Math 20E

August 11, 2017

Question 1 Given a **simple** region $D \subset \mathbb{R}^2$.
Then, D is

A. elementary

B. x-simple

C. y-simple

D. **B** and **C**

***E.** All of the above

Question 2 Given an **elementary** region $D \subset \mathbb{R}^2$. Then, D is

A. x-simple

B. y-simple

C. simple

D. **A** or **B**

*__E.__ **A** or **B** or **C**

Question 3 Consider the iterated integral

$$\int_{y=0}^{\sqrt{\pi/2}} \int_{x=y}^{\sqrt{\pi/2}} \sin\left(x^2\right) dx\, dy.$$

Which best describes how it might be evaluated?

A. The iterated integral can easily be integrated by evaluating it as written, integrating with respect to x first and then y.

B. The iterated integral is impossible to integrate analytically because the antiderivative of $\sin(x^2)$ cannot be expressed in terms of elementary functions.

C. The iterated integral should be expressed as

$$\iint_D \sin(x^2)\, dA$$

for an appropriate region D.

D. The iterated integral should be rewritten as an iterated integral with respect to y first and then x.

***E.** **C** and then **D**

Question 4 Consider the triple integral

$$\int_{z=p}^{q} \int_{y=c}^{d} \int_{x=a}^{b} f(x, y, z)\, dx\, dy\, dz.$$

Which of the following best describes the possibility(s) for the order of integration?

A. There is only one possible order of integration: the one given.

B. There are two possible orders of integration: x and y may be switched, as in double integrals.

C. There are three possible orders of integration: one for each variable.

***D.** There are six possible orders of integration: one for each permutation of (x, y, z).

E. None of the above: not enough information is given about the region of integration to decide.

Question 5 Given an elementary region D in $\mathbb{R}^2$ and a function $f : D \to \mathbb{R}$ for which the double integral $\iint_D f(x, y)\, dA$ exists. The number $\bar{f}_D = \dfrac{1}{D} \iint_D f(x, y)\, dA$ is called the mean (or, average) value of the function f on D. Then:

A. If m_D and M_D are the maximum and minimum values of f on D, respectively, then $m_D \leq \bar{f}_D \leq M_D$. This is called the mean value inequality.

B. There is a point $(x_0, y_0) \in D$ at which $f(x_0, y_0) = \bar{f}_D$. This is called the mean value theorem.

C. There is a point $(x_0, y_0) \in D$ at which $f(x_0, y_0) = \bar{f}_D$, provided f is continuous on D. This is called the mean value theorem.

D. **A** and **B**

*__E.__ **A** and **C**