Homework Section 16.3

1. A table of values of a function *f* with continuous gradient is given below. Evaluate $\int_C \nabla f \bullet d\mathbf{r}$, where *C* is a smooth curve beginning at (0, 0) and ending at (2, 1).

x \ y	**0**	**1**	**2**
0	-1	6	5
1	3	4	7
2	8	3	9

2. Determine whether or not **F** is a conservative vector field. If it is, find a function *f* such that $\mathbf{F} = \nabla f$.

a) $\mathbf{F}(x, y) = (5x + 3y)\mathbf{i} + (3x + 5y)\mathbf{j}$

b) $\mathbf{F}(x, y) = (x^3 + 2xy)\mathbf{i} + (4xy - 2x)\mathbf{j}$

c) $\mathbf{F}(x, y) = (ye^x + \cos y)\mathbf{i} + (e^x + x \sin y)\mathbf{j}$

3. Let *C* be a piecewise smooth curve in an open region that goes from the point (2,3) to the point (5,6), and $f(x, y) = x^2 y$ is a potential function for a continuous vector field $\mathbf{F}(x, y)$. Find the work done by $\mathbf{F}(x, y)$ on an object moving along the path from (2,3) to (5,6).

4. Find a function *f* such that $\mathbf{F} = \nabla f$ and use it to evaluate $\int_C \nabla f \bullet d\mathbf{r}$ along the given curve *C*.

a) $\mathbf{F}(x, y, z) = yz\mathbf{i} + xz\mathbf{j} + (xy + 2z)\mathbf{k}$, *C* is the line segment from (0, 1, -3) to (5, 4, 3)

b) $\mathbf{F}(x, y, z) = y^2 \sin z\mathbf{i} + 2xy \sin z\mathbf{j} + xy^2 \cos z\mathbf{k}$, *C*: $\mathbf{r}(t) = t^2\mathbf{i} + \cos t\ \mathbf{j} + t\ \mathbf{k}$, $0 \le t \le \pi$