7th Grade Assignment – Week #8

A Fantastic Book! This is a book I highly recommend: *The Man Who Counted*

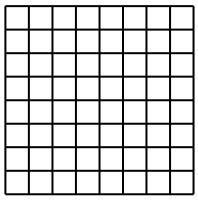
It is a "collection of mathematical adventures" – tales of wise mathematician traveling through 14th century Arabia. Although this book is appropriate for older students as well, I recommend it for 7th grade.

Individual Work: See how much you can do on Measurement Sheet #4.

Group Assignment: For work on either Tuesday or Thursday

- *Pythagorean Theorem*. You are given a triangle that has a hypotenuse (longest side) of length 13cm, and a shortest side of length 5cm. Use the Pythagorean Theorem (with the areas of the three squares along the sides of the triangle, etc.) to find the length of the third side of the triangle.

- *Puzzle!* Pieces on a Chessboard
  Draw a standard 8x8 grid (as shown here) on a separate piece of paper, or find a floor with square tiles. Select eight of the squares on which to place an X (or a coin). You must do this such that no two X's lie along the same horizontal, vertical, or any of the diagonal lines (not just the two main diagonals).

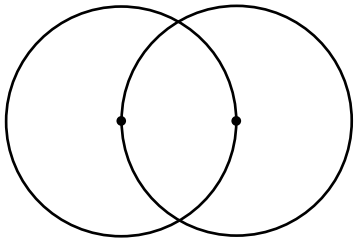


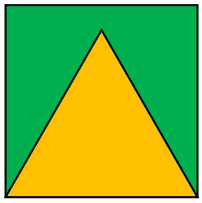
- *An Introduction to Area*

  1. The small square (on the right) has edges that are 1 cm long. The rectangle measures 3cm by 4cm. How many of the small squares fit inside the rectangle? Draw horizontal and vertical lines inside the rectangle that show how many squares fit inside the rectangle.
  2. With the above square and rectangle, we say that the square has an area of "one square centimeter", which is written as 1 cm^2, because it is a square with 1 cm long edges. This square is a basic unit of area measure, as is a "square inch" (written in^2), a "square foot" (written ft^2), and a "square meter" (written m^2).
     a) How many square inches fit inside a square foot?
     b) How many square feet fit inside a square yard?
     c) How many square centimeters fit inside a square meter?
     d) How many square meters fit inside a square kilometer?
     e) How many square feet fit inside a square mile?
  3. Calculate the area of each:
     a) What is the area of a rectangle that measures 4 inches by 5 inches? (This is the same asking: "How many square inches fit inside this rectangle?")
     b) What is the area of a rectangle that measures 7 inches by 11 inches?
     c) What is the area of a rectangle that measures 6 inches by 2½ inches?
     d) What is the area of a rectangle that measures 4½ inches by 3⅓ inches?
     e) What is the area of a right triangle that has a base of 5 inches and a height of 8 inches?

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

- Main Lesson Book Page. Title: **The Pythagorean Theorem**
  Instructions: Draw the puzzle configuration (with the right triangle and the three attached squares). Show how with the puzzle the two smaller squares were cut into two and three pieces. Briefly explain how the puzzle worked. Lastly, write your statement for the Pythagorean Theorem – be sure that your statement starts with the words "In any right triangle", and that it includes the word "area" at least once.
- Main Lesson Book Page. Title: **The Vesica Piscis**
  Instructions: As explained in the lecture, draw a triangle, a square, a pentagon, and a hexagon in the vesical piscis, such that:
- Every polygon (shape) must be *regular,* which means all sides and angles are equal.
- Every polygon has its base lying on the line that connects the centers of the two circles.
- Every polygon (except for the triangle) has 4 points on the circles.
- Color it in beautifully so that each polygon has a different color, and it appears that the polygons are in a stack with the smallest (the triangle) at the top, and the largest (the hexagon) at the bottom, like this triangle appears to be on top of the square:





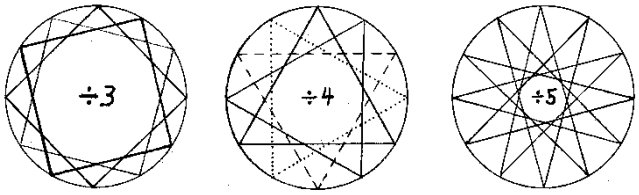
Main Lesson Work (geometry) **Pages coming out of Lecture #2**

- Main Lesson Book Page. Title: **Star Patterns**
  Instructions: You should follow the instructions I gave in the lecture, but I will give you more guidance here. First you need to make three decisions (*division, step,* and *points*), as described below.

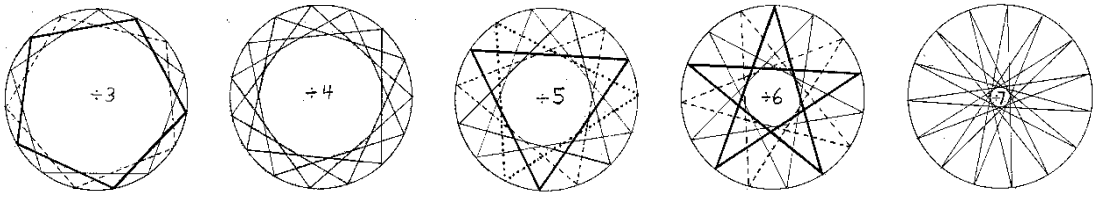
  (1) *Division.* Would you like to do the 12-division, the 15-division, or the 24-division?
  I will refer to your division number as "N", when I give further instructions below.

  (2) *Step*. This determines the length of the initial diagonal lines. The various possibilities are shown below with both the 12-division and the 15-division.

12-Division with various "steps"



15-Division with various "steps"



  (3) *Points*. How many points do you want your star pattern to have?
  Important: Your answer to this question must be a factor of N your division number). For example, if you use a 15-division, then your star pattern must have either 3 or 5 points, because these number are factors of 15. Also, the number of points must be at least 3.

(Continued on the next page →)

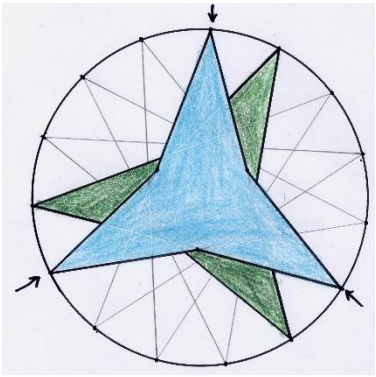
(Instructions for Star Patterns, continued from previous page.)

Now that you have made the three above decisions, here are the steps:

1. Draw a large circle, and mark the points on the circle according to your chosen division (N). (If you do the 15-division, then – as I showed in the lecture – you should start with a 3-division and a 5-division in two different circles.)

2. Draw the diagonals (very lightly in pencil) according to your chosen *step.* (See the drawings on the previous page.)

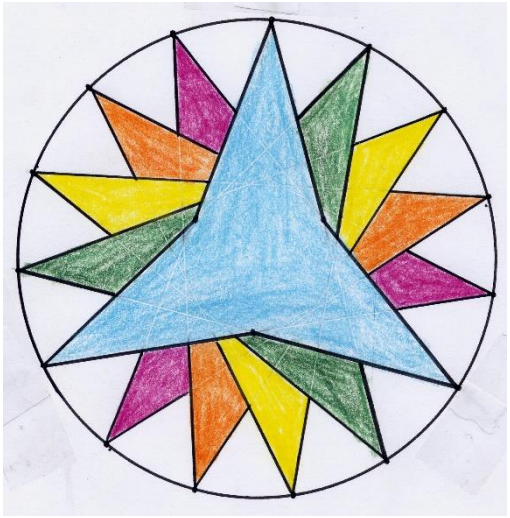
3. Now check that your values are valid. The drawing shown here is from the lecture. I chose a 15-division, and a "step" value of 6. (Can you see all the diagonal pencils lines that connect points on the circle that are 6 steps apart?) Then I chose my *points* to be 3. This means that my star pattern will have 3 points on the circle.
Your "points" value must be a factor of your N value (which means that the "points" value must divide into N without a remainder.) For my drawing, 3 is a factor of 15, so I am OK.



4. Now comes the tricky part! I'll explain what I did. I marked three points on the circle (shown by arrows) that were equally spaced apart. Then, imagining that each diagonal pencil line is a road, I had to travel from one of the three marked points to another, and then I marked over that path in black ink, until the entire star pattern was revealed.

5. Then I erased the construction lines inside that first star pattern, and colored it in (in light blue). Then I had to visualize where the next star pattern was underneath the top one (that I just colored in). So I erased the small bits of construction lines within that second star pattern, went over the edges in black ink, and colored it in (in green, as shown above).

6. Lastly, I continued identifying more star patterns hidden underneath the others I had already colored in, erased more bits of construction lines, inked the edges, and colored it in. The final result is shown below.



Measurement – Sheet #4

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

a) 17.34m – 784cm =

b) 25gal – 48qt =

c) 14kg –750g =

d) 75cm + 18mm =

e) 0.54ℓ – 26mℓ =

f) $\frac{7}{12}$hr + 17min + 480s =

g) 4yd + 18in =

h) 1500lb + 2ton =

2) A loaf of bread, weighing 972g, is cut into 18 equal slices. What is the weight of each slice?

3) A bag, which weighs 50g when empty, has 600 identical marbles in it. If the full bag weighs 1.40kg, then what is the weight of one marble?

4) Two lines are drawn on a chalkboard. The first line is 1.65m long and the second is 185cm long. Which line is longer, and by how much?

5) 1ℓ of water has a weight of 1kg. What is the weight of 573000mℓ of water?

6) Circle the measurement that makes the most sense.

a) Width of a chalkboard

2.5m 2.5cm

b) Mass of a shoe

4kg 450g

c) Volume of balloon

2 ℓ 45mℓ

d) Diameter of a pizza

48cm 1.8m

7) **Complete.**

a) 2 days = _____min

b) 5 fl.oz. = _____tbsp

c) 37 g = _____kg

d) 300 yd = _____in

e) 26 mℓ = _____ℓ

f) 48 fl.oz = _____gal

g) 5690 ℓ = _____mℓ

h) 3.5 m = _____mm

i) 15840 in = _____mi

j) 2708mg = _____g

k) $\frac{3}{16}$ton = _____oz

l) 1200 mm =_____km

8) A window washer is washing a 25m tall building. He has four buckets of cleaning solution, each one holding 4.5ℓ.

a) He wants to reach a window that is 1530cm above the ground. How far will the window washer have to lower himself from the roof to reach the window?

b) There are 240 windows that need to be washed and the average window takes 25mℓ of cleaning solution. How much cleaning solution will be left after all the windows have been washed?

Mental Math

9) $25 \cdot 36 =$

10) $320 \cdot 25 =$

11) $1.8 \cdot 25 =$

12) $19 \cdot 21 =$

13) $19 \cdot 17 =$

14) $6.4 \div 4 =$

15) $700 \cdot 300 =$

16) $6 \cdot 9999 =$

Review Section

17) Divisibility. State whether each number is evenly divisible by anything from 2 to 12 (but not 7).

a) 4568212

b) 31640625

18) Convert to a decimal.

a) $\frac{5}{6}$

b) $\frac{5}{60}$

c) $\frac{389}{1111}$

19) $(2\frac{1}{5})^2$

20) $(2\frac{1}{5})^3$

21) *Challenge!*

$$\frac{\frac{5}{3\frac{3}{4}}}{5\frac{1}{2} - \frac{5}{2^{-\frac{1}{4}}}}$$