**Instructions.** Show all work, with clear logical steps. No work or hard-to-follow work will lose points.

**Problem 1.** (10 points) Given that the area of D is equal to 2017 and the volume under the surface z = f(x, y) and above the region D is 16020, calculate the average value of the function f(x, y) over the region D.

Solution. Recall that the average value of a function f(x, y) over a region D is given by

$$\frac{1}{\mathcal{A}(D)} \iint_D f(x, y) \, dA,$$

where A(D) is the area of D. Moreover, the volume under the surface z = f(x, y) is precisely  $\iint_D f(x, y) dA$ . We are given A(D) = 2017 and  $\iint_D f(x, y) dA = 16020$ , so

$$\frac{1}{\mathcal{A}(D)} \iint_D f(x, y) \, dA = \frac{16020}{2017}.$$