7th Grade Assignment – Week #6

Important Notes for Parent/Teacher:

- I will be introducing the Pythagorean Theorem next week in a very unconventional manner: through a cutout puzzle. Then the students will try to formulate a statement of the theorem in their own words. Please don't give it away! Also, be aware that I don't introduce the formula $c^2 = a^2 + b^2$ until 8th grade!
- At the end of the year, I plan on covering the Geometry unit found at the back of my workbook.

Individual Work: See how much you can do on Measurement Sheet #2.

Group Assignment: For either Tuesday or Thursday

- *Puzzle!* Tear and Stack. Imagine taking an infinitely large sheet of paper, tear it in half, stack the two pieces, tear that stack in half, and stack the two halves on top of one another again. Continue doing this until you have torn and stacked 42 times. Estimate how high the stack will be? (Hint: it may help to know that a ream of 500 sheets of paper is about 5cm in thickness.)
- Digit Arithmetic Puzzles
  With each of the following puzzles, you must put in a digit for each letter. For each problem, the same digit must be put into the same letters, and different letters must have different digits. Note also that the value for A in one problem does not have to be the same for the next problem.

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1)   AB        2)   AB          3)    ABCD
     AB             + B              CD
     AB              BA          + EFGH
   + AB                          IJDH
     CA
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Main Lesson Work (geometry) **Pages coming out of Lecture #1**

(For those who are doing the Geometry main lesson.)

- Note: For those who are new to Waldorf geometry, I have included various geometric constructions from the 6th grade geometric drawing main lesson, in the pages below.
- If using a compass is new to you, be sure to first practice drawing circles with your compass. Remember to have one hand holding the needle, and one hand holding the top of the compass.
- Main Lesson Book Page. Title: **Constructing a Square on a Line**
  Instructions:
  Draw a line around 4-inches-long near the middle of the page. With a compass and straightedge only, very accurately construct a square onto the line. Once you are finished, use the compass to confirm that all four sides of the square are equal, and that the two diagonals are equal. If you need help with the construction of the square, use the directions found below.
  Now repeat the construction using a second line.

- Main Lesson Book Page. Title: **A 12-Pointed Star**
  Instructions:

  Step #1
  Draw a large circle, and then carefully mark in ink twelve equally-spaced points on the circle either by following the method I showed in the lecture, or following the instructions for "The 12-Division of the Circle" (see "Basic Constructions", below). Erase all construction lines except for the circle and the 12 points on the circle.

  Step #2
  Choose a "Stepping Distance" of either 3, 4, or 5. (I did 5 in the lecture.) For every point on the circle, draw lines that connect that point to the points on the circle that are the stepping distance away. You will need to draw a total of 12 lines.

  Step #3 Use colored pencils to shade it in beautifully.

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

- *A drawing needed for our next lecture*. With the page (8.5 by 11 inches) in landscape orientation, draw a square (with a compass and straightedge) that has edges that are 4.5 inches long. (If your paper is larger, then you can make the square larger.) The square should be toward the left side of the page – about 1 inch from the left edge of the page. When you complete the square, be sure that it is accurate by measuring (with your compass) all four sides and both diagonals. This square will be the first step of an important drawing that I will do in the next lecture.

- Main Lesson Book Page. Title: **Two Angle Theorems**
  Instructions:

  Create a main lesson book page that includes the two theorems I gave in the lecture:
  (1) The Supplementary Angle Theorem.
  (2) The Vertical Angle Theorem.

  For each theorem, you should make a drawing and give a statement in your own words.
  (Note: The *Triangle Angle Theorem* (where we cut out the angles in a triangle) will appear in your main lesson book next week.)

- Main Lesson Book Page. Title: **Construction of a Pentagon**
  Instructions: Draw a large circle on the page, and then follow the instructions I gave in the lecture (and also given below as *method #1*) to make a regular (perfect!) pentagon. Keep all construction lines. Only color the perimeter of the pentagon.
  Extra Drawing: Make another pentagon by following the directions (given on the pages below) for *method #2*.

- Main Lesson Book Page. Title: **Nested Pentagons and Pentagrams**
  Instructions:

  Step #1
  If you can, draw a large circle with black ink. Then locate the five points of the pentagon on the circle, and erase all construction lines and marks (except for the circle itself and the five points of the pentagon.

  Step #2
  Using a fine black pen, draw the pentagon, and then draw the diagonal lines of the pentagon, which creates the pentagram. At the center will appear a new pentagon. Draw another pentagram inside the new pentagon. See how many (smaller and smaller) pentagrams you can draw.

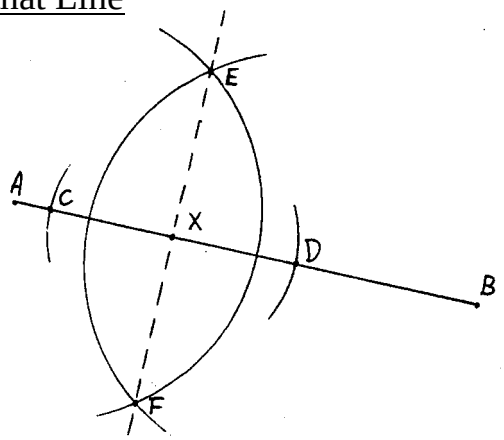
  Step #3 Use colored pencils to shade it in beautifully.

Instructions for Geometric Constructions

Note: The below constructions are mostly from the 6th grade geometric drawing main lesson. These notes are intended for the teacher or parent to help them in presenting the material to the students.

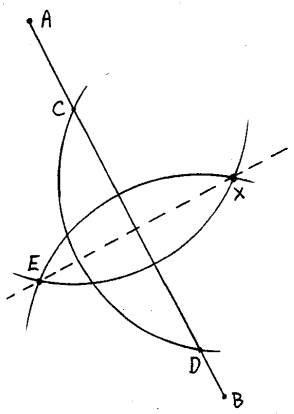
Constructing a Perpendicular Line through a Point on that Line

Instructions (for the teacher only)**:** *The intention is to construct a line perpendicular to AB that passes through X, which is a point on AB.* First, draw two arcs, each one using the same compass width and with the needle at X − one arc passing through AX at C and the other passing through XB at D. Now lengthen the compass somewhat and draw two long arcs − one with the needle at C and the other with the needle at D, such that they cross each other at points E and F. Line EF is the desired line; it passes through X and is perpendicular to AB.



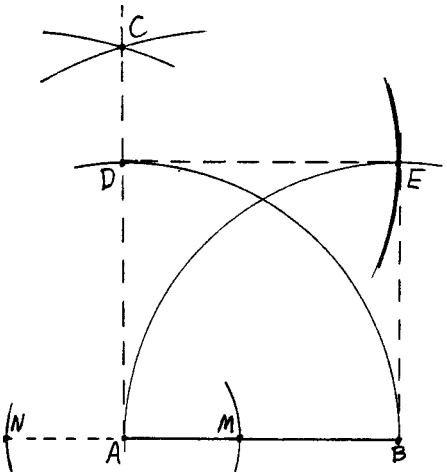
Constructing a Perpendicular Line through a Point *Not* on that Line

Instructions (for the teacher only)**:** *The intention is to construct a line perpendicular to AB that passes through X, which is NOT on AB.* First, set the compass width a bit longer than the distance that X is from line AB and then draw an arc, with the needle at X, that passes through AB in two points, C and D. Now draw two long arcs, both using the same compass width, one with the needle at C and the other with the needle at D. They should cross each other at X and at another point E, which is on the other side of AB from X. Line EX is the desired line – it passes through X and is perpendicular to AB.

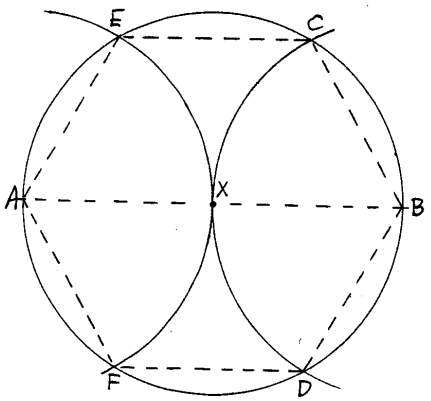


Constructing a Square, Given One Side

Instructions (for the teacher only)**:** *The intention is to construct a square that has each side equal in length to AB.* Extend AB past A to N, and then mark point M on AB such that the length of NA is equal to the length of AM. Adjust the compass so that it is somewhat wider than AB and draw two arcs – one with the needle at N, and the other with the needle at M, so that they intersect vertically above A, at point C. Line AC is now perpendicular to AB. Set the compass width equal to AB and draw an arc, with the needle at A, so that it crosses line AC at point D. Using the same compass width, draw two more arcs**:** one that is horizontally to the right of D, with the needle at D, and a second arc that is above B, with the needle at B. These two arcs cross at point E. Finish the square by connecting the four points ABED.

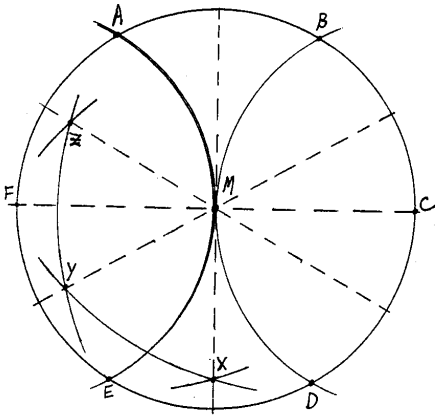


Constructing a Hexagon, Inside a Given Circle



Instructions (for the teacher only)**:** *The intention is to construct a regular hexagon inside the given circle.* Draw diameter AB passing through the center of the circle, X. Then set the width of the compass equal to the radius of the circle, and draw one arc with the needle at B, which crosses the circle at points C and D, and another arc, with the needle at A, which crosses the circle at points E and F. The desired hexagon is AFDBCE.

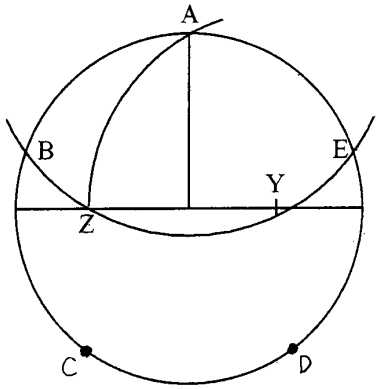
The 12-Division of the Circle (Constructing a Dodecagon)



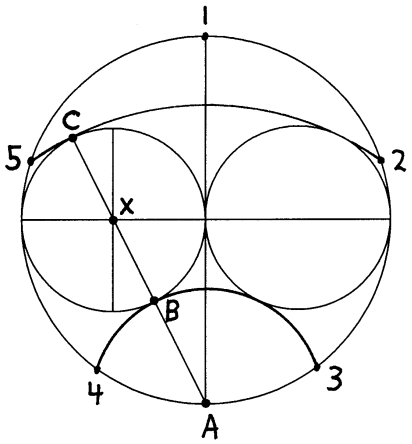
Instructions (for the teacher only)**:** *The intention is to construct a dodecagon (12-gon) inside the given circle.* Locate the 6 points (A, B, C, D, E, F) of the hexagon inside the given circle (with center M) as described above. Now, set the width of the compass to a bit less than the diameter of the circle. We only need to bisect 3 out of the 6 central angles (e.g., angle AMB) in order to locate the 6 additional points needed for the dodecagon. We do this by drawing two arcs – one with the needle at B and the other with the needle at C – by having the compass reach over the center of the circle. These two arcs cross each other at point Y. Then, with the same compass width, draw two shorter arcs – one with the needle at A and the other with the needle at D – that cross the two previously drawn arcs at X and Z, respectively. We can now locate six new points on the circle by extending XM, YM, and ZM to form diameters of the circle so that they each cross the circle in two places. This gives us the 12 points on the circle that are needed to draw the dodecagon.

Constructing the Pentagon (with nested pentagons and pentagrams)

- *Method #1*. Draw a diameter of the circle, and then find the midpoint, Y, of the radius. Draw the perpendicular bisector of the diameter, which intersects the circle at point A. Placing the needle of the compass at Y, draw an arc through A to point Z on the diameter. The distance from A to Z is precisely the length of the sides of the desired pentagon. Place the needle of the compass at A, and draw an arc through Z that intersects the circle at points B and E. Points A, B, and E are three of the points of the pentagon. Now, keeping the compass at the same width, place the needle at B and draw an arc that crosses the circle at C. Similarly, place the needle at E, and draw an arc that crosses the circle at D. The desired pentagon has points A, B, C, D, E equally spread out on the circle. Use a compass to check that the five sides have equal length. Connect the five points to draw the pentagon.



- *Method #2*. Draw horizontal and vertical diameters of the circle. Draw two half-sized circles along the diameter of the original circle. Draw line AX so that it intersects one of the half-sized circles at points B and C. Place the compass needle at point A and draw an arc using AB as the radius, which locates points 3 and 4 on the original circle. Now draw a second arc using AC as the radius (keeping the needle on point A), which locates points 2 and 5 on the original circle. The desired pentagon has points 1, 2, 3, 4, 5 equally spread out on the circle. Use a compass to check that the five sides have equal length. Connect the five points to draw the pentagon.



Measurement – Sheet #2

1) Circle the measurement that makes the most sense.

a) Height of a chair

0.75 m 2 m

b) Volume of a bathtub

8 ℓ 500 ℓ

c) Weight of a full backpack

5 kg 75 g

d) Thickness of a book

0.5 m 14 mm

e) Distance that a ball is thrown

0.015 km 470 m

2) **Estimate.** For each of the following, give an estimate (without measuring) using metric units.

a) Length of a tennis court

b) Weight of a piece of paper

c) Volume of a mouthful of water

d) Weight of a tennis ball

e) Volume of a tennis ball

f) Width of this paper

3) **Add or Subtract.** Give answer in the smallest unit.

a) 8ℓ – 348mℓ =

b) 5.3g + 570mg =

c) 3m + 53cm–28mm =

d) 25ft – 7yd =

e) ½kg–23g–250mg=

f) 3hr – 90min =

4) Megan starts with a piece of wood that is 2m long. She cuts off two pieces that are each 56cm long, how long is the piece of wood that is left over (in meters)? (Ignore the width of the saw's blade.)

5) A group of 24 people have found 7.2kg of gold. Assuming the gold is split evenly, how much gold does each person get (in grams)?

6) John's bottle holds 130mℓ. How many trips will he have to make to completely fill up a 500ℓ tub?

7) Mike ran 25m in 15 seconds. Is this fast or slow?

8) A family is taking a 300km road trip. How far have they traveled when they are $^3/_5$ of the way there?

9) **Complete.**

a) 180 hr = _____days

b) 7.32 g = _____kg

c) 6.4 km = _____m

d) 56 fl.oz = _____c

e) 12 tsp = _____tbsp

f) 2½ qt = _____pt

g) 23760 ft = _____mi

h) 51 cm = _____mm

i) 25.06 kg = _____g

j) 65.75 ℓ = _____mℓ

k) 3¾ ton = _____lb

l) 3 m = _____km

Mental Math

10) $41 \cdot 39 =$

11) $24 \cdot 26 =$

12) $89 \cdot 91 =$

13) $7 \div 999 =$

14) $480 \cdot 5 =$

15) $55 \cdot 4 =$

16) $212 - 198 =$

17) $6000 \div 9000 =$

Review Section

18) Short Division. Leave your answer as a mixed number.

a) $76234 \div 5$

b) $400000 \div 7$

19) $\sqrt{64}$

20) $\sqrt[3]{64}$

21) $\sqrt[6]{64}$

22) $\sqrt[3]{64000000}$

23) Convert to a decimal.

a) $\frac{19}{20}$

b) $\frac{10}{11}$

c) $\frac{79}{99}$

24) Reduce.

a) $\frac{40}{64}$

b) $\frac{312}{744}$

25) $53\frac{1}{3} - 49\frac{2}{3}$

26) $87.6 \cdot 0.069$

27) *Challenge!*

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