AP Calculus AB | Quiz 0423 | Name:
Dr. Paul L. Bailey | Thursday, April 23, 2020

The quiz is multiple choice. Enter the answers on the appropriate Google Form:

0423 Vector Calculus Checkin

Problem 1. Which of the following subsets of $\mathbb{R}^2$ is NOT simply connected?

(A) $\{(x,y) \in \mathbb{R}^2 \mid 0 \leq x^2 + y^2 \leq 4\} \cup \{(x,y) \in \mathbb{R}^2 \mid y = 0\}$

(B) $\{(x,y) \in \mathbb{R}^2 \mid 0 \leq x^2 + y^2 \leq 4\} \setminus \{(x,y) \in \mathbb{R}^2 \mid y = 0\}$

(C) $\{(x,y) \in \mathbb{R}^2 \mid 0 < x^2 + y^2 \leq 4\} \setminus \{(x,y) \in \mathbb{R}^2 \mid y = 0\}$

(D) $\{(x,y) \in \mathbb{R}^2 \mid 0 < x^2 + y^2 \leq 4\} \cup \{(x,y) \in \mathbb{R}^2 \mid y = 1\}$

(E) $\{(x,y) \in \mathbb{R}^2 \mid 2 < x^2 + y^2 \leq 4\} \setminus \{(x,y) \in \mathbb{R}^2 \mid y = 1\}$

Problem 2. Which of the following vector fields is NOT conservative in $\mathbb{R}^3$.

(A) $\vec{F} = \langle x, y, 1 \rangle$

(B) $\vec{F} = \langle x, y, z \rangle$

(C) $\vec{F} = \langle x^2, y^2, z^2 \rangle$

(D) $\vec{F} = \langle yz, xz, xy \rangle$

(E) $\vec{F} = \langle 4x^3y^4z^4, 4x^4y^3z^4, 4x^4y^4z^3 \rangle$

Problem 3. Consider the following statements.

(♂) The double integral of divergence in a region equals flux across the boundary.

(♀) The double integral of divergence in a region equals flow along the boundary.

(☿) The double integral of curl in a region equals flux across the boundary.

(♅) The double integral of curl in a region equals flow along the boundary.

Which of the following is a correct list of the true statements?

(A) ♂, ♅

(B) ♀, ☿

(C) ♂, ☿

(D) ♂, ☿, ♅

(E) ♂, ♀, ☿, ♅

Problem 4. Let the surface S be the portion of the paraboloid $z = 5x^2 + 5y^2$ that lies between the planes $z = 2$ and $z = 7$. The surface is parameterized by

$$\vec{s}(u, v) = \langle u \cos v, u \sin v, 5u^2 \rangle.$$

We let $v \in [0, 2\pi]$. What is the appropriate domain for u?

(a) $u \in \left[2, 7\right]$

(b) $u \in \left[\frac{\sqrt{2}}{5}, \frac{\sqrt{7}}{5}\right]$

(c) $u \in \left[\sqrt{2}, \sqrt{7}\right]$

(d) $u \in \left[\frac{\sqrt{10}}{5}, \frac{\sqrt{35}}{5}\right]$

(d) $u \in \left[\frac{\sqrt{2}}{5}, \frac{\sqrt{7}}{5}\right]$

Problem 5. Let $\vec{F} = \langle 2x^2, 0, -z^3 \rangle$ and let S be the portion of the parabolic cylinder $y = 2x^2$ for which $0 \leq z \leq 1$ and $-1 \leq x \leq 1$. What is the outward flux of $\vec{F}$ across S?

(A) $-\frac{4}{3}$

(B) $\frac{4}{3}$

(C) -4

(D) 4

(E) 0