10th Grade Assignment – Week #3

Announcements:

- Next week's assignment will include a test on the *Geometry Basics* unit (from the workbook). You will take this test at home, supervised by a parent, and then send it to your tutor when you are finished.
- Our *Greek Geometry* main lesson begins next week. Here are some ideas about how the main lesson will work:
    - When a math main lesson is taking place, you are getting an "extra dose" of math beyond what is normally happening in the Math Academy.
    - As normal, I will give two lectures per week, and you will meet with your work group twice per week. In these two lectures, I will deliver the content of the main lesson, and I will give suggestions for essays and main lesson book pages in the weekly assignments. I advise that you plan on setting aside extra time in the morning ("main lesson time") to work on these assignments.
    - However, it is your and your parent's decision about how much time and effort you'd like to put into this main lesson. You may even want to go further and supplement what I offer with additional material and studies.
    - In terms of grading, I am not handling this main lesson as a separate course, although you may wish to do so in your own homeschool curriculum. I will read through your essays and main lesson book pages, and will give you a grade based upon the quality of what you hand in. This grade will then be incorporated as part of your overall Math Academy grade this semester.

Group Assignment: Do as much as you can from…

for Tuesday:

- **Problem Set #7 (***Geometry Basics* unit)**:** #8-13
- Look over the document *Basic Euclidean Constructions* (at the end of this document), and make sure that everyone in your group understands each of the constructions. Note that the two pentagon constructions are the most difficult. Don't expect to understand why these two constructions work (I might be able to explain this later in the year), but rather just aim to be able to follow the instructions.

for Thursday:

- Help each other prepare for the test on the *Geometry Basics* unit by going over some of the more difficult problems found in Problem Sets #7-9.
- *Puzzle!* Of the three girls Ann, Betty, and Christy, two are sisters. The taller of Ann and Christy is the younger sister. The shorter of Ann and Betty is the older sister. The younger of Betty and Christy is the shorter sister. Which of the two girls are sisters?

Individual Work

- See how much you can do from the homework sections from the *Geometry Basics* unit, **Problem Sets #7-9.**

Problem Set #7

Group Work

1) SSA is not one of the *Triangle Congruency Theorems*. Why is that?

2) Give an example of two triangles where the side-side-angle of one triangle is the same as another triangle, but the two triangles are *not* congruent.

The HL congruence theorem (HL ≅ Th) is a special case of SSA that *does* work as long as the two triangles are right triangles.

3) Why does the HL ≅ Th work when SSA in general does not work?

Triangle Similarity Theorems

Just as there are *Triangle Congruency Theorems* used to prove that two triangles are congruent, there are also *Triangle Similarity Theorems*, which can be used to prove that two triangles are similar.

They are: SSS ~ Th.
SAS ~ Th.
AA ~ Th.
HL ~ Th.

4) Why do the congruence theorems include ASA and AAS, but the similarity theorems only need AA?

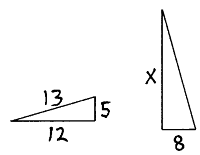
5) Give two triangles where the AA ~ Th. could be used to prove that the triangles are similar.

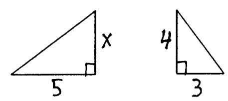
6) Give two triangles where the SSS ~ Th. could be used to prove that the triangles are similar.

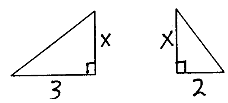
7) Give two triangles where the SAS ~ Th. could be used to prove that the triangles are similar.

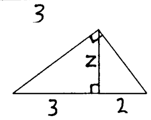
The Altitude of the Hypotenuse Theorem

Find each variable. (All pairs of figures are similar.)

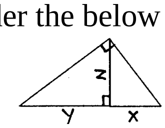
8) 

9) 

10) 

11) 

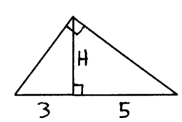
12) Consider the below drawing…



a) What can be said about the three triangles in the drawing?

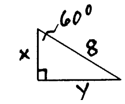
b) Give a formula for z in terms of x and y.

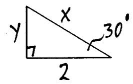
13) Find H.

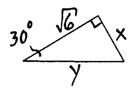


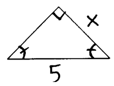
Homework

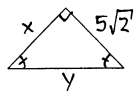
Find each variable. (All pairs of figures are similar.)

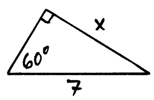
14) 

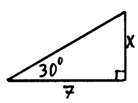
15) 

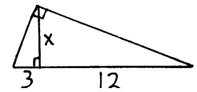
16) 

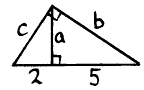
17) 

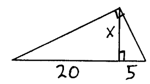
18) 

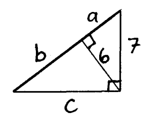
19) 

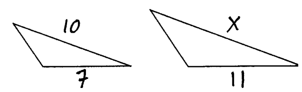
20) 

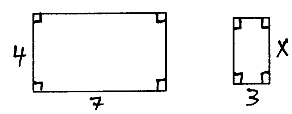
21) 

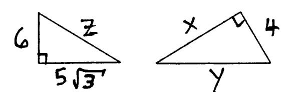
22) 

23) 

24) 

25) 

26) 

27) 

Euclidean Triangle Constructions

Remember, only a compass and straight edge is allowed!

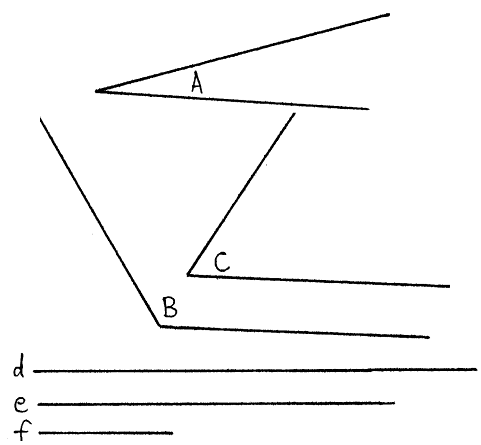
28) Construct ΔdeF.

29) Construct ΔBeA.

30) Construct ΔdBe.

31) Construct ΔdeB.

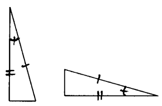
32) Construct ΔedB.

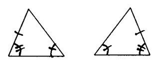


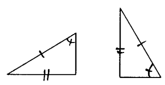
Problem Set #8

<u>Homework</u>

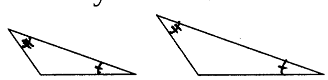
For each pair of triangles, state the congruency theorem that proves they are definitely congruent, or state that they are not definitely congruent.

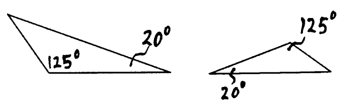
1) 

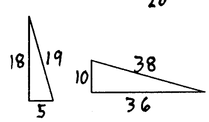
2) 

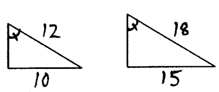
3) 

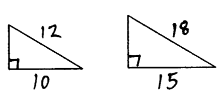
For each pair of triangles, state the similarity theorem that proves they are definitely similar, or state that they are not definitely similar.

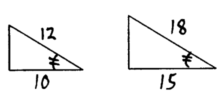
4) 

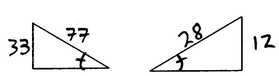
5) 

6) 

7) 

8) 

9) 

10) 

Special Triangles

In a 30-60-90 triangle…

11) Find the length of the hypotenuse if the shortest leg is 5.

12) Find the length of the shortest leg if the hypotenuse is 5.

13) Find the length of the longest leg if the shortest leg is 12.

14) Find the length of the shortest leg if the longest leg is 7.

15) Find the length of the hypotenuse if the longest leg is 13.

16) Find the length of the longest leg if the hypotenuse is 6.

In a 45-45-90 triangle…

17) Find the length of the hypotenuse if the leg is 4.

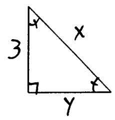
18) Find the length of the leg if the hypotenuse is 9.

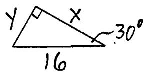
In an equilateral triangle…

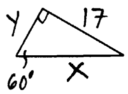
19) Find the height if the length of the side is 12.

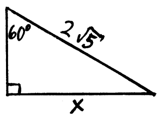
20) Find the length of the side if the height is 3.

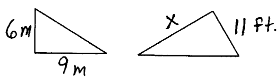
Find each variable. (All pairs of figures are similar.)

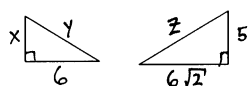
21) 

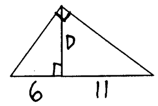
22) 

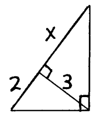
23) 

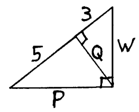
24) 

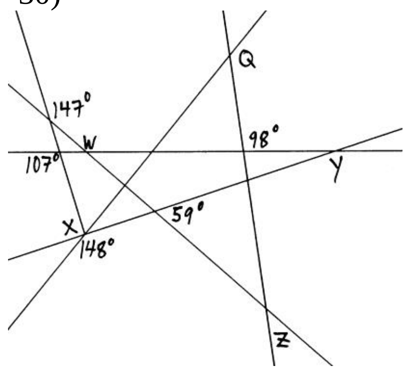
25) 

26) 

27) 

28) 

29) 

30) 

Euclidean Triangle Constructions

31) Construct ΔdeF.

32) Construct ΔdBf.

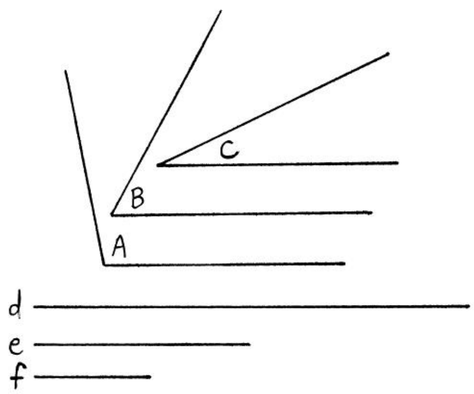
33) Construct ΔAeB.

34) Construct ΔBeA.

35) Construct ΔdeC.

36) Construct ΔedC.

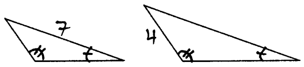
37) Construct ΔfdC.

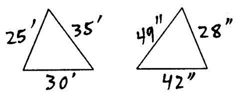


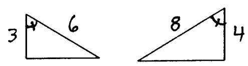
Problem Set #9

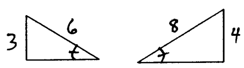
Homework

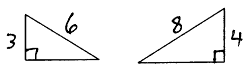
For each pair of triangles, state the similarity theorem that proves they are definitely similar, or state that they are not definitely similar.

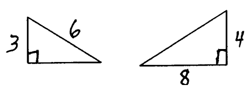
1) 

2) 

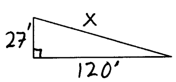
3) 

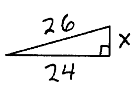
4) 

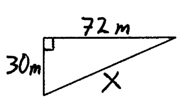
5) 

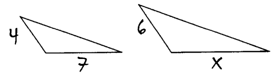
6) 

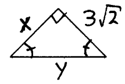
Find each variable. (All pairs of figures are similar.)

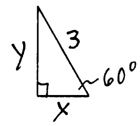
7) 

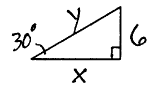
8) 

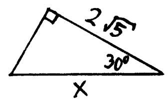
9) 

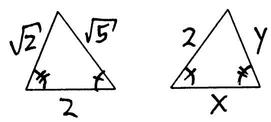
10) 

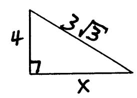
11) 

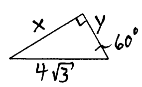
12) 

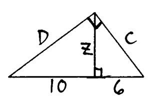
13) 

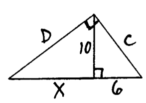
14) 

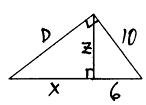
15) 

16) 

17) 

18) 

19) 

20) 

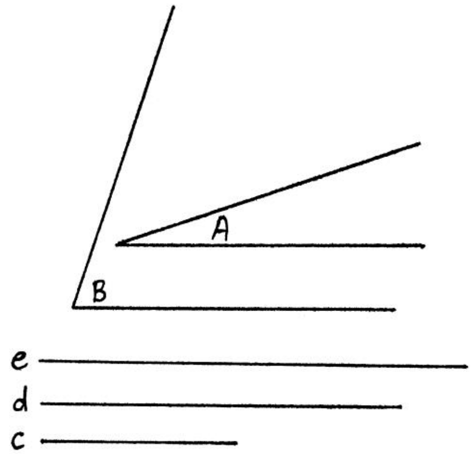
21) Construct ΔAeB.

22) Construct ΔecB

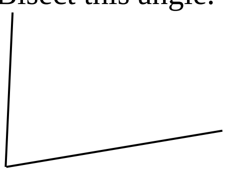
23) Construct ΔceB

24) Construct ΔceA

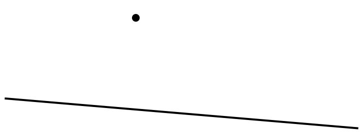
25) Make a parallelogram that has sides d and e and angle B.



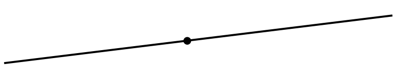
26) Bisect this angle.



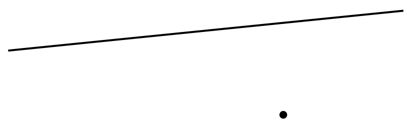
27) Through the given point, draw a line perpendicular to the given line.



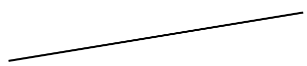
28) Through the given point, draw a line perpendicular to the given line.



29) Through the given point, draw a line parallel to the given line.

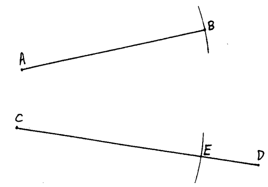


30) Construct a square onto this line.



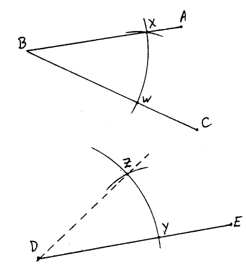
Basic Euclidean Constructions

Copying a line segment



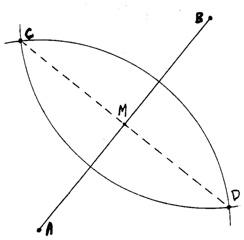
Instructions: *The intention is to copy line segment AB onto line CD.* Make sure that CD is longer than AB. Set the compass's width equal to AB. Put the needle of the compass on C, and mark an arc that passes through line CD at point E. CE is now equal in length to AB.

Copying an angle



Instructions: *The intention is to copy angle ABC onto line DE.* Set the compass at a width that is a bit less than the shortest of the line segments AB, BC, and DE. Using this width of the compass, draw an arc with the needle at B that passes through both AB (at X) and BC (at W), and then draw an arc with the needle at D that passes through DE at Y. Place the needle at W and adjust the compass so that it reaches to X, and then draw a short arc through X. Keeping this width of the compass, draw an arc, with the needle at Y, that crosses through the previously drawn arc at point Z. Angle ZDY is now equal to angle ABC.

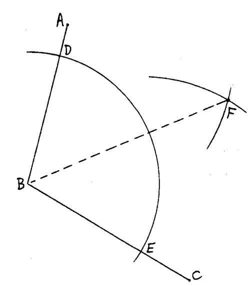
Bisecting a line segment (and construction of the perpendicular bisector)



Instructions: *The intention is to bisect the line segment AB, and to draw a perpendicular bisector* through *it.* Set the compass width so that it is a bit more than half the length of AB. Using this compass width, draw two arcs, one with the needle at A and the other with the needle at B, so that they cross one another in two places – at points C and D. CD is the perpendicular bisector of AB, and M is the midpoint of AB.

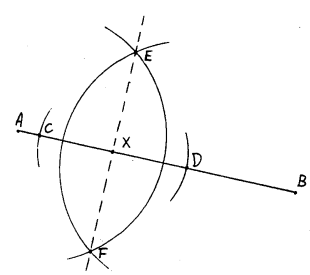
Note: This same technique is used to bisect an arc.

Bisecting an angle



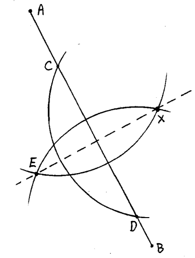
Instructions: *The intention is to bisect angle ABC.* Set the compass width a bit less than both AB and BC. Draw an arc, with the needle at B, that passes through AB at D, and passes through BC at E. Now draw two arcs, both with the same compass width, with the needle at D and then at E, so that the two arcs cross inside angle ABC at point F. The line BF is the desired bisector of the angle ABC. Notice that this will still work if the two arcs are made to intersect "outside" (in this case, to the left of) the angle.

Constructing a perpendicular line through a point on that line



Instructions: *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

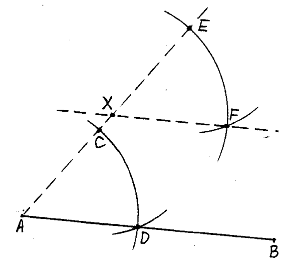


Instructions: *The intention is to construct a line perpendicular to AB that passes through X, which is NOT on AB.* First, set the compass width a bit longer than the distance that X is from line AB, and then draw an arc, with the needle at X that passes through AB in two points, C and D. Now draw two long arcs 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.

Basic Euclidean Constructions (p2)

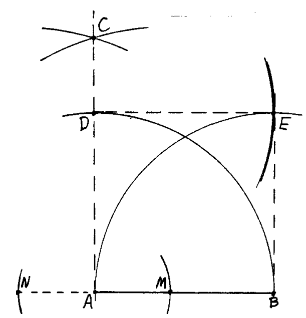
Constructing a parallel line

Instructions: *The intention is to construct a line that is parallel to AB and that passes through X, which is not on AB.* Draw line AX significantly beyond X. Set the compass width so that it is a bit shorter than AX, and draw an arc, with the needle at A, that passes through both AB at D and AX at C. Using that same compass width, draw an arc, with the needle at X, that passes through both the extended line AX (at E) and the line (not yet drawn) that passes through X and is parallel to AB. Now, adjusting the compass width, draw a short arc, with the needle at C, that passes through D, and then using the same compass width, draw an arc, with the needle at E that crosses, at point F, the arc that was drawn earlier that passed through E. The line XF is the desired line – it passes through X and is parallel to AB.



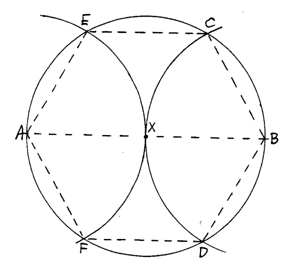
Constructing a square, given one side

Instructions: *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

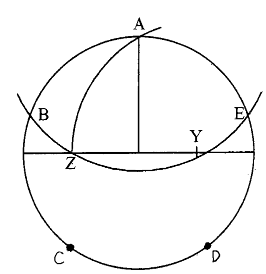
Instructions: *The intention is to construct a regular hexagon inside the given circle.* Draw diameter AB passing through the center of the circle, X. Then set the width of the compass equal to the radius of the circle, and draw one arc with the needle at B, which crosses the circle at points C and D,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



Constructing a pentagon, inside a given circle

Instructions: *The intention is to construct a regular pentagon inside the given circle.*

- *Method #1.* Draw a diameter and then find the midpoint, Y, of the radius. Point A is located vertically above the center. Placing the needle of the compass at Y, draw an arc through A to point Z on the diameter. The distance A to Z is the desired length of the sides of the pentagon. Copy the length AZ around the perimeter of the circle to get the five points of the pentagon: A, B, C, D, E.



- *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.