Written Assignment 3:
The Laplacian

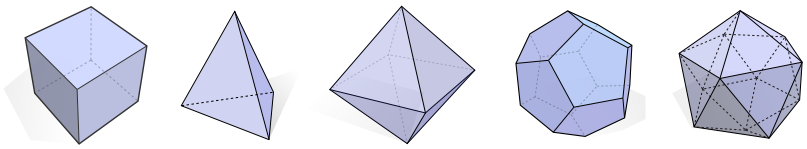
CMU 15-458/858

Submission Instructions. Please submit your solutions to the exercises (whether handwritten, LaTeX, etc.) as a **single PDF file** to Gradescope. Scanned images/photographs can be converted to a PDF using applications like *Preview* (on Mac) or a variety of free websites (*e.g.*, `http://imagetopdf.com`). Your graded submission will (hopefully!) be returned to you at least one day before the due date of the next written assignment.

Grading. Please clearly show your work. Partial credit **will** be awarded for ideas toward the solution, so please submit your thoughts on an exercise even if you cannot find a full solution. **Note that you are required to complete ALL the exercises (except for extra credit).** (7 problems total.) You are of course welcome to do more. :-)

If you don't know where to get started with some of these exercises, just ask! A great way to do this is to leave comments on the course webpage under this assignment; this way everyone can benefit from your questions. We are glad to provide further hints, suggestions, and guidance either here on the website, via email, or in person. Office hours are listed on the course website, but let us know if you'd like to arrange an individual meeting.

Late Days. Note that you have 5 no-penalty late days for the entire course, where a "day" runs from 6:00:00 PM Eastern to 5:59:59 PM Eastern the next day. No late submissions are allowed once all late days are exhausted. If you wish to claim one or more of your five late days on an assignment, please indicate which late day(s) you are using in your email submission. You must also draw **Platonic solids** corresponding to the late day(s) you are using (cube=1, tetrahedron=2, octahedron=3, dodecahedron=4, icosahedron=5). Use them wisely, as you cannot use the same polyhedron twice! If you are typesetting your homework on the computer, we have provided images that can be included for this purpose on the course webpage (in LaTeX these can be included with the `\includegraphics` command in the `graphicx` package).



Collaboration and External Resources. You are **strongly encouraged** to discuss all course material with your peers, including the written and coding assignments. You are especially encouraged to seek out new friends from other disciplines (CS, Math, Engineering, etc.) whose experience might complement your own. However, *your final work must be your own, i.e.*, direct collaboration on assignments is prohibited.

You are allowed to refer to any external resources *except* for homework solutions from previous editions of this course (at CMU and other institutions). If you use an external resource, cite such help on your submission. **If you are caught cheating, you will get a zero for the entire course.**

Warning! With probability 1, there are typos in this assignment. If *anything* in this handout does not make sense (or is blatantly wrong), let us know! We will be handing out extra credit for good catches. :-)

Format. This written assignment is cement your understanding of curvature on both continuous and discrete surfaces.

> This assignment is closely connected to Chapter 6 of the course notes. All problems are assigned from this chapter. Additionally, the course slides (as they are released) will be extremely helpful for completing the assignment.

1. Do Exercise 6.1 of the course notes.
2. Do Exercise 6.2 of the course notes.
3. Do Exercise 6.3 of the course notes.
4. Do Exercise 6.4 of the course notes. (It might be to show positive-semidefinite, depending on your sign convention for Δ!)
5. Do Exercise 6.5 of the course notes.
6. Do Exercise 6.6 of the course notes.
7. Do Exercise 6.7 of the course notes.
8. Do Exercise 6.8 of the course notes.
9. Do Exercise 6.9 of the course notes.