# Quiz 5 - Practice

MATH 2400

July 4, 2012
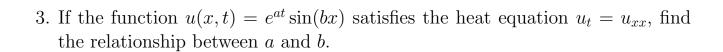
1. Suppose that $w = f(u)$ and that $u = x - y$. Show that,

   (a) $\dfrac{\partial w}{\partial x} = -\dfrac{\partial w}{\partial y}$

   (b) $\dfrac{\partial^2 w}{\partial x^2} = \dfrac{\partial^2 w}{\partial y^2} = -\dfrac{\partial^2 w}{\partial x \partial y}$

2. (a) Find the best quadratic approximation of the function $\cos(xy)$ for $(x, y)$ near $(0, 0)$.

   (b) Use this quadratic approximation to find the following limit:

   $$\lim_{(x,y)\to(0,0)} \frac{\cos(xy) - 1 - xy}{xy}$$

3. If the function $u(x,t) = e^{at}\sin(bx)$ satisfies the heat equation $u_t = u_{xx}$, find the relationship between $a$ and $b$.

4. Decide if the following function is differentiable at $(0,0)$. Explain your reasoning.

$$f(x,y) = |x| + |y|$$