Project 3: Research, Investigate, and Present a Metric Form

You may work alone or with one other person and turn in one per group. Metric forms are on a **first come-first-served** basis in the ASULearn choice selection feature. Other interesting metric forms may be approved, so check with me if you have a different form in mind.

Explore the following questions via researching and learning content that you can understand. This project intentionally has less questions as you will likely encounter material and topics that are beyond the scope of our class and will need time to research and process so that you can summarize in your own words. This is quite common when reading research papers as an advanced undergraduate student, graduate student, or faculty member—we may very well encounter material we aren't familiar with and either skim over it at first, to come back to it later, or stop and find another source that explains it. Learning everything you might encounter up front would not be possible for this project or in many research settings. (**Keep track of ALL references for # 8**). **Write it up in your own words in the language of our class** but you may use pictures from elsewhere (with proper reference).

You will turn in all of the following and share with your classmates (see #11).

1. List your preferred first name(s). If you are turning this in with a partner, list both names.

2. Handwrite or professionally typeset a metric form for your topic (like $ds^2 = ...$) and summarize what any variables stand for.

3. If it was named for a person or people, then summarize in your own words the related people who it was named for. Include full names as well as dates and look up where the people were from.

   If it was not named for anyone, then research related people who discovered or investigated it, and provides dates and where they were from.

4. Search MathSciNet

   `https://library.appstate.edu/find-resources/databases/subject/mathematical-sciences`

   for a journal article that relates. Note that if Gödel metric is your topic, you'll want to include "metric" in the title, but for the others you'll have better luck by searching with only the names(s), like anti-de Sitter instead of anti-de Sitter metric. Choose one article you find interesting and write down the full bibliographic reference from the MathSciNet database. You may search in physics or other databases if you prefer.

5. Summarize in your own words at least one physically interesting feature that relates to your topic, like perhaps connections to a concept like black holes, electric charge, energy, event horizon, heat, lightcones, mass, momentum, singularities, spin...

6. If you haven't already brought one in for the preceding question, then find one or two pictures that relate to your topic and summarize it in your own words. Wikipedia and Google images are a good place to search, but be sure to reference the original site (Google images is a database - it does not contain the images).

7. Summarize in your own words at least 2 geometric connections of your metric form to differential geometry, like perhaps null geodesics, timelike geodesics, curvatures, or other connections. One option is to research differential geometry connections. Another would be to modify the Maple file Wormholes.mw that is on ASULearn to calculate curvatures (if so, you'll need to modify and then execute the commands in Details of the Computations section too).

8. Give proper credit to any references you used, including proper credit to image sources. This includes citing sources professionally, including author names, except authors are not needed for images. If you used Wikipedia for anything other than pictures, try to find the original scholarly sources, as Wikipedia notes: "because it can be edited by anyone at any time, any information it contains at a particular time could be vandalism, a work in progress, or just plain wrong"' (accessed 4 December 2023 `https://en.wikipedia.org/wiki/Wikipedia:Wikipedia_is_not_a_reliable_source`).

9. **If you are a graduate student**, then add more connections than the undergraduate instructions of "one physically interesting feature" in #5 and "2 geometric connections" in #7.

10. Collate your work into one PDF for submission to the ASULearn assignment for Project 2. Electronically, you can append PDFs you create from Maple to the end of your other PDFs, like by using Preview on a Mac or PDFsam on a PC. Maple lists instructions for creating a PDF. If you have a phone or tablet, apps like Adobe Scan or CamScanner can work well to scan work to one full size multipage PDF. You can also use many printers or photo copiers to scan to PDFs—the school library lists that as an option and they can help.

11. **Elevator pitch presentation about your metric form**—up to 100 seconds. The idea of an elevator pitch is to make a short, persuasive pitch that sparks interest in a topic during the time it takes to ride an elevator with a stranger. You will present your elevator pitch during class and each person is limited to 100 seconds. Start your pitch with your name.

    If you work in a group then you should try and pitch different information than your partner did. You could pitch separately or take turns within the same pitch, but both people must speak about equally—as a group you are limited to 200 seconds total.