

NAME:

ID:

## MATH 317 Q1 WINTER 2017 QUIZ 3

Feb. 17, 2017, 25 minutes

- The quiz has 3 problems. Total 10 + 1 points.

QUESTION 1. (5 PTS) *Calculate the surface area of the torus*

$$((a + b \cos \theta) \cos \varphi, (a + b \cos \theta) \sin \varphi, b \sin \theta) \quad (1)$$

where  $0 < a < b$ .

QUESTION 2. (5 PTS) Let  $\mathbf{f}(x, y, z) := \begin{pmatrix} 3 \\ 2 \\ 1 \end{pmatrix}$  and  $S$  be the portion of  $x^2 + y^2 = z$  with  $1 \leq z \leq 4$ , oriented so that the normal points upward. Calculate  $\int_S \mathbf{f} \cdot d\mathbf{S}$

QUESTION 3. (1 BONUS PT) Let  $\Omega \subset \mathbb{R}^3$  be the region bounded by  $x=0$ ,  $y=0$ ,  $z=0$  and  $x+y+z=1$ . Let  $\partial\Omega$  be its boundary. Let  $f, g, h \in C^1$ . Prove

$$\int_{\partial\Omega} f \, dy \wedge dz + g \, dz \wedge dx + h \, dx \wedge dy = \int_{\Omega} \left( \frac{\partial f}{\partial x} + \frac{\partial g}{\partial y} + \frac{\partial h}{\partial z} \right) dx \, dy \, dz, \quad (2)$$

where the normal of  $\partial\Omega$  points outward.

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