

Name _____

Homework 20
Section 18.3

1. (5) Determine the potential function, f , for the vector field

$$\vec{F}(x, y, z) = (xye^z + y)\vec{i} + \left(\frac{1}{2}x^2e^z + x\right)\vec{j} + \left(\frac{1}{2}x^2ye^z + 3\right)\vec{k}$$

for which $f(2, 1, 0) = 0$.

2. (7) Use the Fundamental Theorem of Calculus for Line Integrals to compute $\int_C \vec{F} \cdot d\vec{r}$ where

$$\vec{F}(x, y, z) = (2x + yz)\vec{i} + (2y + xz)\vec{j} + (2z + xy)\vec{k}$$

and C is the path from $(1, 2, 3)$ to $(3, 4, 1)$ given by $x(t) = 2t + 1$, $y(t) = 3 - \cos(\pi t)$, $z(t) = 3 - 2t^2$, for $0 \leq t \leq 1$.

3. (5,3) The path C is a line segment of length 10 in the xy -plane starting at $(3, 1)$. For $f(x, y) = 4x + 3y$, consider $\int_C \text{grad} f \cdot d\vec{r}$.

(a) Where should the other end of the line segment C be placed in order to maximize the value of the integral? *Hint:* what direction will maximize the value of the integral?

(b) What is the maximum value of the integral?