Double integrals II, polar coordinates

1. Given domain $D \subset \mathbb{R}^2$ lies in 1^{st} quadrant and is bounded by curves: $y = x$ and $x = 3$.
   (a) Sketch the domain and express it as Elementary Domain of Integration relative to y-axis.
   (b) Express the domain as EDI relative to x-axis.
   (c) Compute $\iint\limits_D (\frac{x^2+y^2}{x})\,\mathrm{d}x\,\mathrm{d}y$
   (d) Begin a calculation (compute inner integral) of the previous integral with the other EDI .
2. Reverse the order of integration (a): $\int\limits_0^\pi (\int\limits_0^y x \sin y \,\mathrm{d}x)\,\mathrm{d}y$
   and compute the double integral (b).
3. Compute the double integral $\int\limits_0^2 (\int\limits_{y/2}^1 e^{x^2}\,\mathrm{d}x)\,\mathrm{d}y$.
   hint: Reversing the order of the integration could help you.
4. Given domain in $\mathbb{R}^2$ is bounded by curves: $y = 8 - x^2; \quad y = x^2$.
   (a) Sketch the domain and express it as EDI of your choice.
   (b) Compute area of the domain.
   (c) Compute $\iint\limits_D xy\,\mathrm{d}x\,\mathrm{d}y$.
5. Given $D = \{[x, y] \in \mathbb{R}^2 :\ 0 \leq x \leq \sqrt{4 - y^2}\}$.
   (a) Sketch the domain and express it as EDI relative to y-axis.
   (b) Transfer the following integral to polar coordinates $\iint\limits_D f(x, y)\,\mathrm{d}x\mathrm{d}y$.
6. Transfer the following integral to polar coordinates $\int\limits_{-3}^0 (\int\limits_0^{\sqrt{9-x^2}} \sin(x^2 + y^2)\,\mathrm{d}y)\,\mathrm{d}x$ and compute it.
7. Given $D = \{[x, y] \in \mathbb{R}^2 :\ x^2 + y^2 \leq 4 \ \wedge\ y \geq 0\}$.
   (a) Transfer the following integral to polar coordinates: $\iint\limits_D xy\,\mathrm{d}x\mathrm{d}y$.
   (b) Compute the integral.
8. Given $f(x, y) = \frac{1}{\sqrt{9-x^2-y^2}}$
   and $D = \{[x, y] \in \mathbb{R}^2;\ x \geq 0 \ \wedge\ x^2 + y^2 \leq 8\}$.

$$\iint\limits_D f(x, y)\,\mathrm{d}x\mathrm{d}y = \,?$$