Elementary Constructions and Concepts

1. Use paper folding to construct:
   - Midpoint of a given line segment.
   - Perpendicular line to a given line through a given point.
   - Parallel line to a given line through a given point.
   - Perpendicular bisector of a given line segment.
   - Angle bisector of a given angle.

2. Use compass and ruler to construct
   - A triangle given its 3 sides
   - An equilateral triangle given its side.

3. Angles. You should be able to measure angles with a protractor. You should be able to classify angles according to their size. Given a picture, you should be able to identify vertical angles, supplementary angles, complementary angles, alternate interior and exterior angles, corresponding angles and reason about their size and congruence. See the homework problem (still on my website).

4. Congruence.
   How would you explain the concept of congruence? How can we tell that two shapes are congruent? Divide a 5x5 Geoboard into two congruent parts. Find at least 5 such partitions. (pg. 221 #3.)

5. Convexity
   How would you define or properly describe a convex and concave shapes? Illustrate on examples.

Lengths and Areas on Geoboard

6. Areas of polygons on the geoboard: Review pg. 362-3 and 367.

7. Perimeters of polygons on the geoboard: (Keep in mind that if a side goes diagonally, its length must be calculated using the Pythagorean Theorem). Find the perimeter of polygons on page 363: 2c, 3a,b,c,d

8. On a Square Dot Paper, draw:

   a. At least three triangles with the given area (for example $5u^2$)
   b. As many non-congruent rectangles with the area of 12 as possible.
   c. At least two pentagons with the area of $5u^2$.
   e. A square with the area of 9 u^2
   f. A trapezoid (traditional definition) with the area of 7 u^2
   g. A parallelogram but not a rectangle with the area of 6 u^2

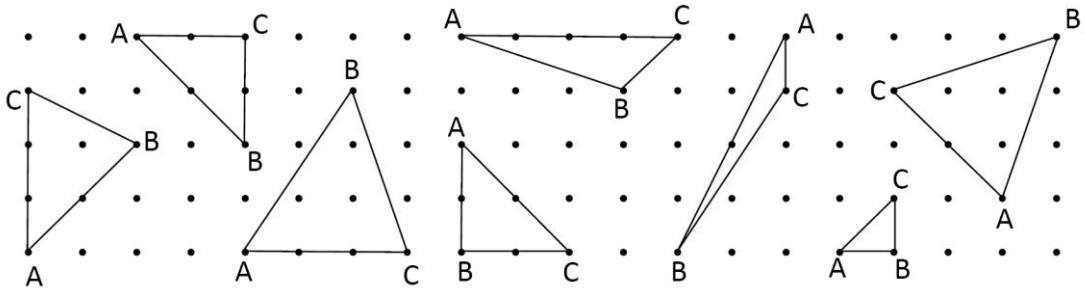
Triangles

9. Triangles:
   Classify triangles using Venn diagrams (use categories: isosceles, right, obtuse,

acute, equilateral)

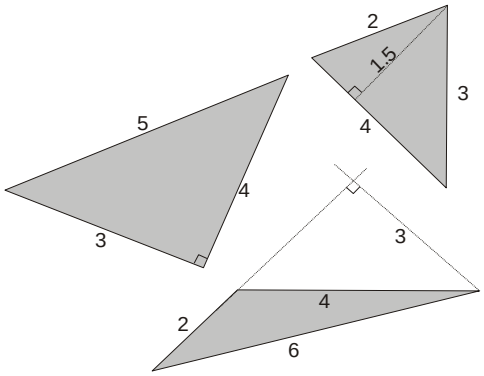
10. A student said: “Acute triangle is a triangle that has an acute angle”. Is the student’s definition correct? If not, explain what you would do to help the student.
    A student said: “Obtuse triangle is a triangle whose all interior angles are obtuse”. Is the student’s definition correct? If not, explain what you would do to help the student.

11. For the triangles on the Geoboard strip (see below) do the following:
    a. Draw **all three** altitudes (=heights) for each triangle.
    b. Find the length of the altitudes from the point B. (In some cases you will have to use the Pythagorean Theorem to find the length and the result may not be a whole number. If it is not a whole number, leave it in a radical form (“square root form”)).
    c. Find the areas of these triangles by (1) applying the formula for the area and (2) using the “Geoboard method”. Check your answers by comparing both results.



12. Explain how the area formulas for a triangle can be derived.

13. Find the area of the following triangles:



Quadrilaterals and other Polygons

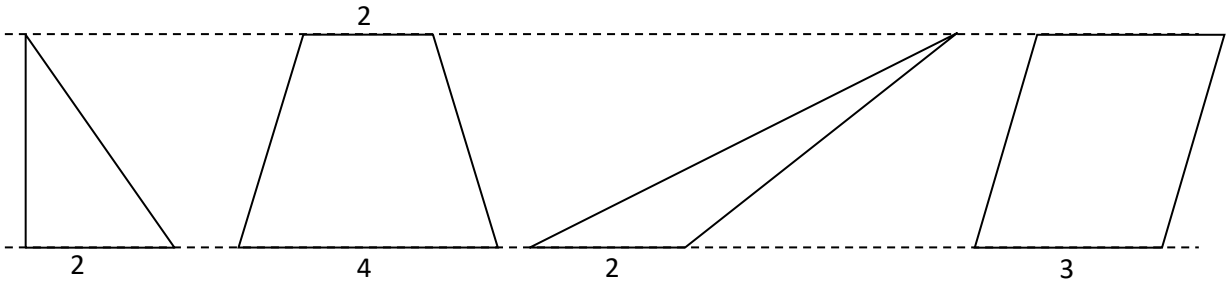
14. Quadrilaterals:
    Classify quadrilaterals using a tree diagram (use categories: parallelogram, rectangle, square, rhombus, trapezoid (modern definition), kite, quadrilateral)

15. Using the diagram from above and what you know about quadrilaterals, decide if the statements are true or false. If the statement is not true, draw a counterexample.
    All rectangles are parallelograms.
    All rhombi (rhombuses) are squares.
    All isosceles triangles are equilateral.
    Some isosceles triangles are equilateral.

All equilateral triangles are isosceles.
All squares are parallelograms.
Some kites are trapezoids.
No rhombus is a rectangle.

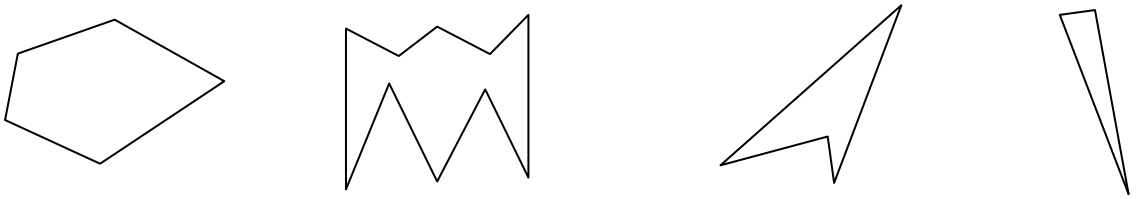
16. Explain how the area formulas for a parallelogram and trapezoid can be derived.

17. Find the areas of the following figures. The vertical distance (between the dotted lines) is 3.



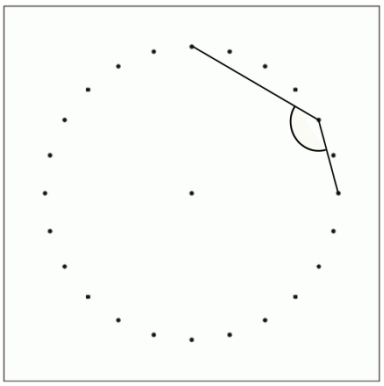
18. Polygons:
On the Geoboard, construct a convex heptagon. Construct a non-convex quadrilateral. Construct a non-convex pentagon. Other examples see pg. 267
Sketch (without the geoboard) a convex nonagon. Sketch a non-convex dodecagon.

19. Name given polygons. Decide if they are convex or non-convex.



Circles and angles

20. Draw a circle and illustrate: a chord, tangent, secant, diameter, radius, arc, inscribed angle, central angle.
21. On the circular geoboard with 24 pegs, construct the following central angles: 105°, 30°, 330°, etc.
22. On the circular geoboard with 24 pegs, construct the following inscribed angles: 52.7°, 15°, 165°, etc.
23. What can you say about central and inscribed angles that correspond to the same arc?
24. Without a protractor, find the measure of the angle pictured on the circular geoboard here.



25. What is the area and circumference of a circle? What manipulatives would you use to explain both formulas and how would you do it?
26. How would you answer: What is π?