Haigazian University **8 Mar 2010**

MATH 202 Quiz 3A

Solution

Let $M(x,y) = 2x - y\sin(xy) - 5y^4$ and $N(x,y) = -20xy^3 - x\sin(xy)$

1) Show that the differential equation $M(x,y)\,dx + N(x,y)\,dy = 0$ is exact

$$\frac{\partial M}{\partial y} = -\sin(xy) - yx\cos(xy) - 20y^3 = \frac{\partial N}{\partial x}$$

2) Solve the initial value problem

$$\begin{cases} M(x,y)\,dx + N(x,y)\,dy = 0 \\ y(1) = \pi \end{cases}$$

$$\frac{\partial f}{\partial x} = 2x - y\sin xy - 5y^4$$

$$f(x,y) = x^2 + \cos xy - 5xy^4 + g(y)$$

$$\frac{\partial f}{\partial y} = -x\sin xy - 20xy^3 + g'(y) = -x\sin xy - 20xy^3$$

$$g'(y) = 0$$

$$g(y) = 0$$

$$x^2 + \cos xy - 5xy^4 = c$$

$$1 + \cos\pi - 5\pi^4 = c$$

$$-5\pi^4 = c$$

$$Answer: x^2 + \cos xy - 5xy^4 + 5\pi^4 = 0$$