave margins on the left and top for the **STAPLE**; Nothing written on this page will be graded;

1. Match each fuction (I–VI) to all the ODE's (A–F) it solves:

$$I.\, y = e^x \quad II.\, y = e^{-x} \quad III.\, y = \sin x \quad IV.\, y = \sinh x \quad V.\, y = xe^x \quad VI. y = e^{-2x}$$

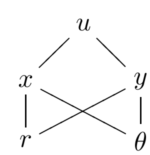
$$\begin{aligned} y'' + y &= 0 \quad A \\ y'' - y &= 0 \quad B \\ y'' - y' &= 0 \quad C \\ y'' - y' + 2y &= 0 \quad D \\ y'' - 2y' + y &= 0 \quad E \\ y' + y &= 0 \quad F \end{aligned}$$

2. The function $u(x, y)$ can also be considered a function of the polar coordinates (r, θ) via $x = r\cos\theta$ and $y = r\sin\theta$. Using the chain rule once to find $\frac{\partial u}{\partial r} = u_r$ gives

$$u_r = u_x x_r + u_y y_r = u_x \cos\theta + u_y \sin\theta$$

and u_r is expressed in terms of just u_x and u_y. Use the chain rule again to find the $u_{r\theta}$ in terms of $u_{xx}, u_{xy}, u_{yy}, u_x$ and/or u_y.

Hint



3. Find the general solution to $y'' - y' + 6y = e^x$

4. True or False and a brief reason why or why not.

   (a) $\int \cos x\, dx = -\sin x + C$ and $\int \sin x\, dx = \cos x + C$
   (b) $\int_{-\pi}^{\pi} \sin(x + x^3 + x^5) - x\cos(\sin(x))\, dx = 0$
   (c) The trigonometric functions $\sin 2x$, $\cos 2x$, and $\tan x$ all have fundamental period π.
   (d) The following are trig identities $\sin(x+y) = \sin x \cos y + \cos x \sin y$ and $\cos(x+y) = \cos x \cos y + \sin x \sin y$
   (e) $e^{i\theta} = \sin\theta + i\cos\theta$
   (f) The ODE $y'' + y' - 3y = \sin y$ is linear.
   (g) The fuction $\mu = x$ is the integrating factor needed for the ODE $y' + y/x = \sin x$.
   (h) The values r for which $y = x^r$ is a solution of $x^2y'' - 2xy' + 2y = 0$ are $r = 1$ and $r = 2$.
   (i) $u(x, t) = e^{-t}\sin 5x$ is a solution to the PDE $u_{xx} = 25u_t$
   (j) If $u(x, y) = f(2x - 3y)$ then $u_x = 2f(2x - 3y)$