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%%%%%%%%% Additional questions %%%%%%%%%%%%%%

Describe a subset $M \subset \mathbf{R}^2$ and a boundary point $x \in \mathbf{R}^2$ which belongs to M.

Describe a subset $M \subset \mathbf{R}^2$ and a boundary point $x \in \mathbf{R}^2$ which does not belong to M.

Describe a subset $M \subset \mathbf{R}^2$ which is neither open nor closed.

Describe a nonempty subset $M \subset \mathbf{R}^2$ which has no interior points.

Describe a subset $M \subset \mathbf{R}^2$ which is closed but not bounded.

Describe a subset $M \subset \mathbf{R}^2$ which is bounded but not closed.

Describe a subset $M \subset \mathbf{R}^2$ which is neither closed nor bounded.

Describe a function defined on $\mathbf{R}^2$ which has both partial derivatives at $[0,0]$ but is not continuous at $[0,0]$.

Describe a function defined on $\mathbf{R}^2$ which is continuous on $\mathbf{R}^2$ but has neither of the partial derivatives at $[0,0]$.

Describe a function f defined on $\mathbf{R}^2$ which is continuous on $\mathbf{R}^2$ such that $\frac{\partial f}{\partial x}(0,0) = 0$ and $\frac{\partial f}{\partial y} f(0,0)$ does not exist.

Describe a function f defined on $\mathbf{R}^2$ which is continuous on $\mathbf{R}^2$ such that $\frac{\partial f}{\partial y} f(0,0) = 5$ and $\frac{\partial f}{\partial x}(0,0)$ does not exist.

Describe a function defined on $\mathbf{R}^2$ which has at the point $[0,0]$ local maximum but not sharp local maximum.

Describe a function defined on $\mathbf{R}^2$ which has at the point $[0,0]$ sharp local maximum but not maximum on $\mathbf{R}^2$.

Describe a function defined on $\mathbf{R}^2$ which has at the point $[0,0]$ both local maximum and local minimum.

Describe a function f defined on $\mathbf{R}^2$ and a subset $M \subset \mathbf{R}^2$ containing $[0,0]$ such that f has at $[0,0]$ local maximum with respect to M but not local maximum (with respect to $\mathbf{R}^2$).

Describe a function f defined on $\mathbf{R}^2$ such that $\frac{\partial f}{\partial x}(0,0) = \frac{\partial f}{\partial y}(0,0) = 0$ but f has no local extremum at $[0,0]$.

Find 2-by-2 matrices $\mathbb{A}$ and $\mathbb{B}$ such that $\mathbb{A} \cdot \mathbb{B} \neq \mathbb{B} \cdot \mathbb{A}$.

Find 3-by-3 matrices $\mathbb{A}$ and $\mathbb{B}$ such that $\mathbb{A} = \mathbb{A}^T$ and $\mathbb{B} \neq \mathbb{B}^T$.

Find vectors $\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3 \in \mathbf{R}^3$ which are linearly dependent such that $\mathbf{v}_1$ and $\mathbf{v}_2$ are linearly independent.

Find a 4-by-3 matrix of rank 2.

Find a 4-by-3 matrix of rank 3.

Find a 3-by-3 matrix with determinant equal to 17.

Find a linear system of 3 equations with 3 unknowns which has no solution.

Find a linear system of 3 equations with 3 unknowns whose set of solutions is $\{[1+t, t, t] : t \in \mathbf{R}\}$.

Find a linear system of 4 equations with 3 unknowns which has a unique solution.

Find a continuous function f on $(0, +\infty)$ such that $\int_0^{+\infty} f(x)dx = 1$.

Find a continuous function f on $(0, +\infty)$ such that $\int_0^{+\infty} f(x)dx = -\infty$.

Find a continuous function f on $(0, +\infty)$ such that $\int_0^{+\infty} f(x)dx$ does not exist.

Find a series which is convergent but not absolutely convergent.

Find a sequence $\{a_n\}$ such that $a_n \to 0$ but the series $\sum_{n=1}^{\infty} a_n$ diverges.

Find a series which has no sum.

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