Aalto University
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Midterm 1, Wednesday 29.01.2014 17:00 - 19:00
Mathematics 2, MS-A0310.
Lecture notes, books, pocket calculators, smart phones or computers
are not allowed during the midterm.

Explain your solutions! If you only give the answer you will not get
any points.

(1) Let
$$F(x, y) = \left(2 \cos y, \frac{1}{y} - 2x \sin y \right)$$
when $y > 0$.
  (a) Is $F(x, y)$ conservative? $\hfill (2p)$
  (b) Let γ be the circle with radius 1 and center $(2, 2)$. Calculate
      the circulation
      $$\oint_\gamma F(x, y) \cdot d\gamma.$$
      $\hfill (2p)$
  (c) Let γ be the straight line from $(1, 1)$ to $(2, 2)$. Calculate
      $$\int_\gamma F(x, y) \cdot d\gamma.$$
      $\hfill (2p)$

(2) Find the area of the surface cut from the plane $z = cx$ (c a
    constant) by the cylinder $x^2 + y^2 = 1$. $\hfill (6p)$

(3) Let $F(x, y, z) = (0, 0, z^2)$ and S the part of the sphere
    $$x^2 + y^2 + z^2 = a^2$$
    in the first octant (that is where $x > 0$, $y > 0$, and $z > 0$).
    Calculate the flux of $F(x, y, z)$ upward through S. $\hfill (6p)$

Good luck!