

MODEL: D

KING ABDULAZIZ UNIVERSITY
DEPARTMENT OF MATHEMATICS
Exam/Course: Exam I - Math-204

Student Name:

Student University Number:

Instructor Name:

Section:

Time Allowed: 90 Minutes

March 27, 2011

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(Q1) Select the correct response with writing the details:

(i) The D.E. $(2x + 3y - 2)y' = 1$ is

☐ exact ☐ homogeneous ☐ separable (2Pt.)

(ii) The D.E. $\frac{dy}{dx} = \frac{x}{y} + \frac{y}{x} + 1$ is

☐ exact ☐ Ricatti ☐ homogeneous (2Pt.)

(iii) The D.E. $\frac{dy}{dx} = y^2 - 3y + 2$ is

☐ exact ☐ linear ☐ Ricatti (2Pt.)

(iv) The D.E. $y' = y(1 - y)$ has the solution $y = 1$ as

☐ a singular solution ☐ a particular solution (5Pt.)

(v) According to the **Existence and Uniqueness Theorem** the IVP:

$y' = y \ln y$; $y(0)=1$ has

☐ one solution ☐ an infinitely many solutions ☐ no solution (5 Pt.)

(Q_2) A large tank is filled to capacity with 500 gallons of pure water. Brine containing 2 pounds of salt per gallon is pumped into the tank at a rate 4 gallons per minute. The well mixed solution is pumped out at the same rate. Find the number $A(t)$ of pounds of salt in the tank at any time t . What is the concentration $c(t)$ of the salt in the tank at any time t . (8Pt.)

(Q_3) Two chemicals A and B are combined to form a chemical C. The rate, or velocity, of the reaction is proportional to the product of the instantaneous amounts of A and B not converted to chemical C. Initially, there are 40 grams of A and 50 grams of B, and for each grams of B, 1 gram of A is used. It is observed that 10 grams of C is formed in 5 minutes. How much is formed in 20 minutes?. What is the limiting amount of C after a long time?. (8Pt.)

Answer only three of the following four questions:

(Q₄) **Solve:** $t^2 \frac{dy}{dt} + y^2 = ty$; $y(1) = 1$

(6Pt.)

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(Q₅) **Solve:** $(1+x^4)dy + x(1+4y^2)dx = 0$; $y(1) = 0$

(6Pt.)

(Q₆) **Solve:**

$$\frac{dy}{dx}+y = f(x), \quad y(0) = 0, f(x) = \begin{cases} 1 & \text{if } 0 \leq x \leq 1, \\ -1 & \text{if } x > 1. \end{cases} \qquad (6Pt.)$$

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(Q₇) **Solve** $\frac{dy}{dx} = 3+\sqrt{y-3x+1}$, (6Pt.)

Q1	Q2	Q3	Q4	Q5	Q6	Sum	adapted points