Prince Sultan University

Department of Mathematics
and
General Sciences

Math 225
Major Exam I Term 162
Duration: 80 minutes

Name: Section 429, 666
Student Number:

Grading policy:

Questions	Q.1	Q.2	Q.3	Q.4	Q.5	Total
Question Mark	7	8	8	9	8	45
Student Mark						

Good Luck

1. Consider the IVP $\frac{dy}{dx} = \sqrt{y}$, $y(x_0) = y_0$.
    a) Without solving, explain why the IVP has no solution for $y_0 < 0$.
    b) Solve the initial value problem for $y_0 > 0$ and find the largest interval I on which the solution is defined.

2. Consider the differential equation $y' = -y(4 - y)$.
    a) Draw a direction fields for this equation and comment on the behavior of the solutions.
    b) Solve the differential equation.

3. Consider the differential equation $(-xy\sin x + 2y\cos x)dx + (2x\cos x)dy = 0.$
    a) Show that the equation is not exact.
    b) Show that the equation becomes exact when multiplying by $\mu(x, y) = xy$.
    c) Solve the new differential equation.

4. Consider the differential equation $4y'' + 4y' + 17y = 0,$ with the initial conditions $y(0) = -1,\ \ y'(0) = 2.$
    a) Solve the IVP.
    b) Comment on the behavior of solutions by drawing a sketch for the solution.

5. Verify that the functions $\cos(\ln x)$ and $\sin(\ln x)$ form a fundamental set of solutions for the differential equation $x^2 y'' + xy' + y = 0$ on the interval $(0, \infty)$. Write the general solution.