Math 317 Winter 2017 Homework 2 Solutions

Due Thursday Feb. 16, 2017 5pm

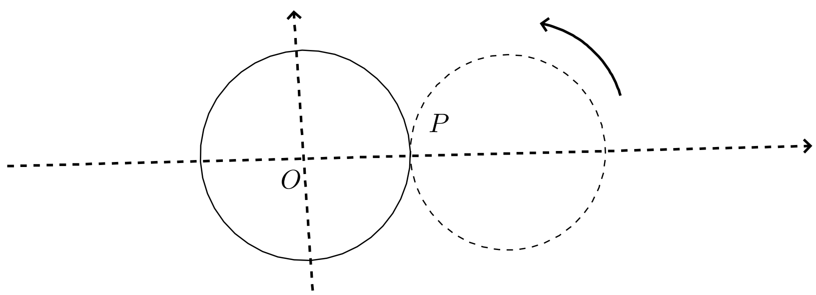
- This homework consists of 5 problems of 4 points each. The total is 20.
- You need to fully justify your answer – for example, prove that your function indeed has the specified property – for each problem.
- This homework covers material up to and including Jan. 26 lecture.

Question 1. (4 pts) *Computer* $\int_C F \cdot \mathrm{d}x$ *where* $F = (e^x, e^y, x + y)$ *and* C *is the triangle joining* $(1, 0, 0)$, $(0, 1, 0), (0, 0, 1)$ *oriented in the counterclockwise direction when viewed from above.*

Question 2. (4 pts) *Calculate* $\int_S (z - x)\, \mathrm{d}S$ *where* S *is the portion of the graph of* $z = x + y^2$ *where* $0 \leqslant x \leqslant y, 0 \leqslant y \leqslant 1$.

Question 3. (4 pts) *Calculate* $\int_S F \cdot \mathrm{d}S$ *where* $F = (0, 0, x)$ *and* S *is the surface with parametrization* $\Phi(u, v) = (u^2, v, u^3 - v^2)$ *for* $0 \leqslant u \leqslant 1, 0 \leqslant v \leqslant 1$ *and oriented by upward-pointing normal vectors.*

Question 4. (4 pts) *Write down a parametrized representation of the trajectory of a fixed point* P *on a unit circle rolling outside another unit circle centered at the origin. Then calculate the arc length of the curve.*



Question 5. (4 pts) *Let* $y = (y_1, y_2, y_3)$, $z = (z_1, z_2, z_3)$ *be two points on the unit sphere centering at the origin. Prove that the shortest path on the sphere connecting them is part of a big circle.*