Math 261 Exam 3 Review Formulas & Reminders

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Here are a few formulas that might be handy for Exam 3. You *cannot* bring this to the exam, but hopefully it helps with studying....

WARNING: I do not guarantee that this is a comprehensive list! Also, please note that there are various alternative formulations for some of these formulas – I am just picking those that I like the best. Finally, there could be typos – beware!

- $\int_a^b \int_{g_1(x)}^{g_2(x)} f(x,y)dydx$ determines the volume below the graph of the function $f(x,y)$ and above the xy–plane. For each x between a and b, y runs from $g_1(x)$ to $g_2(x)$. The value of this integral is the same as $\int_c^d \int_{h_1(y)}^{h_2(y)} f(x,y)dxdy$ for appropriate choices of $h_1(y), h_2(y), c, d$. Know how to switch between the two, how to sketch the region given by some bounds, and how to read the bounds off of a sketch.
- The area of a region in the plane is just the integral of the function $f(x,y) = 1$ over that region. The average function value over a region is the volume under the graph over the region divided by the area of the region.
- Polar coordinates: Know how to set up/do double integrals using polar coordinates.
- Triple integrals in rectangular – Know how to set up integrals in any variable order. The bounds are the hard part here. Integrate 1 for volume.
- Mass, moments: Know the formulas for these (mass & first moments only, not second moments) and how to spot that some coordinate of the center of mass is 0 (by symmetry).
- Cylindrical, spherical: Know how to set up/do triple integrals in these coordinate systems. Depending on the shape, you might need to do 2 triple integrals to cover it all.
- Substitution in multiple integrals: Know how to find the determinant of the Jacobian of a substitution & don't forget to plug in the absolute value of it when changing variables. Know how to figure out the new bounds from the old ones. There will not be any 3-variable substitution problems on the exam.
- Line integrals of scalar functions: Know how to set up and do these, along with how to parameterize a line segment and a circle (e.g., $\langle \cos t, \sin t \rangle$). There is a short section on mass & moments of wires & strips in this section, too.
- Vector fields & line integrals: Know how to set up a line integral for a curve through a vector field (work=circ=flow) and how to set up the line integral for flux.

The main things we are excluding from what we have taught you are 3-variable substitution, the expectation that you draw complicated sketches (know how to handle spheres, cylinders, circles, lines, planes, and such; not quadric surfaces), and long, complicated integrals. The best way to prepare is to try the Exam 3 practice problems on the 261 website, along with the suggested homework.