# Math 147 Research Project

**Description.** The purpose of this project is to give an expository account of how to calculate the volume of the sphere $S(n)$ of radius $R$ in $\mathbb{R}^n$ centered at the origin in $\mathbb{R}^n$. [1] Note $\mathbb{R}^n$ is Euclidean $n$-space, so that it is just the set of all $n$-tuples of the form $(a_1, a_2, \ldots, a_n)$ with each $a_i \in \mathbb{R}$. This account should include the formulas for $S(n)$ and explanations of how to arrive at these formulas.[2] You may freely use any available sources, but these sources should be referenced. You should also not copy directly from those sources, but rather give an expository account in your own words. Your account should also include any features of the calculations or formulas that you find interesting.

For this project you will work in your Tuesday-Thursday lab groups, and each group will turn in just one paper. Ideally, the paper should be typeset using Latex, which is how almost all mathematics papers are written and prepared for publication. Some comments regarding typesetting in Latex are below. I will also send via Canvas Latex source files of our Daily Update and the solutions to Exam 2 that you can use as a means to learning Latex. All members of each team should contribute to the endeavor, including typesetting portions of the project. Each team can earn up to 15 bonus points. The project is due on the day of the final exam, December 17.

**Some comments on typesetting in Latex.** The easiest thing for any group to do would be to copy the initial instructions at the top of one of the files sent and all of the so-called top matter, to create a new file. Then, cut and past from any of the sourse files I send to the file your group creates. That way all of the original code used in the sources I send is preserved. Also, by looking back and forth between the latex file and pdf, you should be able to see how various math expressions were made. And: When writing a particular sentence, type as usual for non-math expressions, but put dollar signs around math symbols, and all math commands are preceded by a backslash. Thus, for example, to create the expression

$$\int\int\int_V \nabla \cdot \mathbf{F}\ dV = \int\int_{\partial B} \mathbf{F} \cdot d\mathbf{r},$$

in latex code this equation becomes

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$\int\int\int_B \nabla \cdot {\bf F}\ dV} = \int\int _{\partial B} {\bf F}\cdot d{\bf r}$
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where *int* (with the backslash) gives the integral sign, *bf* means boldface, backslash with a space gives a space, *cdot* means a centered dot, *partial* is the partial or boundary sign. Subscripts and superscripts are done in the usual way. Also: There are plenty of online resources to help finding latex commands for various math symbols you might want to use. Finally, images in a pdf come from a separate file (e.g., a png file) kept in the same folder as the latex file.

[1] Please note that some sources denote the sphere of radius $R$ in Euclidean $n$-space as $S^{n-1}$, since geometrically it has dimension one less than the ambient space.

[2] You'll discover along the way that there are really two distinct formulas, depending upon whether $n$ is even or odd.