Exercise 1.

(a) Describe and sketch the image of the disk of radius 1, $D = u^2 + v^2 \leq 1$, under the transformation $x = au$, $y = bv$, where $a, b \in \mathbb{R}$ and $a \neq 0$, $b \neq 0$.

(b) Use the ideas from part (a) to find the area enclosed by the ellipse $(2x + 5y - 3)^2 + (3x - 7y + 8)^2 = 1$. 
Exercise 2.

Evaluate $\int_{\mathbb{R}} e^{-ax^2} \, dx$, where $a$ is any positive real number. (Hint: Let $I = \int_{\mathbb{R}} e^{-ax^2} \, dx$ then write $I^2$ as a double integral.)
Exercise 3.

Show that a constant force field does zero work on a particle that winds uniformly \( w \) times around the ellipse \( \left( \frac{x}{a} \right)^2 + \left( \frac{y}{b} \right)^2 = 1 \).
Exercise 4.

Compute \( \int_0^1 \int_0^1 e^{\max(x^2, y^2)} \, dy \, dx \) where \( \max(x^2, y^2) \) means the larger of the numbers \( x^2 \) and \( y^2 \).
Exercise 5.

Evaluate $\int_C \vec{F} \cdot d\vec{r}$ where $\vec{F}(x, y) = \left( \frac{x}{\sqrt{x^2+y^2}}, \frac{y}{\sqrt{x^2+y^2}} \right)$ and $C$ is the parabola $y = 1 + x^2$ from $(-1, 2)$ to $(1, 2)$. 