King Fahd University of Petroleum and Minerals
Department of Mathematical Sciences

MATH 260 First Major Exam

February 22, 2018, At 5:45 PM Time Allowed: 100 min Term 172

Name: ______________________________

ID: ______________________ Sec: ___________ Serial number: ___________

Check that this exam has 8 questions.

Important Instructions:

1. No electronic device (such as calculator, mobile phone, smart watch) is allowed in this exam.
2. Justify your answers no credit is given for (correct) answers not supported by work.
4. Write clearly. Marks may be deducted for messy work.
5. Write your name, ID number and Section number on the exam paper.

Question	Marks	Out of
1		15
2		10
3		10
4		15
5		15
6		10
7		10
8		15

Q1. If $y = \frac{1}{x^2} + A\frac{\ln x}{x^2} + B$ where A and B are constant is the solution of the initial value problem

$$y' - \frac{1}{x}(1-2y) - \frac{2}{x^3} = 0, \quad y(1) = \frac{3}{2},$$

then find the values of A and B.

Q2. Solve the IVP:

$$\frac{dy}{dx} = (1-x)e^{4x-2x^2}, \quad y(2) = 1.$$

Q3. Solve the following IVP:

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

Q4. Solve the first order DE:

$$(x^2+4)y' - 2xy = x(x^2+4)^3.$$

Q5. Solve the DE:

$$(-y\cos x + \sec^2 x)dx + (2y - \sin x)dy = 0$$

Q6. Use the adjoint of the matrix:

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & -1 & 1 \\ 1 & 1 & -1 \end{bmatrix}$$

to find the inverse matrix of A.

Q7. For the following system, find a solution vector **u** such that the solution space is the set of all scalar multiples of **u**

$$\begin{aligned} x_1 + 5x_2 + x_3 - 8x_4 &= 0 \\ x_2 - 11x_4 &= 0 \\ x_3 + 22x_4 &= 0 \end{aligned}$$

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Q8. (a) Show that the set $V = \{(x, y, z) : z = 2x + 3y\}$ is a subspace of $\mathbb{R}^3$

(b) Show that $W = \{(x, y, z) : xyz = 1\}$ is NOT a subspace of $\mathbb{R}^3$