

Name: _____

M344: Calculus III (Spring 2018)

Instructor: Justin Ryan

Unit IV Exam (Take Home): Chapter 16



WICHITA STATE
UNIVERSITY

Read and follow all instructions. You may use any resources you want, but make sure you write your work in your own style, show enough work, and provide sufficient explanation when appropriate. These questions are worth 8 points each.

1. Find the work done by the force field

$$\mathbf{F} = z\mathbf{i} + x\mathbf{j} + y\mathbf{k}$$

in moving a particle from the point $(3, 0, 0)$ to the point $(0, \frac{\pi}{2}, 3)$ along the helix $\mathbf{r}(t) = \langle 3 \cos t, t, 3 \sin t \rangle$.

2. If f and g are twice differentiable functions, show that

$$\nabla^2(fg) = f\nabla^2g + g\nabla^2f + 2\nabla f \cdot \nabla g.$$

Use this formula to compute $\Delta(e^x \tan y)$.

3. Use Green's Theorem to evaluate

$$\int_C \sqrt{1+x^2} dx + 2xy dy$$

where C is the triangle with vertices $(0,0)$, $(1,0)$, and $(0,1)$.

4. Find $\text{curl} \mathbf{F}$ and $\text{div} \mathbf{F}$ for

$$\mathbf{F} = \langle e^{-x} \sin y, e^{-y} \sin z, e^{-z} \sin x \rangle.$$

5. Show that $\mathbf{F}$ is conservative and find a potential function f .

$$\mathbf{F} = \langle \sin y, x \cos y, -\sin z \rangle$$