Aalto university
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Hand-in exercises 2
Differential and integral calculus 3, MS-A0311.
Submit your solutions on MyCourses by **Wednesday, March 17th 2021 23.59**.

(1) Consider the vector field
$$F(x, y, z) = \frac{-C}{(x^2 + y^2 + z^2)^{3/2}}(x, y, z)$$
for a positive constant C. This vector field is defined when $(x, y, z) \neq (0, 0, 0)$ and is conservative. Calculate a potential function. (6p)

(2) The vector field
$$F(x, y, z) = \left(\frac{2x}{z}, \frac{2y}{z}, -\frac{x^2 + y^2}{z^2} \right)$$
is defined when $z \neq 0$. It is conservative. Find a potential function. Describe it's equipotential surfaces. (6p)

(3) Let $a > 0$ and
$$\gamma(t) = (a(t - \sin t), a(1 - \cos t)), 0 \leq t \leq 2\pi.$$
Calculate
$$\int_\gamma (2a - y)\ dx + x\ dy.$$
(6p)

(4) Calculate
$$\int_\gamma \frac{y\ dx - x\ dy}{y^2}$$
where γ is the part of $xy = 2$ that begins at $(1, 2)$ and ends at $(2, 1)$.
(6p)