# HOMEWORK 9 - MATH 112

# DUE DATE: Monday, April 18
# 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 following integrals: $\int \frac{-4}{x^2-4}dx$ and $\int_0^1 \frac{3}{2x^2+5x+2}dx$.

2. Evaluate the following improper integrals: $\int_1^\infty \frac{1}{\sqrt{x}}dx$ and $\int_{-\infty}^0 \frac{x}{x^2+1}dx$

3. Evaluate the following improper integrals: $\int_0^2 \frac{1}{(x-1)^{4/3}}dx$ and $\int_0^2 \frac{x}{\sqrt{4-x^2}}dx$.

4. Verify that the function given is a solution of the differential equation:
   (a) $y = 3e^{x^2}$ is a solution of $y' - 2xy = 0$
   (b) $y = \frac{1}{x}$ is a solution of $xy'' + 2y' = 0$
   (c) $y = x^2 + 2x + \frac{C}{x}$ is a solution of $xy' + y = x(3x+4)$
   (d) $y = \frac{2}{1+Ce^{x^2}}$ is a solution of $y' + 2xy = xy^2$

5. Use implicit differentiation to verify that the equation is a solution of the differential equation for any value of $C$:
   (a) $y^2 + 2xy - x^2 = C$ is a solution of $(x+y)y' - x + y = 0$
   (b) $x^2 - y^2 = C$ is a solution of $y^3y'' + x^2 - y^2 = 0$

6. First, verify that the solution satisfies the given differential equation and, then, find a particular solution that satisfies the given initial condition:
   (a) $y = C_1x + C_2x^3$ satisfies $x^2y'' - 3xy' + 3y = 0$. Initial conditions $y = 0$ and $y' = 4$ when $x = 2$
   (b) $y = Ce^{x-x^2}$ satisfies $y' + (2x-1)y = 0$. Initial conditions $y = 2$ when $x = 1$

7. Use separation of variables to find the general solution of the given differential equation:
   (a) $(y+1)\frac{dy}{dx} = 2x$
   (b) $\frac{dy}{dx} = \sqrt{\frac{x}{y}}$
   (c) $e^x(y'+1) = 1$

8. Use the given initial condition to find the particular solution of the differential equation:
   (a) $\sqrt{x} + \sqrt{y}y' = 0$, $y = 4$ when $x = 1$
   (b) $\frac{dy}{dx} = x^2(1+y)$, $y = 3$ when $x = 0$
   (c) $dT + k(T-70)dt = 0$, $T = 140$ when $t = 0$