Print Name: Key

Sign Name: _____

TARDIS CODE:				

Mathematics 5B Spring 2011: Lecture Quiz 4
May 5, 2011
Professor J. Douglas Moore

Multiple Choice. Circle the best answer to each of the following questions. Each question is worth 2 points.

1. Suppose that a planet is moving around the sun with a Newtonian gravitational potential

$$\phi(x,y,z) = \frac{-GMm}{\sqrt{x^2+y^2+z^2}},$$

where M is the mass of the sun, m is the mass of the planet and $G > 0$ is the Newtonian gravitational constant. The work performed on the planet by the gravitational field when the planet moves along a parametrization γ of a directed curve $\mathbf{C}$ is

$$(\text{work}) = \int_{\mathbf{C}} \nabla\phi \cdot \mathbf{T} ds = \int_{\mathbf{C}} \nabla\phi \cdot d\mathbf{x} = \int_{\mathbf{C}} d\phi$$

If $\mathbf{C}$ is the directed line from $(3,4,0)$ to $(1,0,0)$, this work is

a. $-4GMm$ b. $-(4/5)GMm$ (c. $(4/5)GMm$) d. $4GMm$ e. None of these

2. If

$$D = \{(x,y) : 0 \le y \le 1-x^2\},$$

then the area of D

$$\int_{-1}^{1}\left[\int_0^{1-x^2} dy\right] dx = \int_{-1}^{1}(1-x^2)\,dx = x - \tfrac{1}{3}x^3\Big|_{-1}^{1} = \frac{4}{3}$$

a. 2/3 (b. 4/3) c. 8/3 d. 16/3 e. None of these

3. If

$$D = \{(x,y) : x \ge 0,\ y \ge 0,\ x+y \le 1\}, \quad \text{then} \quad \int\int_D y\,dx\,dy = \int_0^1\left[\int_0^{1-x} y\,dy\right] dx$$

a. $-1/6$ (b. 1/6) c. 1/3 d. 1/2 e. None of these

$$= \int_0^1 \tfrac{1}{2}(1-x)^2\,dx = -\tfrac{1}{6}(1-x)^3\Big|_0^1 = \frac{1}{6}$$