## MATH 241 Calculus III Spring 2023 Groupwork 11: Exam 4 Review Problems

You should work on and discuss this worksheet with members of your group. Your TA will assist as needed. Turn in your solutions either on this sheet or a separate sheet of paper. Be sure to include your name!

- 1. Evaluate  $\iiint_V dV$  where *V* is the solid enclosed by the ellipsoid  $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c} = 1$ . Hint: A nice change of variables converts this to a problem over a sphere.
- 2. Find a potential *f* such that  $\mathbf{F} = \nabla f$  where  $\mathbf{F} = (yz, xz, xy + 2z)$ . Use this to evaluate  $\int_C \mathbf{F} \cdot d\mathbf{r}$  where *C* is a curve starting at (1, 0, -2) and ending at (4, 6, 3).
- 3. Evaluate  $\int_C x^4 dx + xy dy$  where *C* is the triangular curve consisting of the line segments from (0,0) to (1,0), from (1,0) to (0,1), and from (0,1) to (0,0), the direction being implied by these connections. Hint: There is a useful theorem!
- 4. Compute the flux of  $\mathbf{F} = (y, x, z)$  through the surface *S* being the boundary of the solid region enclosed by the paraboloid  $z = 1 x^2 y^2$  and the plane z = 0. Suppose the outward orientation is taken. Hint: There is a useful theorem!
- 5. Compute  $\iint_S \operatorname{curl} \mathbf{F} \cdot \mathbf{n} \, dS$  where  $\mathbf{F} = (xz, yz, xy)$  and *S* is the part of the sphere  $x^2 + y^2 + z^2 = 4$  that lies inside the cylinder  $x^2 + y^2 = 1$ , and above the *xy*-plane. Suppose the outward orientation is taken. Hint: There is a useful theorem!