

Math 3331 ODEs - Sample Test 1

1. For the following ODEs state the order and whether the equations are linear (homogeneous or nonhomogeneous) or nonlinear. If they are nonlinear, underline or circle the nonlinear terms

(i) $y'' = 1 - y^2$

(ii) $x^2y'' - 2xy' + y = 0$

2. Verify that the given function satisfies the given ODE and IC/BC if given

(i) $y = x \ln x, \quad xy' - y = 1 \quad y(1) = 0$

(ii) $y = 2xe^x + e^x, \quad y'' - 2y' + y = 0, \quad y(0) = 1, \quad y'(0) = 3$

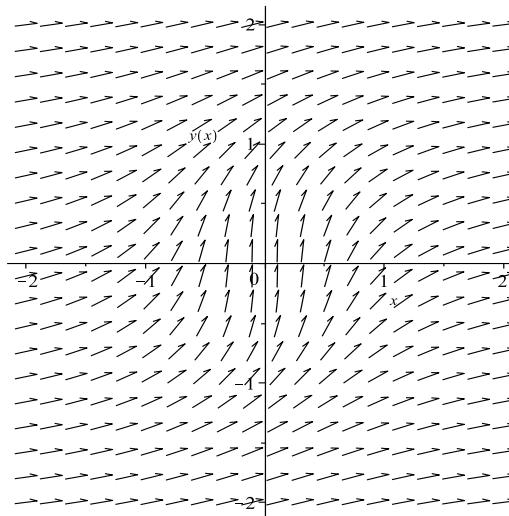
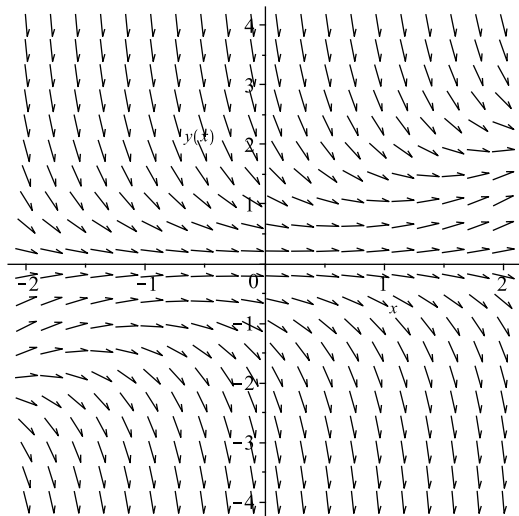
3. For the given ODEs and corresponding direction fields, trace the solution for the given IC.

(i) $\frac{dy}{dx} = y(x - y)$

(ii) $\frac{dy}{dx} = \frac{1}{x^2 + y^2}$

(a) $y(-1) = -1$ (b) $y(0) = 1$

(a) $y(-1) = 1$ (b) $y(1) = 1$



Solve the following ODEs

4. $\frac{dy}{dx} = \frac{x}{y} + \frac{1}{y} + x + 1$

5. $x \frac{dy}{dx} + 2y = x^2 y^2$

6. $\frac{dy}{dx} - y = 2e^x, \quad y(0) = 3$

7. $\frac{dy}{dx} = \frac{1 - 2xy^2}{1 + 2x^2y}, \quad y(1) = 1$

8. $\frac{dy}{dx} = (\ln y - \ln x + 1) \frac{y}{x}$