Line integral II

1. A curve is given as a segment of a function $y = x^2$ from $A = [0; 0]$ to $B = [2; 4]$.
   (a) Suggest its parametrization (and determine bounds for the parameter).
   (b) Compute line integral of a scalar function $f(x, y) = x + 4xy$.
   (c) Compute line integral of a vector function $\vec{f}(x, y) = (x;\ xy)$.
2. A curve is given as a segment of a function $x = 2y^2$ from $A = [8; 2]$ to $B = [2; 1]$.
   (a) Suggest its parametrization (and determine bounds for the parameter).
   (b) Compute line integral of a vector function $\vec{f}(x, y) = (\sqrt{x} + y;\ x + \sqrt{y})$.
3. For a curve $C = \{[x, y] \in \mathbb{R}^2 :\ y = e^x \ \wedge\ |x| \leq 1\}$ oriented with the starting point $[1; e]$ compute integral:
$$\int_C x^3 \,\mathrm{d}x + \frac{1}{y} \ln y \,\mathrm{d}y.$$
4. For a curve $C = \{[x, y] \in \mathbb{R}^2 :\ x^2 + y^2 = a^2 \ \wedge\ y \geq 0\}$ oriented clockwise ($a \in \mathbb{R}^+$) compute:
$$\int_C \frac{1}{\sqrt{x^2 + y^2}} (y;\ -x) \cdot \mathrm{d}\vec{s}.$$
5. For the line segment between points $A = [7; -2; 0]$ a $B = [3; 0; 1]$ compute integral:
$$\int_C (z^2\vec{i} + z\vec{j} - y\vec{k}) \cdot \mathrm{d}\vec{s}.$$
6. Compute line integral of a vector function $\vec{f}(x, y, z) = (-yz;\ z\sqrt{9 - y^2};\ xy)$ along one-quarter of a thread of a circular helix with radius 3 ($z = \frac{3t}{2\pi}$). The helix starts in the lowest point $z = 0$.
7. Given force $\vec{f}(x, y, z) = \frac{K}{\sqrt{(x^2+y^2+z^2)^3}} (x;\ y;\ z)$ where $K > 0$ is a real constant.
   Compute a work done by the force when it moves a mass point along a strait line AB where $A = [2; 0; 0]$ and $B = [2; 1; 5]$.