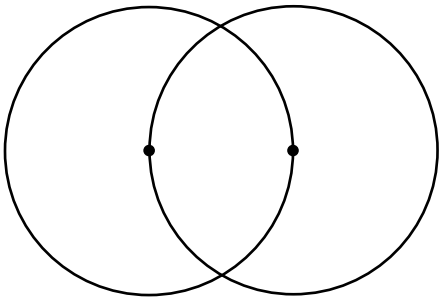
7th Grade Assignment – Week #7

Individual Work: See how much you can do on Measurement Sheet #3.

Group Assignment: For Tuesday



Vesica Piscis

The *Vesica Piscis* is the shape that results when you intersect two equal-sized circles, where each circle has its center lying on the edge of the other circle. Conveniently, you can draw an equilateral triangle inside the vesica piscis, where the three points of the triangle are the two centers of the circles, and the (upper) point of intersection of the two circles. (Can you picture this triangle?)

For next week, I will assign you to create a main lesson book page where you will need to draw the vesica piscis, and then include the triangle (as described above), as well as a square, pentagon, and hexagon.

Your task as a group is to try to figure out how to draw the square, pentagon, and hexagon. Each of these polygons must meet these criteria:

- It must be regular (meaning the sides and angles are equal).
- Its base (one of its sides) must be the line connecting the centers of the two circles.

You don't need to make a perfect drawing yet (that will come later!) – you just need to figure out how to do draw the square, pentagon and hexagon, as required above. (The pentagon is definitely the hardest!) I'll then show you how to do this in the next lecture – but I want to give you a chance to think about it first.

Group Assignment: For Thursday

These problems should be done in the order given below.

1. **An Important Law**. (Important Note: You should be sure to solve the puzzle that I gave in the lecture – with the five pieces cut out of the squares – before you work on this assignment.) The puzzle we did actually has to do with a very important law in mathematics. It has to do with the areas of the three squares. Carefully think about the wording of this law by filling in the following sentence, and making sure that you include the word "area":

   "With any right triangle…"

2. **Vesica Piscis**. If you didn't have a chance to think about the *Vesica Piscis* problem from the lecture #1 group assignment, then you should do so now.

3. **Triangle Constructions**. In the lecture today, I constructed two triangles with a compass and straightedge: one triangle was constructed from three sides (as given by the "triangle architect"). This was called SSS. After that, I did a SAS construction, where we were given an angle and two sides. Although I didn't do it in the lecture, you can also imagine doing an ASA construction, where we are given one side and two angles, and are required to construct the triangle such that the two given angles are placed on either end of the given side. Here's the question for you to contemplate:
   Under what circumstances are each of these three triangle constructions not possible?

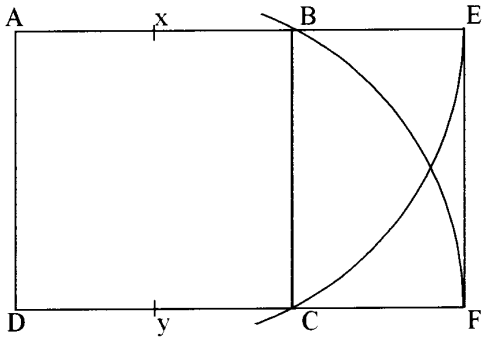
Main Lesson Work (geometry) **Pages coming out of Lecture #1**

- **Important drawing needed for our next lecture!**
  This needs to be done before you work on the main lesson book pages assigned below.
  Bring it to the lecture, where I will give you instructions about what to do with it.
  Be sure to have scissors available for the next lecture.

  Instructions: Picture a right triangle where the two smaller sides are not equal to each other. Now picture that there are squares attached to the three sides of the right triangle. Now, on a loose piece of paper (not in your main lesson book), construct this configuration as exactly as possible with a compass and straightedge. Make it as large as you can on the page, but not so large that the squares run off the page. Check that your squares are as perfect as can be by measuring that all four sides are equal, and that the square's diagonals are also equal.

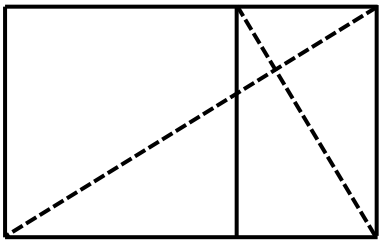
- Main Lesson Book Page. Title: **The Half-Wheel Theorem**
  Instructions: Make a drawing similar to what I did in the lecture. The first stage should show a triangle where the sides have been extended, and the angles (each a different size) are shaded in using a different color. The second stage shows the base of the triangle moving upward, thereby shrinking the triangle – yet the angles do not change. The third and final stage shows the three lines intersecting at the same point, and shows why the three angles (each a different color) add to be a straight line (180 degrees). Next to your drawing, add a statement (in your own words) that expresses the *Half-Wheel Theorem.*

- Main Lesson Book Page. Title: **The Golden Rectangle and its Spiral**
  Instructions: (These are the same instructions I gave in the lecture.)
  - Note that you should not mark your drawing with letters. I am only doing this here so that you can follow the instructions.
  - Construct a square (with points shown here as A,B,C,D).
  - Extend lines AB, and DC to the right. Using a compass, construct the midpoint (x) of AB, and the midpoint (y) of DC. Place the needle at x, and draw an arc so that it passes through point C and intersects the extended part of the line AB to the right of B at point E. Draw another arc with the needle at y, so that it passes through point B and intersects the extended part of the line DC to the right of C at point F. AEFD is a golden rectangle, and so is BEFC. Go over the lines for the square and rectangle in black ink. Erase all other construction lines.



(Continued on the next page →)

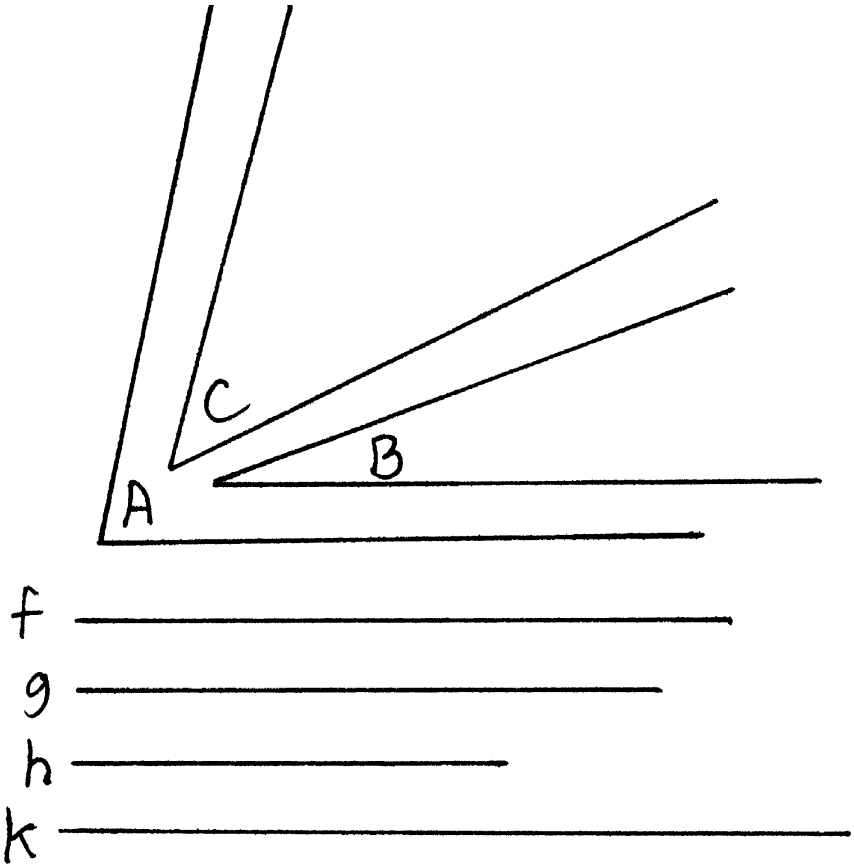
- Lightly in pencil, draw a diagonal across the original (larger) rectangle, and a diagonal across the smaller rectangle, so that they intersect (as shown at the right).



- Draw a line dividing the smaller rectangle into a square and another golden rectangle, and divide that rectangle, and every succeeding one in the same manner, so that the squares *spiral* in toward the intersection of the two diagonals, but making sure that the intersection point of the diagonals never falls inside a square. (All of this was also shown and explained in the lecture.) Go over the lines for the squares in black ink. Erase all other construction lines.
- Carefully and beautifully draw a spiral that passes through the centers of all the squares.
- Color each square beautifully in a different color.

Main Lesson Work (geometry) **Pages coming out of Lecture #2**

- Main Lesson Book Page. Title: **Triangle Constructions**
  (See also the related topic, above, with the group assignment.)
  Do these constructions: (It might help to start with what is in the middle.)
  - ΔfgK (SSS)
  - ΔhAg (SAS)
  - ΔCkB (ASA)



Measurement – Sheet #3

1) **Add or subtract.** Give answer in the largest unit.

a) 3 lb + 40 oz =

b) 4.2ℓ – 270mℓ =

c) 4kg + 9500mg =

d) 14km – 2730m =

e) 4days + 120hr =

2) A bag, which weighs 1.75kg empty, is filled with 350 balls, each weighing 180g. What is the total weight of the full bag (in kg)?

3) John and David live 0.7km apart. If John takes 25cm steps, then how many steps would it take him to walk from his house to David's house?

4) A punch recipe calls for 135mℓ of orange juice, 550mℓ of sparkling water, and 85mℓ of apple juice. Is a 1.0 ℓ pitcher big enough to hold the punch? If so, how much more punch could be added. If not, how much will spill?

5) Circle that which is most reasonable.

a) 250g
toy truck
pickup truck
monster truck

b) 6kg
golf ball
soccer ball
bowling ball

c) 40km
sled ride
car ride
airplane ride

d) 1.9m
doll's height
person's height
house's height

e) 15mℓ
full spoon
full bowl
full bathtub

f) 400mℓ
full spoon
full bowl
full bathtub

6) David can carry 15 bricks, each brick weighing 24oz. How many pounds of bricks can David carry at one time?

7) Tom has a book that is, without the cover, 3.2cm thick. If the book has 800 pages, then how thick is the average page, in millimeters?

8) **Complete.**

a) 25 days = _____hr

b) 48 pt = _____qt

c) 56 mm = _____cm

d) 97 mℓ = _____ℓ

e) 75 cm = _____m

f) 490 min = _____hr

g) 5 c = _____pt

h) 12 tbsp = _____tsp

i) 35200 mg = _____kg

j) 15 min = _____s

k) 8¼ lb = _____oz

l) 30 mi = _____yd

Mental Math

9) $44 \cdot 25 =$

10) $25 \cdot 16 =$

11) $25 \cdot 14 =$

12) $31 \cdot 29 =$

13) $13 \cdot 15 =$

14) $54 \div 10000 =$

15) $26 \cdot 11 =$

16) $16 \cdot 999 =$

Review Section

17) Division. Leave your answer as a mixed number.

a) $8908 \div 29$

b) $86218 \div 3193$

18) $\sqrt{81}$

19) $\sqrt{8100000000}$

20) $\sqrt[4]{81}$

21) $\sqrt[4]{8100000000}$

22) Convert to an improper fraction.

$15\frac{2}{15}$

23) Convert to a mixed number.

$\frac{8908}{29}$

24) The previous problem is the same as which other problem on this sheet?

25) $\dfrac{5\frac{4}{7}}{3\frac{3}{5}}$

26) Give your answer as both a decimal and as a fraction.

$3.75 + 5\frac{7}{8}$