

Your name: _____

Quiz 1

1. State the general solution of $v_z(z, w) = 7v(z, w)$.

2. State the general solution of $2y''(x) - 5y'(x) + 6y(x) = 0$.

3. For each of the following equations, state its degree, and identify it as linear or nonlinear, and homogeneous or nonhomogeneous.

(a) $3u_x(x, y) - 2u_y(x, y) + x^2 \ln(y)u(x, y) = \frac{\sqrt{e^{-x^2 + \sin(xy)} + xy}}{\tan^{-1}(\int_0^x \frac{\sin(y)}{y} dy)}$

(b) $u_x u_y = x$.

(c) $xu_{xyz}(x, y, z) + yu_{xy}(x, y, z) = 7$

4. Given the general solution $u = \frac{1}{2} + e^{2y}F(x + y)$ of the PDE $u_x - u_y + 2u = 1$, solve for the side condition $u(x, 3x + 1) = \sin(x)$. (Hint: you need a change of variables to solve for F .)

5. Identify which of the following product solutions of the heat equation can solve the indicated BC, and find A and B (but not λ).

$$\text{PDE} \quad 2u_{xx} = u_t, \quad k > 0, \quad 0 \leq x \leq L$$

$$\text{BC} \quad u(0, t) = e^{-3t}, \quad u(L, t) = e^{-3t}$$

Product solutions:

$$u(x, t) = e^{-\lambda^2 kt} (A \sin(\lambda x) + B \cos(\lambda x))$$

$$u(x, t) = e^{\lambda^2 kt} (Ae^{\lambda x} + Be^{-\lambda x})$$

$$u(x, t) = Ax + B$$

6. Separate (but do not solve)¹ the following ODE $\frac{dy}{dx} = \frac{x^2 \sin(y)}{y} - \frac{\sin(y)}{y}$.

7. Separate (but do not solve)¹ the following PDE using a product separation $u(x, t) = f(x)g(t)$

$$x^2 u_{xx} + u_{tt} = 0$$

¹Ask me if you don't know how far to go.