Math001D Line Integrals

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1. Find the work done by the force field $\mathbf{F(x,y)} = \langle -x^2, xy \rangle$ on a particle that moves once around the circle $x^2 + y^2 = 4$ counterclockwise.

2. Show that $\int_C 2xy^2dx + 2x^2ydy$ is independent of the path, then evaluate the integral. Where C is the path from $(0,0)$ to $(2,-1)$.

3. Use Green's theorem to evaluate the line integral along the given path.
$\int_C x^2y^2dx + 4xy^3dy$ C is the vertices of the triangle (0,0), (1,3), (0,3).

4. Determine if the vector field is conservative. If it is conservative, find a function f such that $\mathbf{F} = \nabla f$.

   a) $\mathbf{F(x,y)} = \langle yz, xz, xy \rangle$

   b) $\mathbf{F(x,y,z)} = \langle 3xy, x^2 + 2y, y^2 \rangle$

5. Evaluate

$$\int_C ydx + 2xydy, \text{ where C is the curve is the line from } (1,1) \text{ to } (5,3).$$

6. Evaluate $\int_C \vec{F} \bullet d\vec{r}$ where $\vec{\mathbf{F}}(x,y) = \langle xe^{x^2} - 2, \sin y \rangle$
and C is the portion of the parabola $y = x^2$, from (-2,4) to (2,4) .