

SPRING 26 - CALCULUS 3 - FINAL

All problems equal points. Takehome due midnight May 1st. Return all work to me as a single pdf to tbeatty@fgcu.edu. All honorable references permitted. Legibility is next to godliness. There should be enough relevant work to support your answers.

- 1) Evaluate $\int_C y ds$ along the curve C given by $y = 2\sqrt{x}$ from $x = 3$ to $x = 24$.
- 2) Given the force field $\mathbf{F} = \langle 3x - 4y + 2z, 4x + 2y - 3z^2, 2xz - 4y^2 + z^3 \rangle$, find the work done in moving a particle once counterclockwise around the ellipse given by $\mathbf{r}(t) = 4 \cos t \hat{\mathbf{i}} + 3 \sin t \hat{\mathbf{j}}$.
- 3) Find the curl of the vector field given by $\mathbf{A}(x, y, z) = \langle 3x^2 - 6yz, 2y + 3xz, 1 - 4xyz^2 \rangle$. Is this field conservative?
- 4) A thin wire in the yz plane is bent to take the shape of the curve $z = 4 - y^2$ for $z \geq 0$. The linear mass density of the wire is $1 + e^z$. What are the coordinates of its center-of-mass? Hint: use symmetry.
- 5) A hemisphere is given by $x^2 + y^2 + z^2 = a^2$ for $z \geq 0$. Some of the area of the hemisphere is inside the cylinder with equation $x^2 + y^2 = ax$. How much area of the hemisphere lies inside the cylinder. Hint: the cylinder has its axis perpendicular to the xy plane and going through the point $(\frac{a}{2}, 0)$ and its diameter is also a . Do the problem in the first octant and then double that area. Use polar coordinates in the surface area formula.