King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics

MATH 260 - Exam I - Term 171
Duration: 90 minutes

Name:_____ ID Number:_____

Section Number:_____ Serial Number:_____

Class Time: _____ Instructor's Name:_____

Instructions:

1. Calculators and Mobile Phones are not allowed.

2. Please write legibly.

3. Show all your work. No points for answers without justification.

4. Make sure that you have 8 pages of problems (Total of 8 Problems)

Question # Number	Points	Maximum Points
1		12
2		07
3		12
4		14
5		14
6		13
7		14
8		14
Total		100

1. [**12 points**] (a) Verify, by substitution, that $y(x) = \dfrac{1}{2x^2 + C}$ is a one parameter family of solutions of the differential equation $\dfrac{dy}{dx} = -4xy^2$.

(b) Solve the initial value problem $\dfrac{dy}{dx} = -4xy^2$; $y(0) = -2$.

(c) Find the interval over which the solution of the initial value problem given in part(b) is defined.

2. [**07 points**] Solve the initial value problem $\dfrac{d^2y}{dx^2} - e^{-x} = 0$; $y(0) = 1$; $y'(0) = 4$.

3. [**12 points**] Solve the differential equation $(\sin\ x)dx + 2y\ (cos^3 x)dy = 0$
   with $0 < x < \dfrac{\pi}{2}$.

4. [**14 points**] Find general solution of the first order differential equation $\dfrac{1}{\sin x}\dfrac{dy}{dx} = (y \sec x - 2)$ with $0 < x < \dfrac{\pi}{2}$.

5. [**14 points**] Solve the first order initial value problem

$$\left(\cos x \, \sin x - xy^2 + \frac{1}{2} \right) + y(1 - x^2) \frac{dy}{dx} = 0; \; y(0) = 1.$$

6. [**13 points**] Use Gaussian elimination method to solve the system

$$
\begin{aligned}
y - 2z + w &= 2 \\
2x + y \quad\quad - w &= 0 \\
3x + y + 2z - w &= 6
\end{aligned}
$$

7. **[14 points]** Find a matrix $A = \begin{pmatrix} 1 & x & z \\ 0 & 1 & y \\ 0 & 0 & 1 \end{pmatrix}$ such that

$$A^2 + \begin{pmatrix} 0 & -1 & 0 \\ 0 & 0 & -1 \\ 0 & 0 & 0 \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}.$$

8. [**14 points**] Using adjoint method, find inverse of the 3×3 matrix $A = \begin{pmatrix} -3 & 4 & 1 \\ 1 & 2 & 0 \\ 1 & 1 & 3 \end{pmatrix}$.