

# Practice Midterm

(MAT303 Summer 2004 Session II)

*Each question is worth 10 points (Max Points = 60).*

1. Check for exactness of the following equations and solve it if it is exact.

a)  $dx = \frac{y}{1-x^2y^2} dx + \frac{x}{1-x^2y^2} dy$

b)  $\cos x \cos^2 y dx + 2 \sin x \sin y \cos y dy = 0$

2. Solve the following differential equation.

$$(1 + x^2) dy + 2xy dx = \cot x dx$$

3. Consider the following differential equation.

$$\frac{dy}{dx} = [\log(\sin x)][\log(\cos y)] \quad \text{with the condition } y(a) = b.$$

Find two numbers  $a$  and  $b$  for which the above differential equation will have a unique solution around  $a$ .

4. Using substitution, reduce the following differential equation to a homogeneous equation. State what assumption you may have to make. Here  $a, b, c, e, f, g$  are constants.

$$\frac{dy}{dx} = \frac{ax + by + c}{ex + fy + g}$$

5. Solve the following differential equations.

a)  $y' = (x + y)^2$  ,  $y(2) = 3$

b)  $y' = \sin^2(x - y + 1)$  ,  $y(0) = 0$

6. Find the equilibrium solutions for the differential equation and find whether each one is stable or not.

$$y' = e^x(\sin^2 x - 1)$$