Exercise 1

Compute the line integral $\int_C \mathbf{F} \cdot d\mathbf{r}$ for the following pairs of vector fields $\mathbf{F}$ and curves $C$.

(a) $\mathbf{F} = (y, x)$ and $C$ is the quarter-circle centered at the origin starting at $(2, 0)$ and proceeding counterclockwise to $(0, 2)$
(b) $\mathbf{F} = \langle y, x \rangle$ and $C$ is the line segment starting at $(2, 0)$ and proceeding counterclockwise to $(0, 2)$. 
Exercise 2

(I)

which of the following vector fields are conservative:

(a) \( F = \langle y, x \rangle \)  \hspace{1cm} (b) \( F = \langle x, y \rangle \)

(c) \( F = \langle x^2 y, 2x \rangle \)  \hspace{1cm} (d) \( F = \langle 2x \sin(y), x^2 \cos(y) \rangle \)

(e) \( F = \langle 3x^2, x - 4y \rangle \)  \hspace{1cm} (f) \( F = \langle 2y^2 + e^{x-y}, 4xy - e^{x-y} + 2 \rangle \)
(II)

Find a potential for the vector field in (f).
Exercise 3

For each of the following regions $D$, associated boundary curves $C$, and line integrals...

(a) Compute the given line integral directly by parameterizing the path $C$.

(b) Compute the given line integral by applying Green’s theorem and computing a double integral.

(I)

\[\int_C xy \, dx + (x^2 - y^2) \, dy\]
\[ \int_C x^3 \, dx - xy^2 \, dy \]
\[ \int_C xy^2 \, dx - x^2y \, dy \]