MTH 3311 Test #1

Fall 2018

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Show CLEARLY how you arrive at your answers.

1. Classify the following according to **order** and **linearity.** If an equation is **not linear,** explain why.

   (a) $y''' + x^2y'' - 2xy = x^2 - 4$

   (b) $y^{(5)} + x^2yy'' = \sin(x)$

   (c) $y^{(4)} + 2xy'' + y^2 = 6x - 6$

   (d) $\sin(x)\,y''' - 3xy' + x^3y = e^x + \sin(x)$

   (e) $y'' - y' + 4y = \frac{x}{x^2+1}$

2. Show that the function $y = c_1e^{-3x} + c_2e^{3x} + 4x^2 + 6x$ is a solution of the differential equation $y'' - 9y = -36x^2 - 54x + 8$

3. Solve: $\frac{dy}{dx} = xy + 2y + x + 2$; subject to the initial condition $y(0) = 1$ (Assume that $x, y \geq 0$)

   Solve the equation by "separating the variables," and then solve the equation using the "integrating factor method."

4. Solve: $y' + \frac{1}{x+1} y = \frac{1}{x+1} \sin(x)$; using the "integrating factor method." (Assume that $x, y > 0$.)

5. Determine whether or not the equation is exact. If the equation is exact, solve it.

$$\left(3x^2y + y\cos(x) + 2y^3 + e^x\right)dx + \left(x^3 + 6xy^2 + \sin(x) + \cos(y)\,e^{\sin(y)}\right)dy = 0$$

6. Solve: $2xy\frac{dy}{dx} = 3x^2 + 4y^2$ using the substitution $v = \frac{y}{x}$. (Assume that $x, y > 0$)