Math 2X03 - Homework 3

Due: May 24, 2018 (by 10:00 pm)

(The following problems are from the textbook.)

1. Evaluate the following line integrals.
   (a) (§16.2 #2) $\int_C (x/y)ds$, where C is the curve given by $C : x = t^3, y = t^4, 1 \leq t \leq 2$.
   (b) (§16.2 #10) $\int_C y^2 z ds$, where C is the line segment from $(3, 1, 2)$ to $(1, 2, 5)$.
2. (§16.2 #8) Evaluate the line integral $\int_C x^2 dx + y^2 dy$, where C consists of the arc of the circle $x^2 + y^2 = 4$ from $(2, 0)$ to $(0, 2)$ followed by the line segment from $(0, 2)$ to $(4, 3)$.
3. Evaluate the following line integrals $\int_C \vec{F} \cdot d\vec{r}$, where C is given by the vector function $\vec{r}(t)$.
   (a) (§16.2 #19) $\vec{F}(x, y) = xy^2\vec{i} - x^2\vec{j}$,
   $\vec{r}(t) = t^3\vec{i} + t^2\vec{j}, 0 \leq t \leq 1$.
   (b) (§16.2 #22) $\vec{F}(x, y, z) = x\vec{i} + y\vec{j} + xy\vec{k}$,
   $\vec{r}(t) = \cos t\vec{i} + \sin t\vec{j} + t\vec{k}, 0 \leq t \leq \pi$.
4. (§16.3 #6) Determine whether or not $\vec{F}(x, y) = (ye^x)\vec{i} + (e^x + e^y)\vec{j}$ is a conservative vector field. If it is, find a function f such that $\vec{F} = \nabla f$.
5. (§16.3 #14)
   (a) Fine a function f such that $\vec{F} = \nabla f$, where $\vec{F}(x, y) = (1 + xy)e^{xy}\vec{i} + x^2 e^{xy}\vec{j}$.
   (b) Use part (a) to evaluate $\int_C \vec{F} \cdot d\vec{r}$ along the curve C given by $\vec{r}(t) = (\cos t)\vec{i} + (2 \sin t)\vec{j}, 0 \leq t \leq \pi/2$.