Analytic Geometry and Metric Perspectives 2

Dr. Sarah's MAT 3610: Introduction to Geometry

goals:

- IGS Exploration
  I can use Interactive Geometry Software (IGS) to discover relationships and demonstrate they seem to apply in a wide variety of examples.
- Proof Considerations
  I can write rigorous proofs in geometry, identify underlying assumptions, and understand limitations and applications.
- Geometric Perspectives
  I can compare and contrast multiple geometric perspectives.

Welcoming Environment: Keep it a safe place to express meaningful ideas and opinions. Actively listen to others and encourage everyone to participate. Part of the welcoming environment is to keep an open mind as you engage in our class activities, explore consensus and employ collective thinking across barriers. Maintain a professional tone, show respect and courtesy, and make your contributions matter.

1. **Building Community**: What are the preferred first names of those sitting near you? If you weren't able to be there write N/A or give reference to anyone you had help from.

Taxicab Circle and π

2. Revisit `https://www.geogebra.org/geometry/enku7tgq`. Notice that the coordinates of A are $(-6, 4)$. Keep A at that location, but drag E to investigate the set of all points that are distance 2 away from A in the taxicab metric (i.e. the taxicab circle of radius 2 with center $(-6, 4)$). Sketch the full taxicab circle of radius 2 about $(-6, 4)$ (it isn't a Euclidean circle!).

3. What is the taxicab circumference/perimeter of this taxicab circle?

4. What is the taxicab diameter across?

5. π is defined historically as the ratio of the circumference to the diameter of a circle, so compute this. Is taxicab π the same as what you obtain using the Euclidean metric?

Taxicab Equidistant Points

6. Go to
   `https://www.geogebra.org/geometry/enku7tgq`
   - insert points at $H = (0, 0)$ and $I = (3, 3)$
   - Move A to a point you think is equidistant from H and I in the taxicab metric (i.e. the same taxicab distance away from both points).
   - Test out your guess by first moving E to H to see the taxicab distance and then to I to see the taxicab distance. If they aren't the same, try a different location for A.
   - **Once you have some points, add them to the sketch I've started on the board.**
   - Find all of the points that are equidistant from H and I. There are more than you might initially think!

7. Sketch all the equidistant points.

8. In a town having perfect square blocks and equally spaced streets running north and south as well as east and west, two ambulance bases (my husband is a volunteer EMT in his spare time!) are to be located at $H = (0, 0)$ and $I = (3, 3)$. The town officials want to divide the town into two districts—District 1 served by Station H and District 2 served by Station I. What are the real-life issues that would go into deciding how the boundary should be drawn?

Circles Continued—in Euclidean and Taxicab Geometry

9. In **Euclidean geometry**'s metric, do 3 noncollinear points determine a unique circle?

10. What Euclidean proof that we did previously would show why or why not? Sketch or explain.

11. In **taxicab geometry**'s metric, do 3 noncollinear points determine a unique taxicab circle? Either say yes, or sketch a counterexample.

12. In **Euclidean geometry**, how can 2 circles intersect? Back up your assertions with rough sketches that show all the different possibilities.

13. **Help each other and PDF responses to ASULearn**: If you are finished with the worksheet before I bring us back together, first ensure that your entire group is finished too, and if not, help each other. If your entire group is finished, then split up and pull up chairs so that you can discuss your responses with other groups. Collate your handwritten responses, preferably on this handout, into one full size multipage PDF for submission in the ASULearn assignment. I recommend you turn it in sometime today, but you have until the next class.