MATH 224B **NAME:**
Instructor: Junaid Hasan **NET ID:**

Quiz 4
20 minutes

Question 1

State **True of False**. Justification is not required. In the problems the bold font for example $\mathbf{F}$ indicates a vector, whereas the normal font for example f indicates a scalar. In most problems D is a region that is not necessarily simply connected, unless explicitly stated.

1. If $\mathbf{F}$ is conservative on D and $\mathbf{F} = P\mathbf{i} + Q\mathbf{j}$ (where P and Q are continuously differentiable) then $\frac{\partial P}{\partial y} = \frac{\partial Q}{\partial x}$ throughout D.

2. If P and Q are continuously differentiable and $\frac{\partial P}{\partial y} = \frac{\partial Q}{\partial x}$ throughout D then $\mathbf{F}$ is conservative on D.

3. If C is a closed curve and f is a function, then $\int_C f\, ds = 0$.

4. If there exists a closed curve C inside a region D such that $\int_c \mathbf{F} \cdot d\mathbf{r} = 0$ then $\mathbf{F}$ is conservative on D.

5. A region is simply connected if any two points in D can be joined by a curve that stays inside D.

6. If $\int_C f\, ds = 0$ for any function f, then C is a closed curve.

7. If $\nabla \times \mathbf{F} = 0$, then $\mathbf{F}$ is conservative.

8. If $\mathbf{F}$ is source-free (for example a magnetic field) then $\nabla \cdot \mathbf{F} = 0$.

9. If $\mathbf{F}$ is a vector field then $\nabla \cdot \mathbf{F}$ is a vector field.

10. If $\mathbf{F}$ is a vector field then $\nabla \times \mathbf{F}$ is a vector field.

11. If $\nabla \times \mathbf{F} \neq 0$, then $\mathbf{F}$ is not conservative.

12. If $\mathbf{F}$ is conservative, then $\nabla \cdot \mathbf{F} = 0$.

13. The work done by a conservative force field in moving a particle around a closed path is zero.

14. If $\mathbf{F}$ and $\mathbf{G}$ are two vector fields and $\nabla \times \mathbf{F} = \nabla \times \mathbf{G}$, then $\mathbf{F} = \mathbf{G}$.

15. If f has continuous partial derivatives on $\mathbb{R}^3$ and C is any circle then $\int_C \nabla f \cdot d\mathbf{r} = 0$.

16. If $\mathbf{F}$ is a vector field on $\mathbb{R}^3$ then $\nabla \cdot (\nabla \times \mathbf{F}) = 0$.

17. $\nabla \times (\nabla f)$ is always non zero.

18. curl(div($\mathbf{F}$)) is not a meaningful expression.

19. If $\mathbf{F}$ is conservative on a region D then there is some function f on D such that $\nabla f = \mathbf{F}$.

20. If work done by a force $\mathbf{F}$ on an object moving along a curve is W, then if the object moves along the curve in the opposite direction the work done by $\mathbf{F}$ will be $-W$.

SCRATCH PAPER