

# HOMEWORK 9 - MATH 112

DUE DATE: WEEK BEFORE FINAL EXAMS

INSTRUCTOR: George Voutsadakis

Read each problem **very carefully** before starting to solve it. Four out of the eight problems will be chosen at random and graded. Each problem graded is worth 3 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points.

GOOD LUCK!!

1. Use integration by parts to compute the following integrals:

$$(a) \int x e^{-x} dx \quad (b) \int x^2 e^x dx \quad (c) \int \ln(x^2) dx \quad (d) \int x^{2006} \ln x dx$$

2. Use partial fraction expansions to compute the integrals:

$$(a) \int \frac{3}{x^2+x-2} dx$$

$$(b) \int_0^1 \frac{3}{2x^2+5x+2} dx$$

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

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