## EXAM 3

Math 212, 2018 Fall, Clark Bray.

Name: $\qquad$ Section: $\qquad$ Student ID: $\qquad$

## GENERAL RULES

## YOU MUST SHOW ALL WORK AND EXPLAIN ALL REASONING TO RECEIVE CREDIT. CLARITY WILL BE CONSIDERED IN GRADING.

No notes, no books, no calculators. Scratch paper is allowed, but (1) it must be from the instructor, (2) it must be returned with the exam, and (3) it will NOT be graded.

All answers must be reasonably simplified.
All of the policies and guidelines on the class webpages are in effect on this exam.

## WRITING RULES

Do not write anything on the QR codes or near the staple.
Use black pen only. You may use a pencil for initial sketches of diagrams, but the final sketch must be drawn over in black pen and you must wipe all erasure residue from the paper.

Work for a given question can ONLY be done on the front or back of the page the question is written on.

## DUKE COMMUNITY STANDARD STATEMENT

"I have adhered to the Duke Community Standard in completing this examination."

Signature: $\qquad$
(Nothing on this page will be graded!)

1. (20 pts) Compute the line integral $\int_{C} \vec{F} \cdot d \vec{x}$, where $C$ is parametrized by

$$
\vec{x}(t)=\left(\cos ^{3} t, 1+\cos t, \sin ^{3} t\right), \quad t \in[0, \pi]
$$

and the vector field is given by $\vec{F}(x, y, z)=\left(y^{2}, 2 x y-z^{2},-2 y z\right)$.
(extra space for question from other side)
2. (20 pts) The surface $S$ is the triangle with vertices at $(0,0,0),(1,0,1)$, and $(0,1,1)$, oriented downward. Compute the flux through $S$ of the vector field $\vec{G}(x, y, z)=(3,1,2-z)$.
(extra space for question from other side)
3. (20 pts) The ellipsoid $E$ has equation $x^{2}+4 y^{2}+9 z^{2}=36$, and is oriented toward the origin. Compute the flux through $E$ of the vector field $\vec{H}(x, y, z)=(2 x+y-z, 3 x-y+4 z, x+5 z)$.
(extra space for question from other side)
4. (20 pts) The loop $L$ is in the plane $x=y+z$, and is parametrized by $\vec{x}(t)=(\cos t+\sin t, \cos t, \sin t)$. Compute the circulation around $L$ of the vector field $\vec{J}(x, y, z)=\left(e^{x^{2}}+2 y, y^{3}+3 z, x-2 z\right)$.
(extra space for question from other side)
5. (20 pts) The surface $N$ is the part of the unit sphere above the $x y$-plane, oriented inward. Compute the flux through $N$ of the vector field $\vec{K}(x, y, z)=\left(x+y^{3}, 4 z^{2}-y, x y+3\right)$.
(extra space for question from other side)

