

Math 20E

August 26, 2014

**Question 1** Given a  $C^1$  surface  $S$  parameterized by  $\Phi : D \rightarrow S$ , where

$$\Phi(u, v) = (x(u, v), y(u, v), z(u, v)),$$

let  $f(x, y, z)$  be a continuous function defined on  $S$ . Then,

**A.** 
$$\iint_S f \, dS = \iint_D f(\Phi(u, v)) \|\mathbf{T}_u \times \mathbf{T}_v\| \, du \, dv$$

**B.** 
$$\iint_S f \, dS = \iint_D f(\Phi(u, v)) \|\mathbf{T}_v \times \mathbf{T}_u\| \, dv \, du$$

**C.** The average value of  $f$  on  $S$  is  $\frac{1}{A(S)} \iint_S f \, dS$ , where

$$A(S) = \iint_D \|\mathbf{T}_u \times \mathbf{T}_v\| \, du \, dv$$

**D.** **A** and **B**: they are the same

**\*E.** **A**, **B** and **C**

**Question 2** Given a  $C^1$  surface  $S$  parameterized by  $\Phi : D \rightarrow S$ , where

$$\Phi(u, v) = (x(u, v), y(u, v), z(u, v)),$$

and given  $\mathbf{F}(x, y, z)$  a continuous vector field defined on  $S$ . Then,

**A.** 
$$\iint_S \mathbf{F} \cdot d\mathbf{S} = \iint_D \mathbf{F}(\Phi(u, v)) \cdot (\mathbf{T}_u \times \mathbf{T}_v) \, du \, dv$$

**B.** 
$$\iint_S \mathbf{F} \cdot d\mathbf{S} = - \iint_D \mathbf{F}(\Phi(u, v)) \cdot (\mathbf{T}_v \times \mathbf{T}_u) \, dv \, du$$

**C.** The average value of  $\mathbf{F}$  on  $S$  is  $\frac{1}{A(S)} \iint_S \mathbf{F} \cdot d\mathbf{S}$ , where

$$A(S) = \iint_D \|\mathbf{T}_u \times \mathbf{T}_v\| \, du \, dv$$

**\*D. A and B**

**E. A, B and C**

**Question 3** Given a simple domain  $D$  with  $C^1$  boundary  $\partial D$ , the area of  $D$  is given by

**A.**  $A(D) = \iint_D dx dy$

**B.**  $A(D) = - \int_{\partial D} y dx$

**C.**  $A(D) = \frac{1}{2} \int_{\partial D} x dy - y dx$

**D.** **A** and **C**

**\*E.** **A**, **B** and **C**