Note to students about construction problem sets

Some of these problems are very difficult and will require you to work in groups both inside and outside of class. For the hardest problems I do not expect each student to independently invent the solution without any help from others (this is not a take-home test). I do not consider it cheating for you to discuss how to solve the problems and justify your solutions with your classmates. Talking about these problems is how you learn and retain your knowledge of geometry.

However, there is a difference between sharing ideas for solutions and copying the solution from another student. Copying is cheating. To safeguard against you mindlessly copying another's solution, I have the following policy about construction problem set write-ups: Except for points whose labels I have given in the problem, you must label points using the (non-repeated) letters of your name. If you run out of letters in your last name, you may then use the rest of the alphabet.

Example:

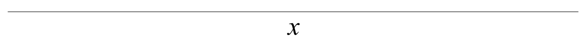
If your name is Betty Smith and I give you a $\triangle ABC$ to work with, you would retain the letters *A, B,* and *C* for the given triangle's vertices, then for each new label for points or lines, you would use letters in the following order: *E, T, Y, S, M, I, H, D, F, G, J, K, L, N.....Z*. Label only one point with *T*, even though you have 3 T's in your name. Don't use *B* because it is already used in the given triangle.

This policy is also helpful if you forget to put your name on your constructions when you submit them. I can unscramble the letters you used in your problems to figure out your name.

Also, on tests, you will be required to do constructions (possibly with proof) which are similar to ones you did for your problem sets, so you must have an understanding of the solutions and the ability to adapt to variations on them.

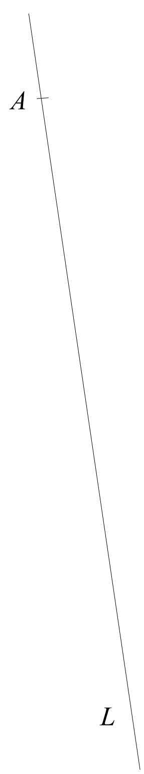
Construction Problem Set #1:

1. Given the length, x of one side, construct a regular hexagon (all sides and angles are equal in measure).



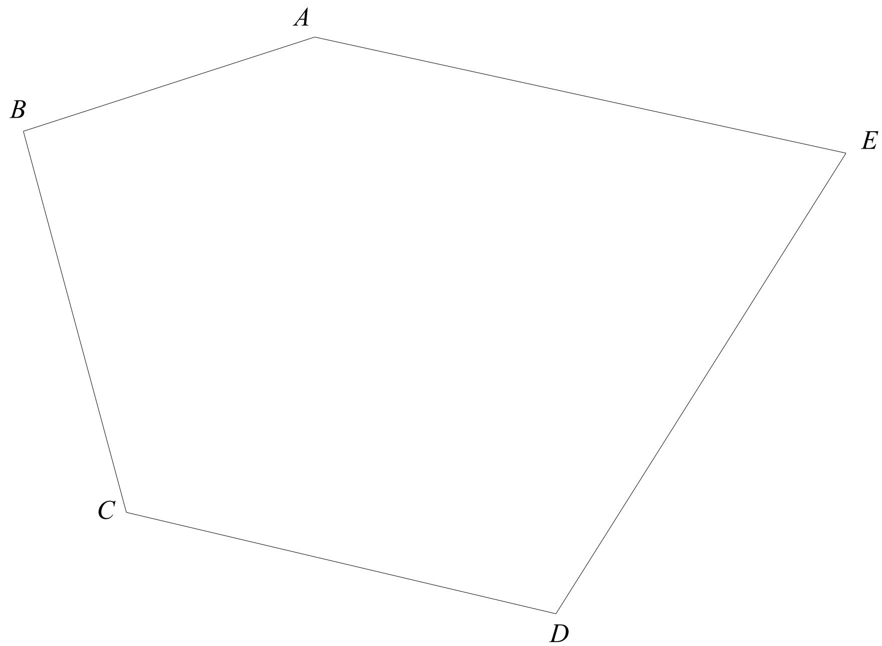
2. The ancient Greeks used a type of compass in their constructions that only fixes distance while the compass is in contact with the paper. Once the compass is lifted from the paper, the compass automatically snaps shut. Under this restriction, there is no "C#3: Copy distance" and "C#2: Circle" is only valid if you are given the center point and a point on the circle. That is, you cannot use a distance from somewhere else as the radius for a circle. Your job on this problem is to devise a method for "copying distance" under the restriction that any time the compass is lifted from the paper it loses its measurement.

Specifically, given the segment $\overline{BC}$ below, construct point P on L so that $AP = BC$. **PROOF REQUIRED**

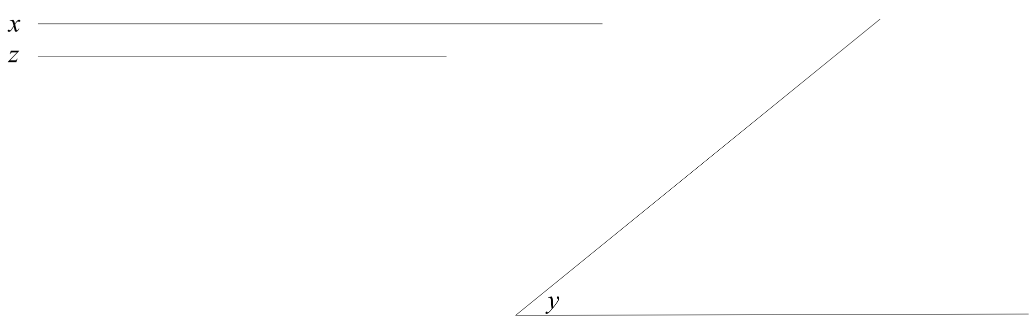


Construction Problem Set #2:

1. Without copying any angles, construct a pentagon congruent to the given pentagon below. (for pentagons to be congruent, all corresponding sides and angles must be congruent)



2. Given $AB = x$, $m\measuredangle A = y$, and the length of the angle bisector from A is z, construct $\triangle ABC$.

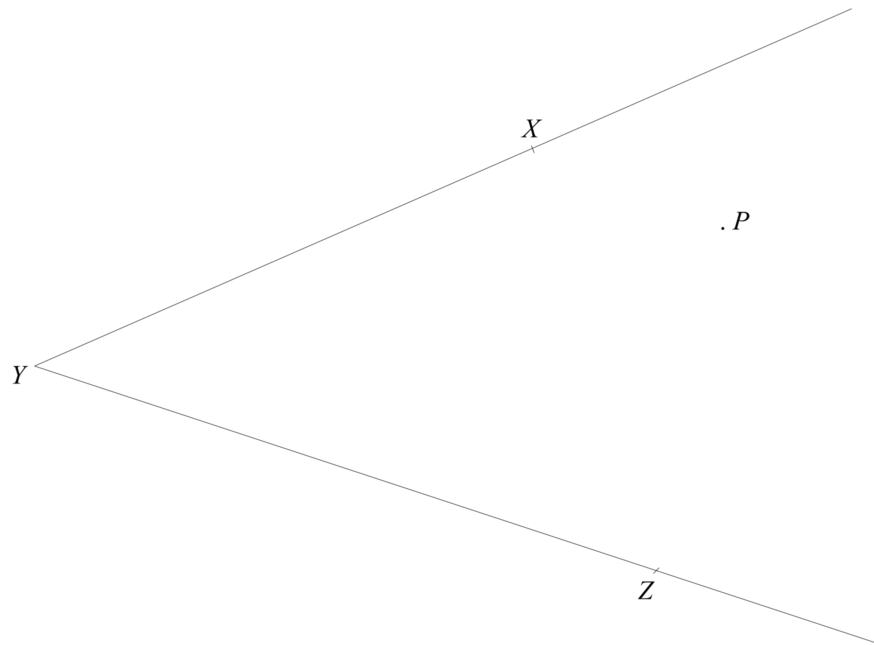


3. Using the measurements given in #2, construct 2 different (non-congruent) triangles, $\triangle ABC$ and $\triangle A'B'C'$ such that $AB = A'B' = x$, $BC = B'C' = z$, and $m\measuredangle A = m\measuredangle A' = y$.

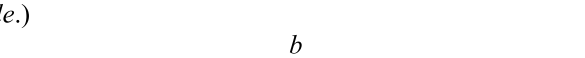
Construction Problem Set #3:

1. Construct angles measuring 22.5º, 67.5º, and 112.5º.

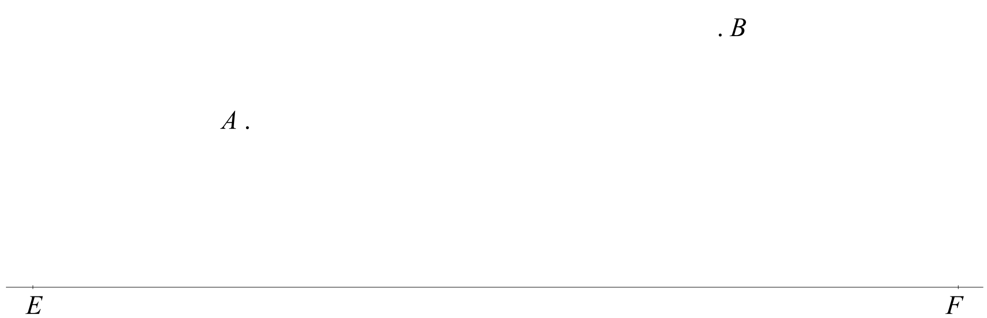
2. Given the angle below, and the point P in its interior construct a line containing P which will make an isosceles triangle with the sides of the given angle. **PROOF REQUIRED**



3. Construct a circle of radius b, given below. Then construct an equilateral triangle with all 3 vertices on the circle. (This is called an *inscribed triangle*.)



4. Construct point C on $\overline{EF}$ such that $\measuredangle ECA \cong \measuredangle BCF$. **PROOF REQUIRED**



Construction Problem Set #4:

1. Given the lengths of sides *AB* = *x*, *BC* = *z*, and the diagonal *AC* = *y*, construct the parallelogram ❑*ABCD*.

x

y

z

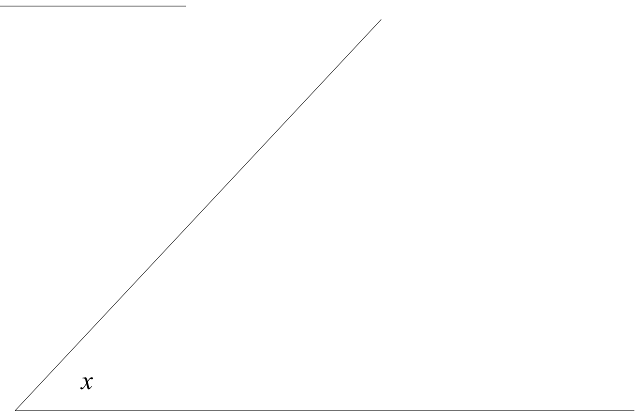
2. Construct △ABC given that *AB* = *x*, *BC* = *y*, and *z* = the median going from C to the midpoint of $\overline{AB}$.
(use the given measurements from #1)

3. The length, *k*, of the segment below is equal to the sum of the lengths of the diagonal and one side of a square. Construct the square. **PROOF REQUIRED**. You will find problem #6 on page 289 useful in your proof. Any proof you have done in homework may be used as a reason in a proof. This construction problem will fit on this page.

k

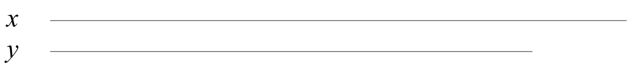
4. Given the length, *b* of the median from *H* and m∡*J* = *x,* given below, construct △*HJK* so that the median from *H* is perpendicular to the angle bisector from *J*. **PROOF REQUIRED**

b



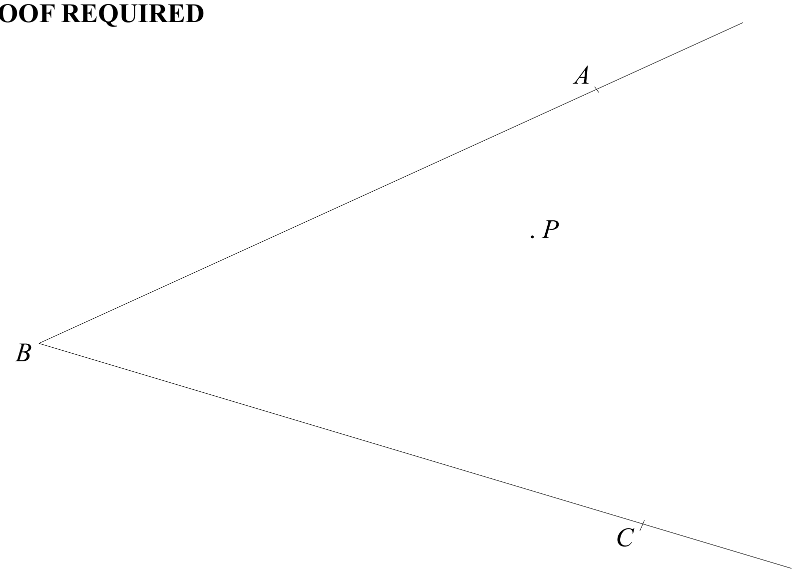
Construction Problem Set #5:

1. Construct a rhombus given the side length *x* and the length of the shorter diagonal, *y*.

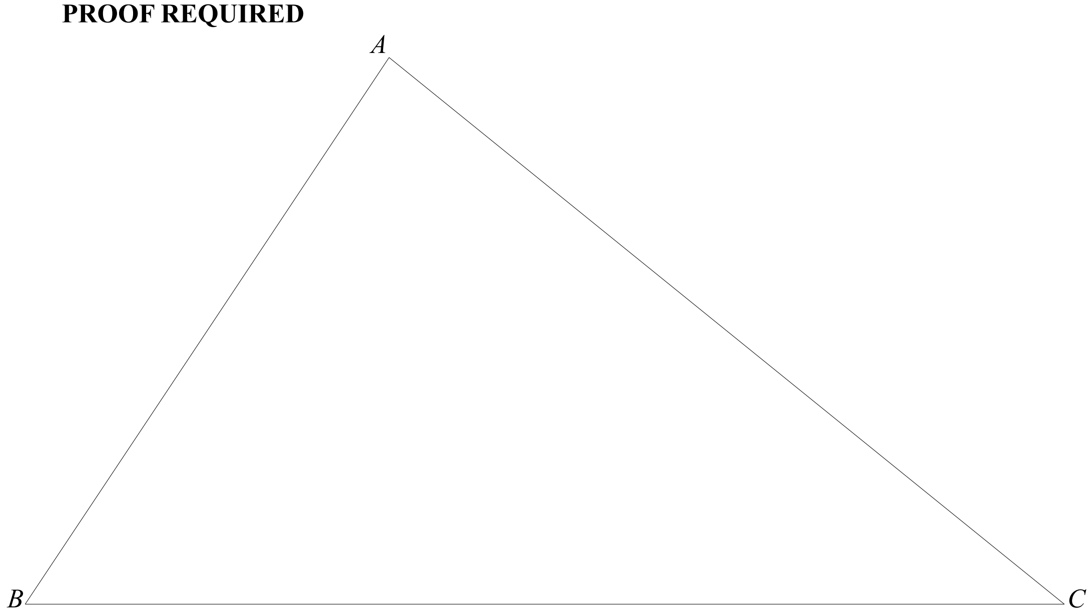


2. Inscribe a square into the rhombus of problem #1. You do not need to redraw it. **PROOF REQUIRED**
In your steps and proof, do NOT use "C#16: Square." You will find problem #6 on Page 289 and problem #17 on page 304 useful in your proof. You may use them as reasons (assuming you have already proven them in your homework)

3. The interior of the angle given below contains the point P. Construct the segment which is bisected by P and has each of its endpoints on the sides of the given angle. A homework problem from Chapter 9 will be useful in your proof.
PROOF REQUIRED



4. Given △ABC below, construct point E on $\overline{AB}$ and point F on $\overline{AC}$ so that $EF = EB + FC$.
PROOF REQUIRED



Construction Problem Set #6:

1. Given the unit length below, construct segments with lengths $\sqrt{2},\ \sqrt{3},\ \sqrt{5},\ \sqrt{11}$.

1

2. Construct $\triangle ABC$ given the following: $r = AB,\ s = BC,$ and y = the median from B to the midpoint of $\overline{AC}$.

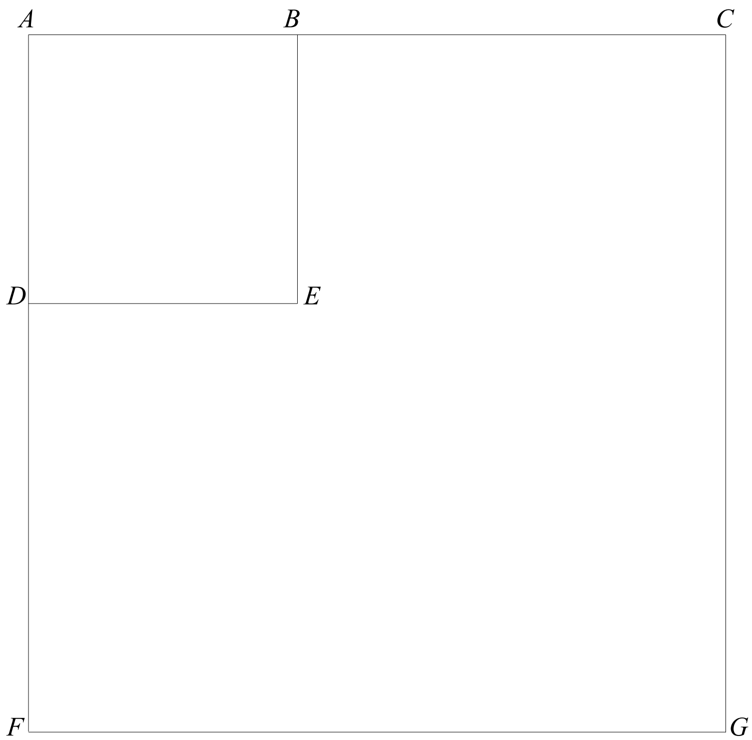
PROOF REQUIRED

r

s

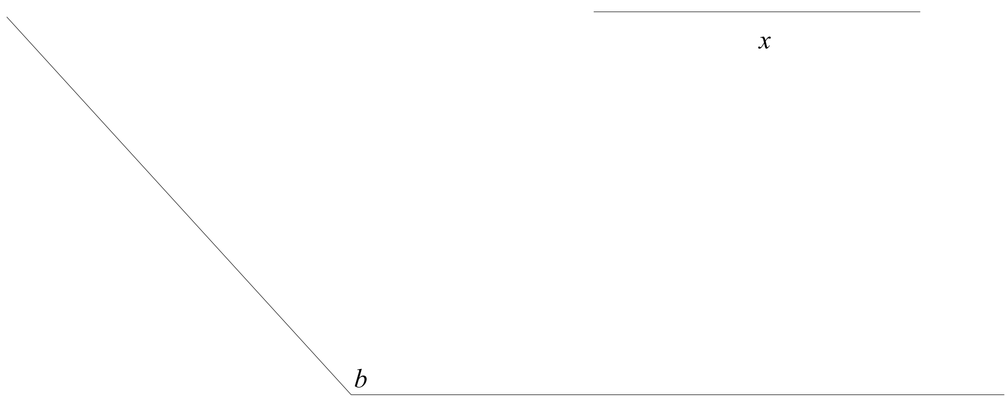
y

3. The quadrilaterals shown below are both squares. Construct a square region whose area is equal to the area of the L-shaped hexagonal region *BCGFDE*. **PROOF REQUIRED**



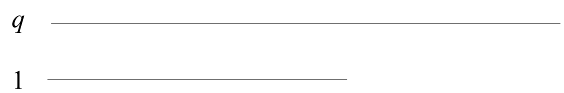
4. Given the difference, x of two consecutive side lengths and an angle, b formed by the diagonals, construct the rectangle.
PROOF REQUIRED

x

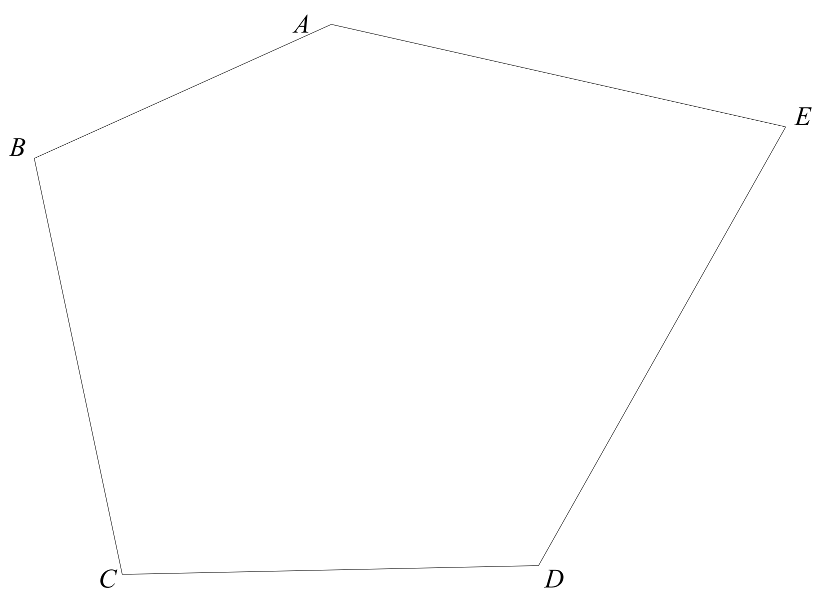


Construction Problem Set #7:

1. Given the unit length and q, construct $\sqrt{q}$.



2. Construct a triangle equal in area to the given pentagon below. **PROOF REQUIRED**

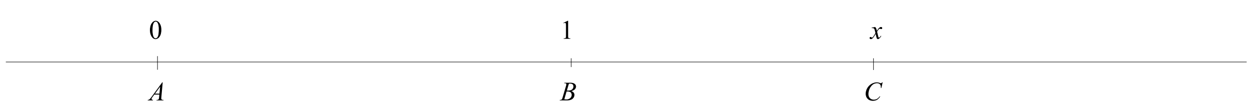


Problem set #7 continues on the next page...

3. USING YOUR COMPASS ONLY, construct point D on the given ray below such that $AD = \sqrt{3}.$ Given: $AB = 1$

PROOF REQUIRED

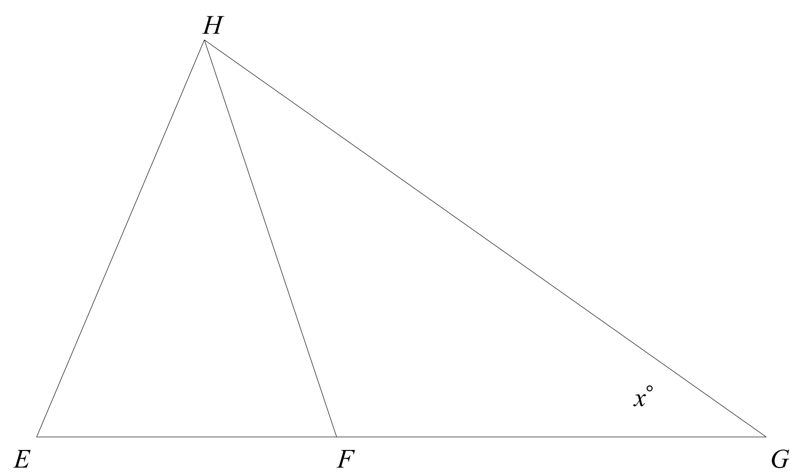
4. On the given number line below, 0, 1 and x are marked. USING YOUR COMPASS ONLY, construct the point on this number line which represents $\frac{1}{x}$. (since you are only using a compass, your steps should only contain **C#2 - Circle**. **C#3-Copy distance** is not required.) **PROOF REQUIRED**



<u>Construction Problem Set #8:</u>

1. **<u>C#23: The Golden Ratio:</u>** Construct point C on $\overline{AB}$ such that $\frac{AC}{CB} = \frac{CB}{AB}$. **PROOF REQUIRED**

2. Given that $\frac{EF}{FG} = \frac{FG}{EG}$ and $EH = HF = FG$, find x. **PROOF REQUIRED**



3. **<u>C#24: 36° Angle:</u>** Construct a 36° angle.

4. Construct a regular pentagon inscribed in a circle of radius r.