

HOMEWORK 9 - MATH 112

DUE DATE: Thursday, December 8

INSTRUCTOR: George Voutsadakis

Read each problem very carefully before starting to solve it. One part of each problem will be chosen at random and graded. Each question is worth 1 point. It is necessary to show your work. Correct answers without explanations are worth 0 points.

GOOD LUCK!!

1. Evaluate the improper integrals:

$$(a) \int_0^{\infty} \frac{5}{e^{2x}} dx \quad (b) \int_{-\infty}^0 \frac{x}{x^2 + 1} dx$$

2. Evaluate the improper integrals:

$$(a) \int_0^1 \frac{1}{x^2} dx \quad (b) \int_3^5 \frac{1}{x^2 \sqrt{x^2 - 9}} dx$$

3. Use implicit differentiation to verify that the equation is a solution of the differential equation for any value of C .

$$(a) y^2 + 2xy - x^2 = C, \quad (x + y)y' - x + y = 0$$

$$(b) x^2 - y^2 = C, \quad y^3 y'' + x^2 - y^2 = 0$$

4. Verify that the general solution satisfies the differential equation. Then find the particular solution that satisfies the initial condition.

$$(a) \text{ General Solution: } y = C_1 x + C_2 x^3$$

$$\text{Differential Equation: } x^2 y'' - 3xy' + 3y = 0$$

$$\text{Initial Condition: } y = 0 \text{ and } y' = 4 \text{ when } x = 2.$$

$$(b) \text{ General Solution: } y = (C_1 + C_2 x + \frac{1}{12} x^4) e^{2x}$$

$$\text{Differential Equation: } y'' - 4y' + 4y = x^2 e^{2x}$$

$$\text{Initial Condition: } y = 2 \text{ and } y' = 1 \text{ when } x = 0.$$

5. Use integration to find the general solution of the differential equation:

$$(a) \frac{dy}{dx} = \frac{1}{2 - 7x} \quad (b) \frac{dy}{dx} = x\sqrt{3x - 5} \quad (c) \frac{dy}{dx} = 11xe^{3x}$$

6. Use separation of variables to find the general solution of the differential equation

$$(a) \frac{dy}{dx} = x^2 y \quad (b) (1 + y) \frac{dy}{dx} - 4x = 0 \quad (c) \frac{dy}{dx} = \frac{x^2 + 2}{3y^2} \quad (d) yy' - 2xe^x = 0$$

7. Use the given initial condition to find the particular solution of the differential equation.

$$(a) yy' - e^x = 0, \quad y = 4 \text{ when } x = 0$$

$$(b) \sqrt{x} + \sqrt{y} y' = 0, \quad y = 4 \text{ when } x = 1$$

$$(c) \frac{dy}{dx} = x^2(1 + y), \quad y = 3 \text{ when } x = 0.$$

8. Solve the differential equations

$$(a) \frac{dy}{dx} + 5y = 15 \quad (b) \frac{dy}{dx} + 3y = e^{-3x} \quad (c) \frac{dy}{dx} + \frac{2y}{x} = 3x + 1 \quad (d) xy' + y = x^2 \ln x$$