

# **Algebra III**

## **Lesson 4**

### **Construction**

# Protractor

**“A device used to measure angles”**

## **How to use a protractor:**

- Align the baseline of the protractor, not the bottom edge, on the one side of the angle
- Slide the protractor along this side until the corner of the angle is under the hole mark in the center of the base
- Read the angle off the outer edge.  
Make sure to pick the angle that is appropriate

## **Compass**

**A device that makes arcs and duplicates length**

## **Straight Edge**

**A device to make straight lines...this is *NOT* a ruler**

# Copying Line Segments

- 1) Make a new line longer than the segment to be copied
- 2) Spread the compass such that the points are exactly on the ends of the segment to copy
- 3) Without changing the compass, place its pointed end on one end of the line from step 1
- 4) Swing the penciled end of the compass so that it leaves a short mark intersecting the line. This marks the length of the original segment

# Copying Angles

- 1) Make a line segment
- 2) On the original angle, put the point of the compass on the vertex, and stretch the compass part way down the side of the angle
- 3) Swing the compass so that an arc is drawn from beyond one line around to and beyond the other side
- 4) Without changing the compass, put the point on one end of the new line
- 5) Swing the pencil end so that it starts beyond the line and continues past where you expect the other side of the angle to be
- 6) On the original angle place the ends of the compass on the spots where the arc from step 3 intersects the angle
- 7) Without changing the compass, place the point where the arc intersects the new line. Swing the pencil end so that it intersects the arc drawn in step 5
- 8) Connect the end of the new line and go through the 'X' made in step 7

# Bisecting Angles

- 1) Make an arc across the angle
- 2) Spread the compass so that it is more than half the width of the arc
- 3) Using this distance from each spot where the arc intersects the angle make a short arc in the middle. Make sure the two short arcs intersect
- 4) From the vertex of the angle draw a line through the intersection

# Bisecting Line Segments

- 1) Spread the compass to more than half the length of the segment.
- 2) From each end of the segment make a short arc segment above the segment and below the segment.  
(Make sure the two arcs above and below the segment intersect.)
- 3) Line up where the arcs intersect and connect them.  
(This is also perpendicular)

# Erecting Perpendiculars

## (Through a given point)

A) Point on the segment.

- 1) Spread the compass a little bit.
- 2) Make an arc on the segment on either side of the point.
- 3) Spread the compass a little wider.
- 4) From each end of the segment make a short arc segment above the segment and below the segment.  
(Make sure the two arcs above and below the segment intersect.)
- 5) Line up where the arcs intersect and connect them.

# Erecting Perpendiculars

## (Through a given point) continued...

B) Point not on the segment.

- 1) Put the point of the compass on the point not on the line, spread the compass so that it reaches easily past the segment.
- 2) Now swing it so that it makes two arcs through the segment.
- 3) Spread the compass a little wider.
- 4) From each end of the segment make a short arc segment above the segment and below the segment.  
(Make sure the two arcs above and below the segment intersect.)
- 5) Line up where the arcs intersect and connect them.

# Constructing Triangles

- 1) Draw a line longer than any of the sides of the triangle.
- 2) Copy one of the sides onto the ray.
- 3) Use the compass to measure one of the other sides.
- 4) Put the point on one end of the segment from 2 and swing an arc above the line.
- 5) Use the compass to measure the last side of the triangle.
- 6) Put the point on the other end of the segment from 2 and swing an arc above the line.
- 7) Make the arcs from 4 & 6 big enough to meet.
- 8) Connect each end of the segment from 2 to the intersection of the arcs.

# Constructing a Parallel (Through a point)

- 1) Draw a line through the point to the given line. Make sure the new drawn line extends past the point and the line.
- 2) Follow the copying on angle steps using the ray that extends through the point as one side of the new angle. Be sure to make the new angle with the same orientation as the angle being copied.

# Equal Segments

(Divide a segment into equal chunks)

- 1) Through one end of the segment to be divided draw a ray at any angle you want (not to extreme)
- 2) Spread the compass a little  $\frac{1}{4}$ "  $\rightarrow$   $\frac{1}{2}$ " and starting at the line make a mark on the new ray.
- 3) Repeat this as needed depending on how much you need to divide the original line. 3 parts  $\rightarrow$  3 arcs
- 4) Connect the last arc to the end of the original segment.
- 5) Create parallel lines to this through the other arc marks.

# Practice

- a) Construct an angle which is congruent to  $\angle PQR$
- b) Construct a triangle whose side have lengths a, b, and c.
- c) The length of the sides of a triangle are 10m, 9m, and 3m, respectively. Is the triangle a right triangle, an acute triangle, or an obtuse triangle?

## Use the Pythagorean inequality

$$(\text{Longest})^2 ? (\text{Medium})^2 + (\text{Shortest})^2$$

$$10^2 ? 9^2 + 3^2$$

$$100 ? 81 + 9$$

$$100 > 90$$

This is an obtuse triangle