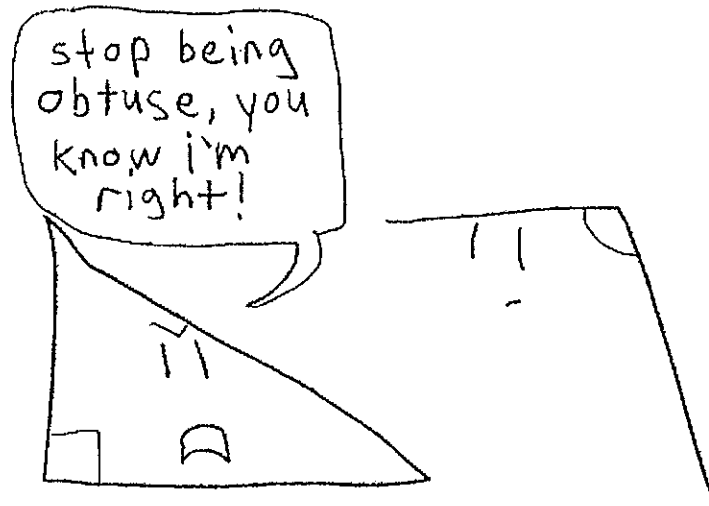


Unit G

Constructions

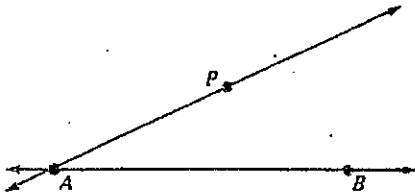
(Compass & Straight Edge)



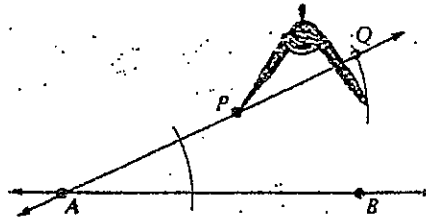
Constructing a parallel line through a point not on that line:

The steps below show how to construct a line that contains P and is parallel to \overleftrightarrow{AB} . The method involves constructing congruent angles.

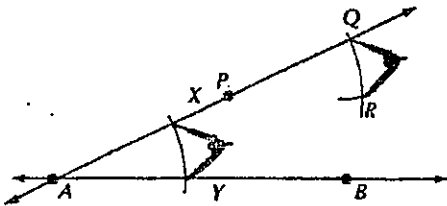
When a line intersects parallel lines, the corresponding angles are congruent.



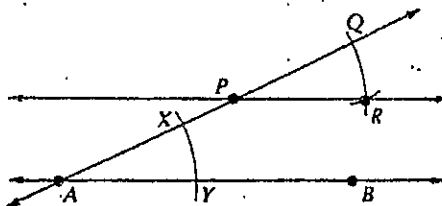
1. Draw a line through P that intersects \overleftrightarrow{AB} at A .



2. Put the steel tip of the compass at A and draw an arc as shown. With the same compass setting, draw an arc at P that intersects \overleftrightarrow{AP} . Label the intersection point Q .



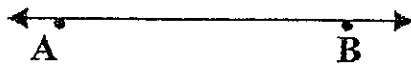
3. Set the compass with one tip at X and the other at Y . Keep the same setting and put the steel tip at Q . Draw an arc that intersects the other arc. Label the intersection point R .



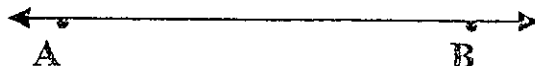
4. Draw \overleftrightarrow{PR} . $\overleftrightarrow{PR} \parallel \overleftrightarrow{AB}$.

Examples:

1.

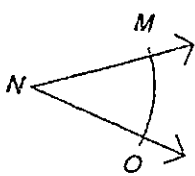


2.

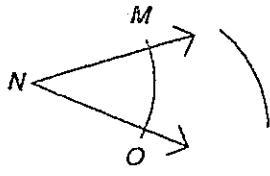


Construct an angle bisector:

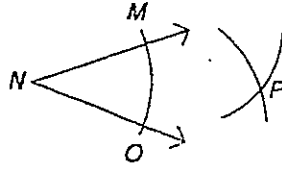
A *bisector* of an angle divides the angle into two congruent angles. Construct the bisector of $\angle N$.



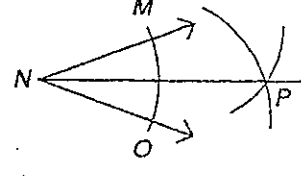
Step 1 With point N as center, draw an arc that intersects both sides of $\angle N$. Label the points of intersection M and O .



Step 2 Using the same opening and point O as center, draw an arc as shown.



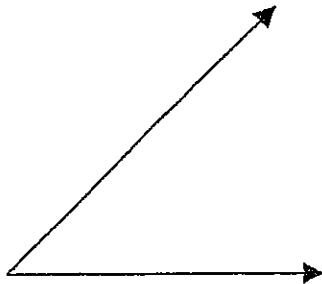
Step 3 Using the same opening and point M as center, draw an intersecting arc. Label the point of intersection P .



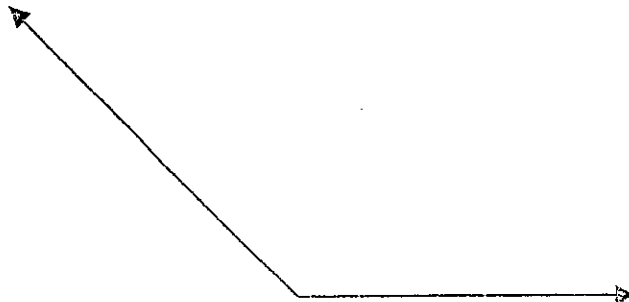
Step 4 Draw \overrightarrow{NP} . \overrightarrow{NP} bisects $\angle N$. $\angle MNP \cong \angle PNO$

Examples: Construct an angle bisector of each angle.

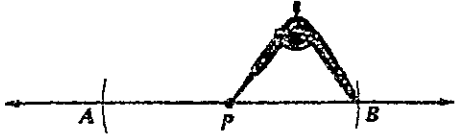
1.



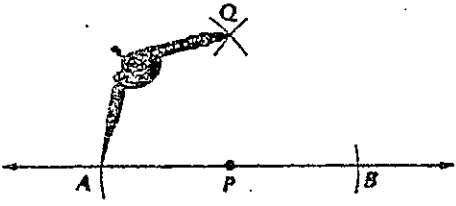
2.



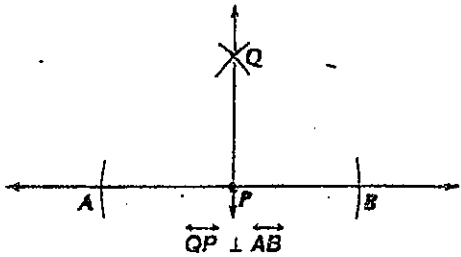
Constructing a perpendicular line to a given line through a point on the line.



1. Put the steel tip of the compass at P . Draw two arcs as shown. Label the intersection points A and B .



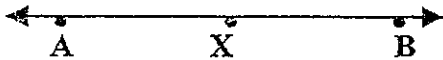
2. Put the steel tip of the compass at B . Extend the compass more than halfway to A and draw an arc as shown in blue. With the same compass setting, put the steel tip at A and draw an arc that intersects the previous arc as shown. Label the intersection point Q .



3. With a straightedge, draw \overleftrightarrow{QP} .

Construct a line perpendicular to \overline{AB} at X .

1.



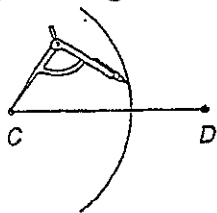
2.



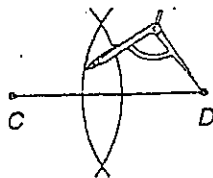
3

Construction a perpendicular bisector of a line:

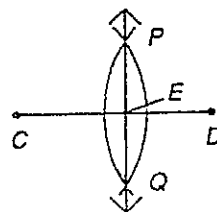
B. A *bisector* of a segment divides the segment into two congruent segments. Construct a bisector of \overline{CD} .



Step 1 With point C as center, open your compass more than halfway to point D . Then draw an arc that intersects \overline{CD} .



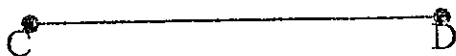
Step 2 Using the same opening and point D as center, draw an arc that intersects the first arc at 2 points. Label the points of intersection P and Q .



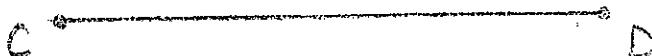
Step 3 Draw \overleftrightarrow{PQ} . \overleftrightarrow{PQ} is a bisector of \overline{CD} . Point E is the midpoint of \overline{CD} .
 $\overline{CE} \cong \overline{ED}$

Example: Construct a perpendicular bisect of \overline{CD} and label it \overline{MN} .

1)



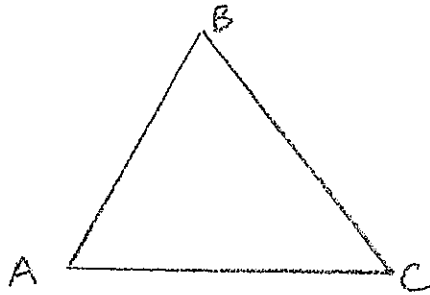
2)



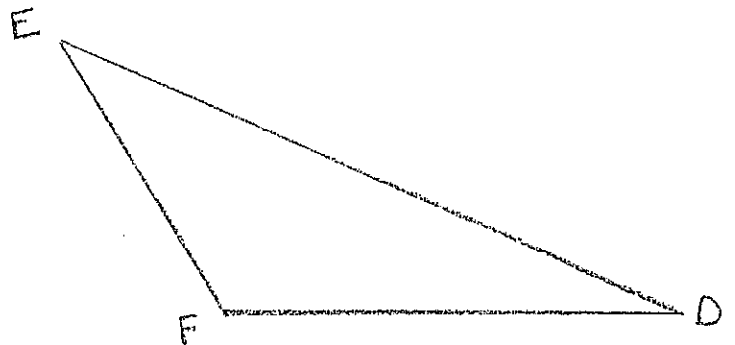
Construct the perpendicular bisector of each side on a triangle.

a. Use the same steps from the previous page ("construct a perpendicular bisector of a line"), in order to construct the perpendicular bisector of each side of the triangles below. Make sure you label the midpoint of each side.

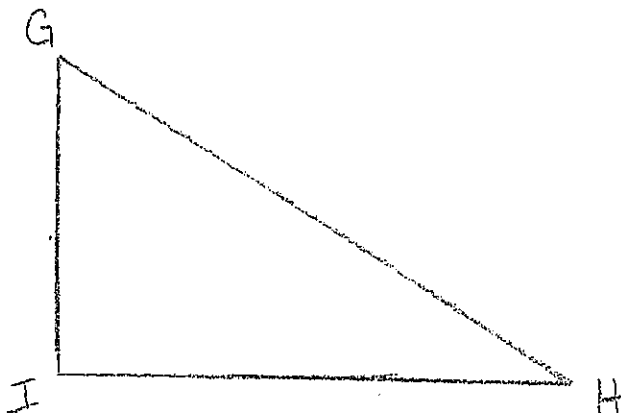
1)



2)



3)



Construct the median of a Triangle

Median – the median of a triangle is a segment whose endpoints are a vertex of the triangle and the midpoint of the opposite side.

Construct the median \overline{BE} of $\triangle BCD$

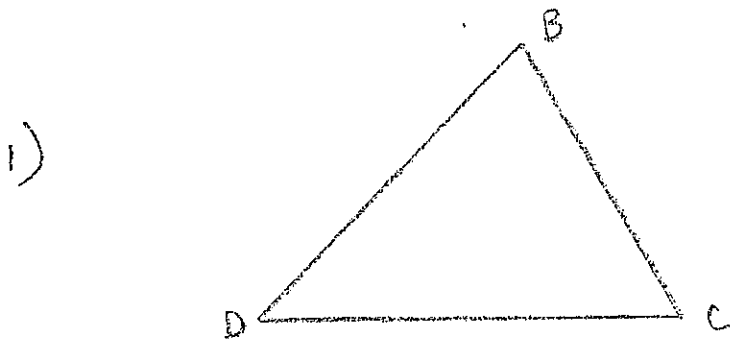
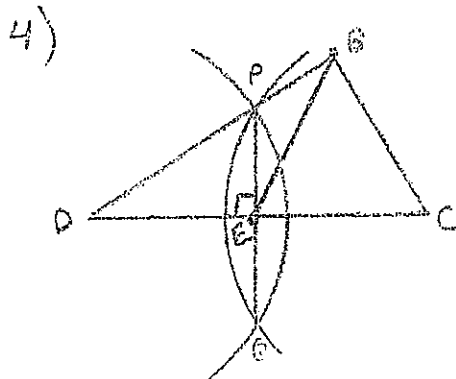
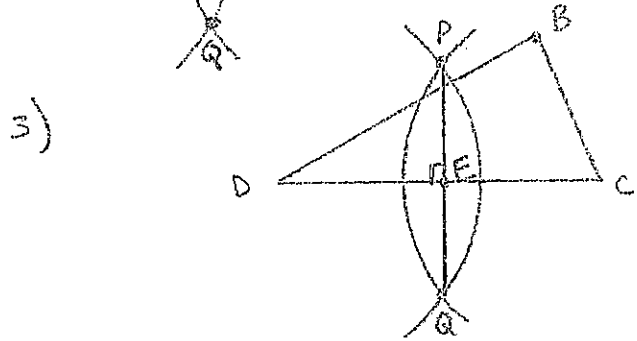
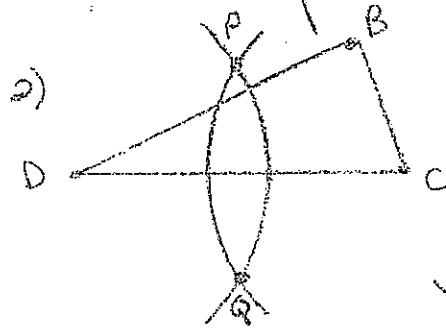
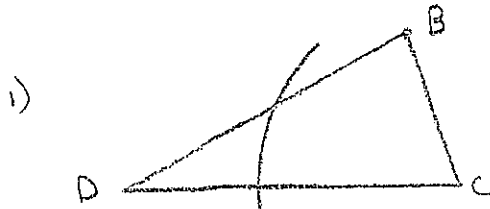
Step 1: With point C as center, open your compass more than halfway to point D. Then draw an arc that intersects \overline{CD} .

Step 2: Using the same opening and point D as center, draw an arc that intersects the first arc at two points. Label the point of intersection P and Q.

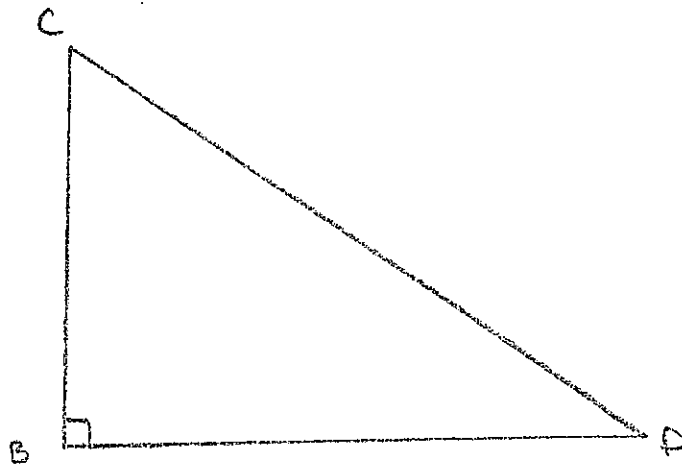
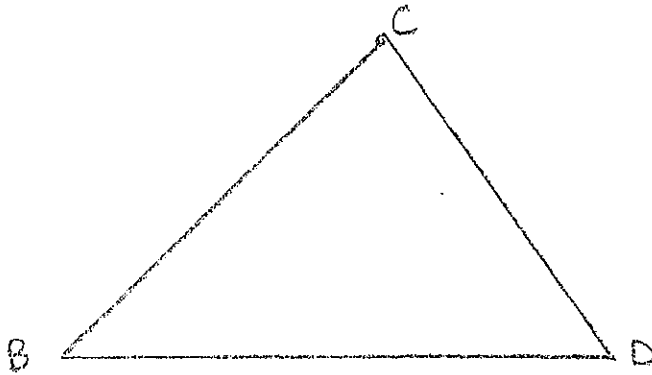
Step 3: Draw \overline{PQ} . \overline{PQ} is a bisector of \overline{CD} . Point E is the midpoint of \overline{CD} . $CE = ED$.

Step 4: Use a straightedge and draw a line from angle B, to E (the midpoint of \overline{CD}). The segment \overline{BE} is one of three medians of $\triangle BCD$.

Example 1: Construct a median of $\triangle BCD$ below.



Example 2: Construct all three medians of $\triangle BCD$ below, and label their intersection point O . Point O is referred to as the **centroid** of $\triangle BCD$.

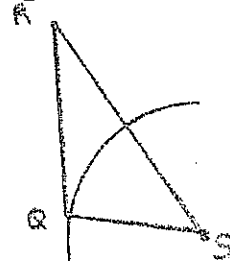


Construct the Altitude of a Triangle

Altitude – an altitude of a triangle is a perpendicular segment from a vertex to the line containing the opposite side. An altitude can be inside, outside, or on the triangle (every triangle has three altitudes).

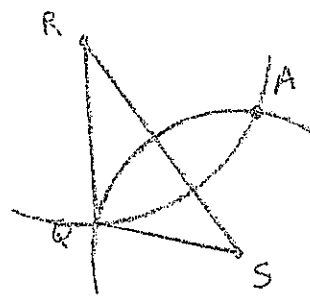
Construct the altitude, \overline{QY} , of triangle RQS .

1)



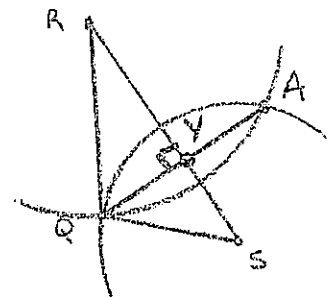
Step 1: With point S as the center, open your compass and draw an arc which intersects point Q and \overline{RS} .

2)



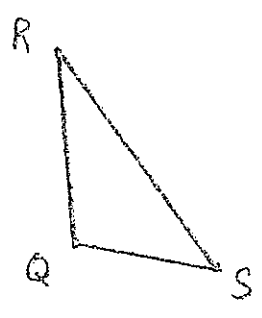
Step 2: With point R as the center, open your compass and draw an arc which intersects point Q and \overline{RS} . Label point A where the two arcs intersect.

3)



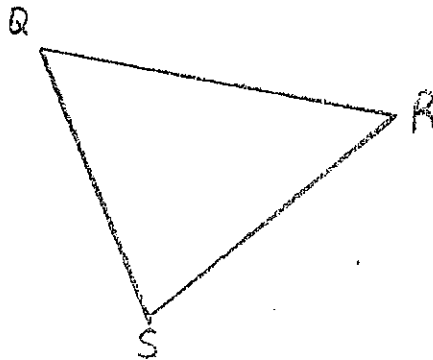
Step 3: Using a straightedge draw a line from point Q to A. Label the intersection of \overline{QA} and \overline{RS} , point Y. Mark the angle 90 degrees.

Example 1) Construct the altitude of $\triangle RQS$ containing point R. (Hint: extend lines QS and RQ)

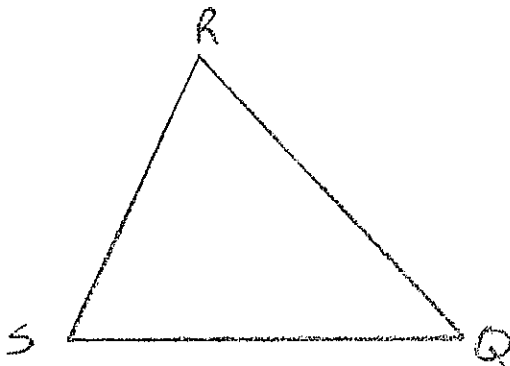


Construct the Altitude of a Triangle

1) Construct the altitude of $\triangle RQS$ containing point R.



2) Construct the altitude of $\triangle RQS$ containing point S.



3) Construct the altitude of $\triangle RQS$ containing point Q.

