American University of Beirut

MATH 202

Differential Equations

Spring 2009

quiz # 1

Exercise 1 *(15 points)* Show that the IVP: $\frac{dy}{dx} = \sqrt{1-y^2}$, $y(0) = 1$, has infinitely many solutions; does it contradict the existence and uniqueness theorem? justify.

Exercise 2 **a.** *(10 points)* solve the differential equation: $\dfrac{dy}{dx} = y - y^2$.

b. *(5 points)* are the solutions found in part **a)** all the solutions? justify.

c. *(5 points)* give the solution of the IVP: $\dfrac{dy}{dx} = y - y^2$, $y(0) = -1$; and give the interval of definition I.

Exercise 3 *(15 points)* Solve the IVP: $\dfrac{dy}{dx} - \dfrac{2}{x}\,y = x^2 + \dfrac{3}{x}$, $y(1) = 2$

Exercise 4 *(15 points)* Use an appropriate substitution to solve the differential equation

$$\frac{y'}{y} + \ln y = \sqrt{1-e^x}$$

Exercise 5 *(15 points)* Integrate $g(x,y,z) = x\sqrt{y^2+4}$ over the surface cut from the parabolic cylinder $y^2 + 4z = 16$ by the planes $x = 0, x = 1$, and $z = 0$.

Exercise 6 *(20 points)* Let C be the curve lying on the surface $z = y^2 + 1$, whose sides lie vertically above the triangle in the xy-plane with $x = 0, y = 0, x + y = 1$ (see figure).

Find $\displaystyle\oint_C 3xzdx + ydy + x^2dz$

i. directly (you need to parameterize three curves on the surface!)

ii. by using **Stoke's theorem**