MTH 256 – Measurement 1 Study Guide

Linear systems

1. Solve the following systems of equations. You should be able to describe three methods of solving them: by substitution, elimination and graphing. Solve for x and y:

a) $4x-3y = 14$ and $2x + y = 12$
b) $2x – y = 7$ and $3y – 6x = -21$
c) $2x – y = 7$ and $3y – 6x = 3$

Measurement

Problems in this part of the study guide often refer to applets. All the applets can be found in this Geogebra Book: http://tube.geogebra.org/student/bcr7NBxgw

Measurement Basics

1. Describe units of measurement for measuring the length, area and volume. What they are and how do they "look like"?
2. Ruler is a tool for measuring the length. Describe, how a tool for measuring the area may look (consider a small area, like a lake on a map).
3. Describe the difference between *measuring* and *calculating* (For example, what would you be doing if you were to measure the area of a lot on a map and what would you be doing to calculate the same area?)
4. Elementary students often start learning about measurement by measuring objects with their own units (stride to measure the length of a room, handspan to measure table length…). Explain the purpose(s) of such activities. What should the students learn from this or realize?

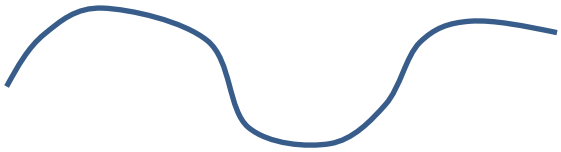
Linear Measurement

On the Geoboard

5. What is the length of the longest line segment on a 5x5 geoboard?
6. You should be able to find the perimeter of any polygon on the geoboard (for example https://www.geogebra.org/m/PzinuC35)

Circle circumference

7. Use your own words to answer the question "What is π?".
8. We used an old method of polygon approximations to approximate the value of π. (https://www.geogebra.org/m/BhxyBJUZ). How would you use a similar idea to approximate the length of the depicted curve? What would you do to make your approximation better?



9. Suggest and describe an activity, in which K-8 students would discover π and the circle circumference formula. (We discussed two or three ideas; One can be followed in the applet: https://www.geogebra.org/m/mZIwiX0F)

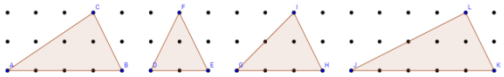
Measurement in the plane

On the Geoboard

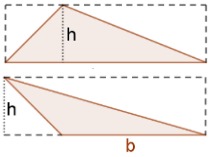
10. What is the largest area of a triangle that can be drawn on a 5x5 geoboard?
11. You should be able to find the area of any polygon on the geoboard using the geoboard method. (For example: https://www.geogebra.org/m/PzinuC35).

Development of formulas

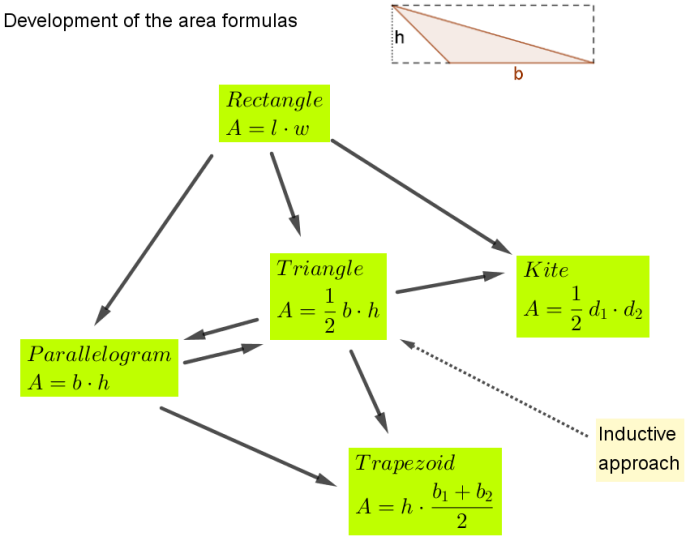
12. You should be familiar with various ways to develop and justify the area formulas.
    a. What is typically the first area formula elementary students encounter? How do they usually learn it?
    b. Describe an activity that would help your students derive the triangle area formula *inductively*.
    c. Is the following set of triangles suitable for an inductive derivation of the triangle area formula? Try it out and explain.



    d. Derive or justify the triangle area formula deductively. Make sure you can do it for acute and obtuse triangles, as in the pictures.



    e. This picture shows different ways of developing area formulas. For example, it shows that the rectangle formula can be used to justify the parallelogram, triangle and kite formulas or that the trapezoid area formula can be explained by applying a triangle or parallelogram formulas. Make sure that you understand and can explain all the paths indicated in this pictures.



    f. Derive the formula for the area of a n-sided regular polygon (apothem h is also given).
    g. Explain how the circle area formula can be derived (two ways). What manipulatives could you use?

Applications

13. You should also be able to apply the formulas to find the areas of various quadrilaterals and other polygons.
    a. Triangles on the Geoboard. Identify all three heights (draw them) and then select an appropriate base and corresponding height to calculate the area. (https://www.geogebra.org/m/e8mvzWxU)
    b. Other complex polygons and shapes: https://www.geogebra.org/m/VVF5tFs4