King Fahd University of Petroleum and Minerals
Department of Mathematical Sciences
Math - 260 Applied Calculus

Test No. 1 *Dr. M. Z. Abu-Sbeih* *August 3, 2009*

Serial No: *Student No.:* *Name:*

1. **SHOW ALL WORK. NO CREDITS FOR ANSWERS NOT SUPPORTED BY WORK.**
2. **All TYPES OF CALCULATORS ARE NOT ALLOWED.**

Problem 1 (12 Points): Show that the equation is exact and solve. $e^{y}\,dx + (x\,e^{y} + 2y)\,dy = 0$.

Problem 2 (12 Points): Find the general solution of the Bernoulli equation

$$x\,dy + y\,dx = xy^{2}\,dx\ .$$

Problem 3 (12 Points): Solve the differential equation $x\cos^2 y + \tan y \dfrac{dy}{dx} = 0$.

Problem 4 (12 Points): Solve the differential equation $\dfrac{dy}{dx} = \dfrac{2x + y + 1}{2x + y - 1}$.

Problem 5 (12 Points): For a substance C, the time rate of conversion is proportional to the square of the amount x of unconverted substance present. If we start with 4 kg of the substance, and after one hour we found that three kgs. left, how long it will take to have only 1 kg left?

Problem 6 (12 Points): Consider the linear system of equations:

$$\begin{aligned} 3x + 8y - z &= -18 \\ 2x + y + 5z &= 8 \\ 2x + 4y + 2z &= -4 \end{aligned}$$

(a) Write the augmented matrix of the system.
(b) Use Gauss-Jordan elimination to write the matrix in reduced echelon form.
(c) Use part (b) to find the solution of the system.

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Problem 7 (10 Points): Determine whether each of the following statements is true or false.

(a) For any matrix A, if $A^2 = \mathbf{0}$, then A = **0** (the zero matrix).
(b) For any matrix A, if $A^2 = \boldsymbol{I}$, then A = $\boldsymbol{I}$ (where $\boldsymbol{I}$ is the identity matrix).
(c) $2(A + B) = 2B + 2A$ for any two matrices A and B with the same size.
(d) If $A^T = A^{-1}$ then $|A| = 1$ or $|A| = -1$.
(e) For any two matrices A and B, if $AB = B$, then $A = I$ (the identity matrix).

Problem 8 (18 Points): Solve the system of equations

$$x + 2y = 4$$
$$2x - y = 3$$

using
(a) the inverse of the coefficient matrix and

(b) Cramer's Rule.