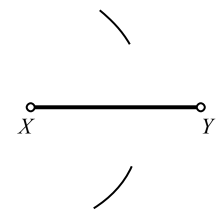
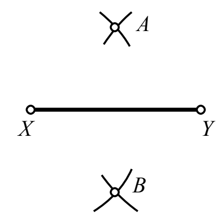
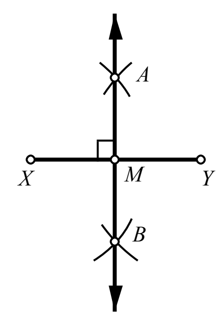
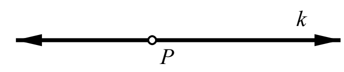
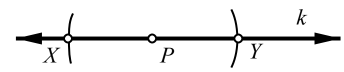
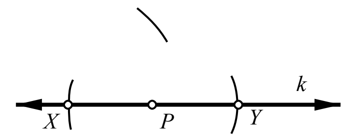
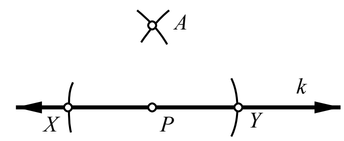
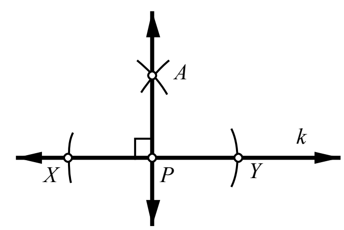
Construction Reference

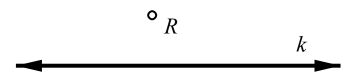
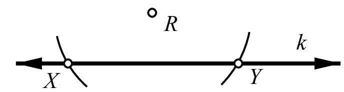
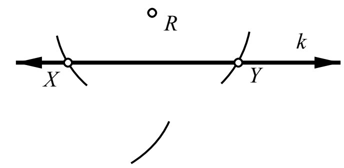
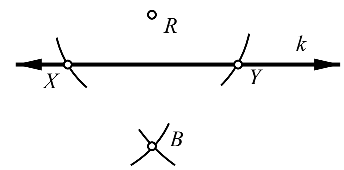
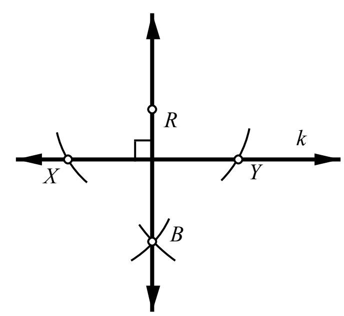
Construct the perpendicular bisector of a line segment.
Or, construct the midpoint of a line segment.

1. Begin with line segment *XY*.	
2. Place the compass at point *X*. Adjust the compass radius so that it is more than (½)*XY*. Draw two arcs as shown here.	
3. Without changing the compass radius, place the compass on point *Y*. Draw two arcs intersecting the previously drawn arcs. Label the intersection points *A* and *B*.	
4. Using the straightedge, draw line *AB*. Label the intersection point *M*. Point *M* is the midpoint of line segment *XY*, and line *AB* is perpendicular to line segment *XY*.	

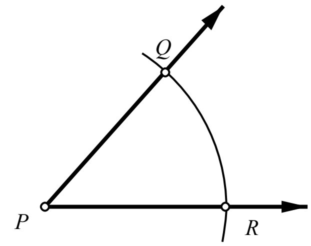
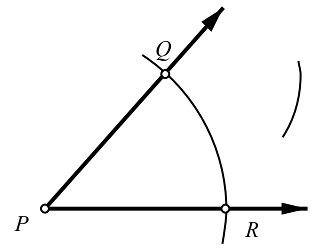
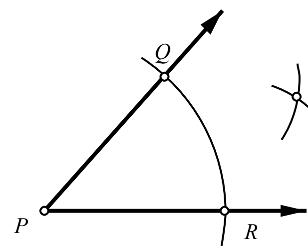
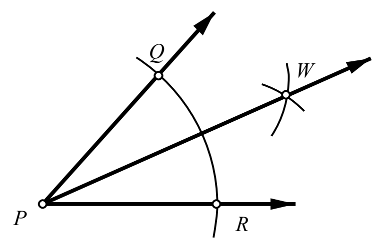
Given point P on line k, construct a line through P, perpendicular to k.

1. Begin with line *k*, containing point *P*.	
2. Place the compass on point *P*. Using an arbitrary radius, draw arcs intersecting line *k* at two points. Label the intersection points *X* and *Y*.	
3. Place the compass at point *X*. Adjust the compass radius so that it is more than (½)*XY*. Draw an arc as shown here.	
4. Without changing the compass radius, place the compass on point *Y*. Draw an arc intersecting the previously drawn arc. Label the intersection point *A*.	
5. Use the straightedge to draw line *AP*. Line *AP* is perpendicular to line *k*.	

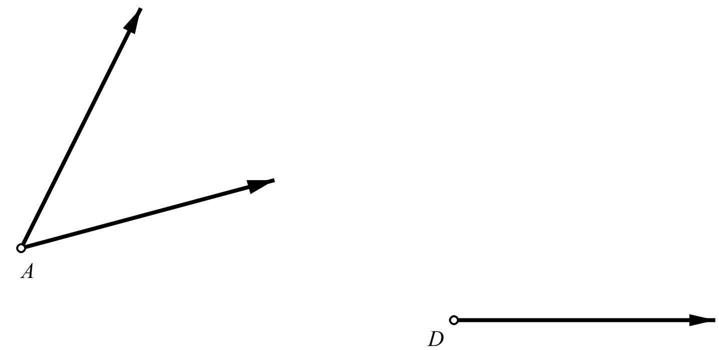
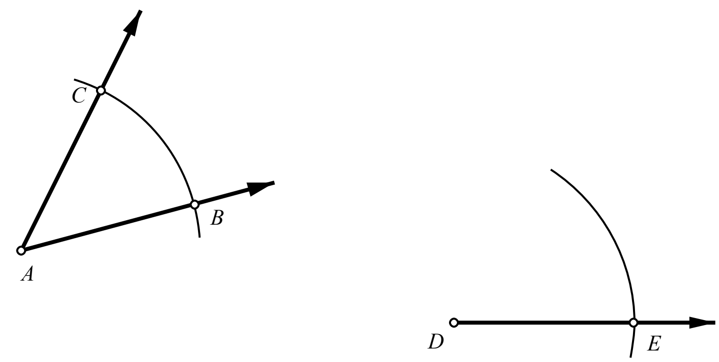
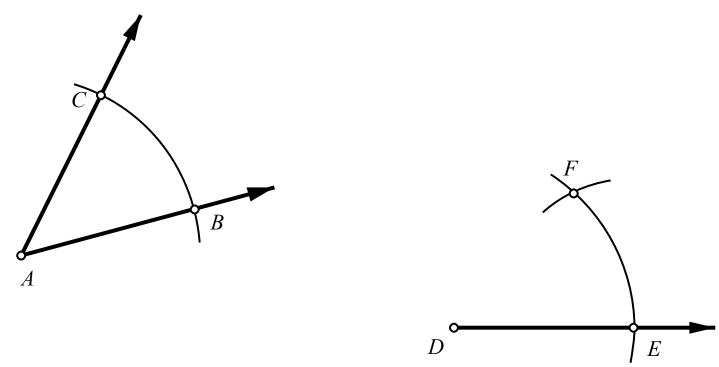
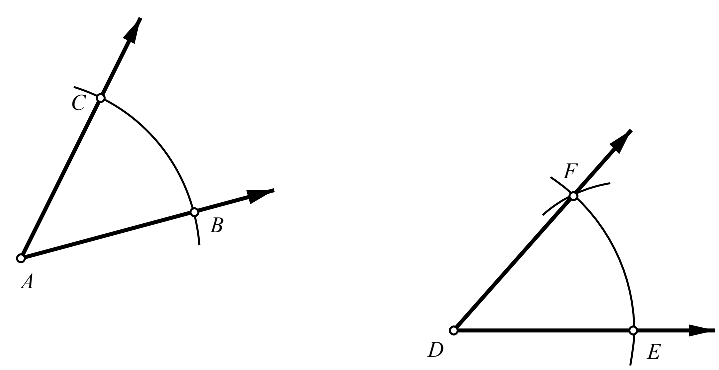
Given point R, not on line k, construct a line through R, perpendicular to k.

1. Begin with point line *k* and point *R*, not on the line.	
2. Place the compass on point *R*. Using an arbitrary radius, draw arcs intersecting line *k* at two points. Label the intersection points *X* and *Y*.	
3. Place the compass at point *X*. Adjust the compass radius so that it is more than (½)*XY*. Draw an arc as shown here.	
4. Without changing the compass radius, place the compass on point *Y*. Draw an arc intersecting the previously drawn arc. Label the intersection point *B*.	
5. Use the straightedge to draw line *RB*. Line *RB* is perpendicular to line *k*.	

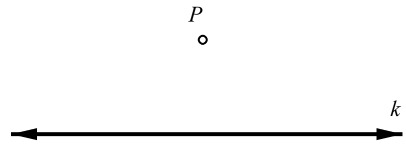
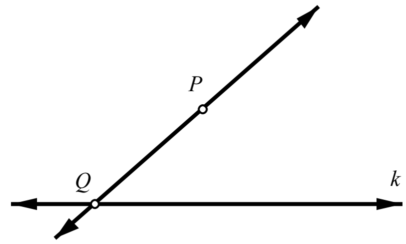
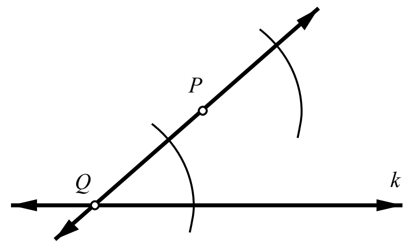
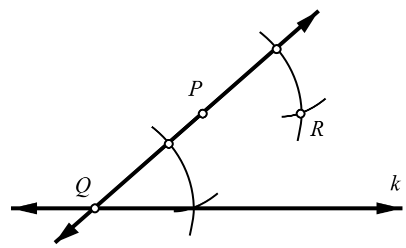
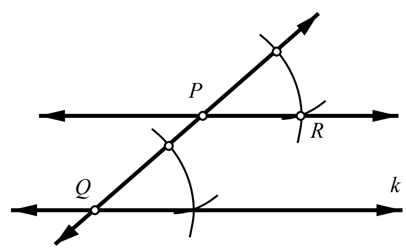
Construct the bisector of an angle.

1. Let point *P* be the vertex of the angle. Place the compass on point *P* and draw an arc across both sides of the angle. Label the intersection points *Q* and *R*.	
2. Place the compass on point *Q* and draw an arc across the interior of the angle.	
3. Without changing the radius of the compass, place it on point *R* and draw an arc intersecting the one drawn in the previous step. Label the intersection point *W*.	
4. Using the straightedge, draw ray *PW*. This is the bisector of $\angle QPR$.	

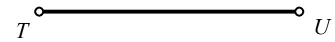
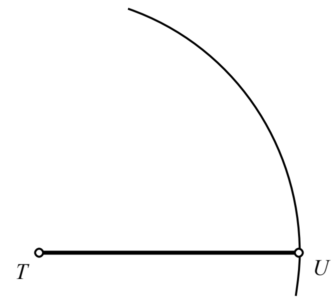
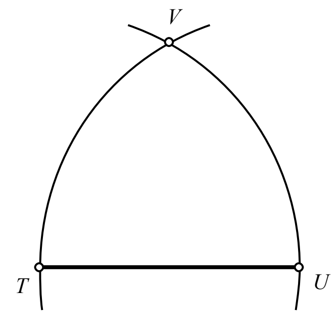
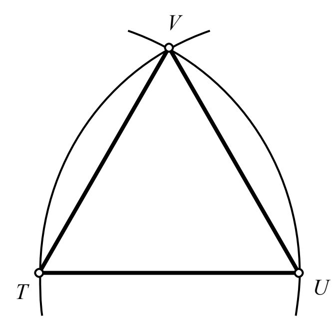
Construct an angle congruent to a given angle.

1. To draw an angle congruent to $\angle A$, begin by drawing a ray with endpoint *D*.	
2. Place the compass on point *A* and draw an arc across both sides of the angle. Without changing the compass radius, place the compass on point *D* and draw a long arc crossing the ray. Label the three intersection points as shown.	
3. Set the compass so that its radius is *BC*. Place the compass on point *E* and draw an arc intersecting the one drawn in the previous step. Label the intersection point *F*.	
4. Use the straightedge to draw ray *DF*. $\angle EDF \cong \angle BAC$	

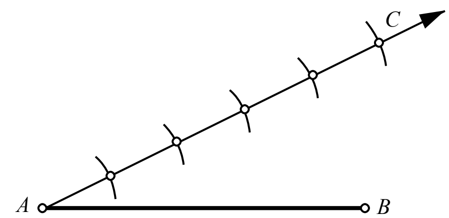
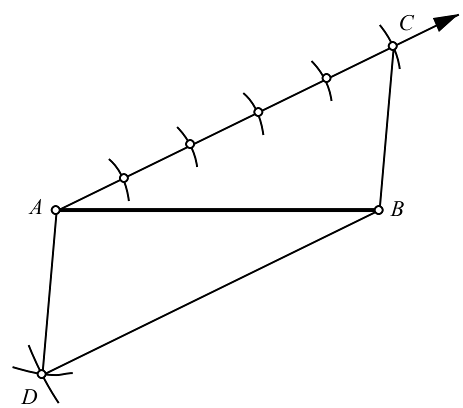
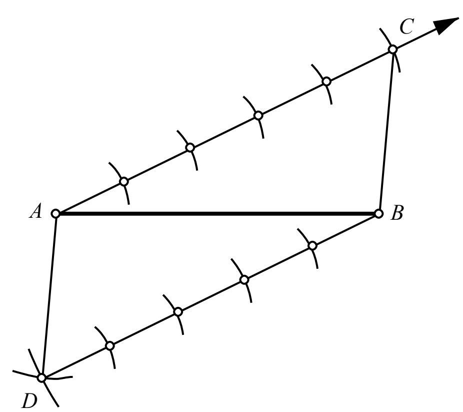
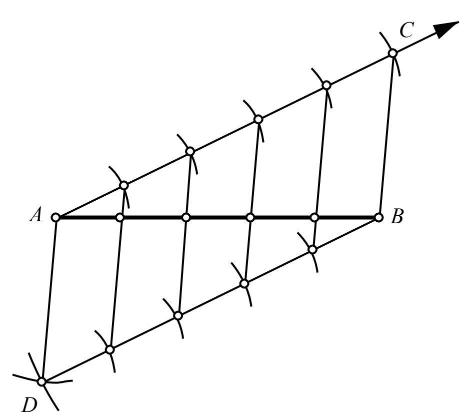
Given a line and a point, construct a line through the point, parallel to the given line.

1. Begin with point *P* and line *k*.	
2. Draw an arbitrary line through point *P*, intersecting line *k*. Call the intersection point *Q*. Now the task is to construct an angle with vertex *P*, congruent to the angle of intersection.	
3. Center the compass at point *Q* and draw an arc intersecting both lines. Without changing the radius of the compass, center it at point *P* and draw another arc.	
4. Set the compass radius to the distance between the two intersection points of the first arc. Now center the compass at the point where the second arc intersects line *PQ*. Mark the arc intersection point *R*.	
5. Line *PR* is parallel to line *k*.	

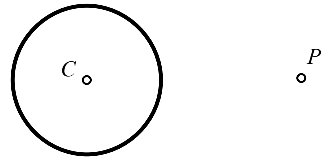
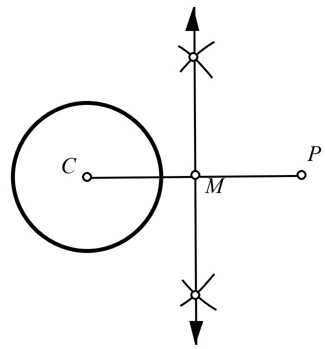
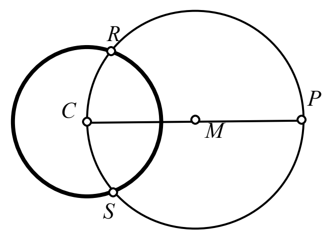
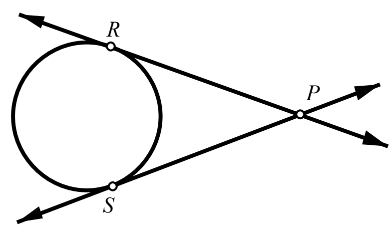
Given a line segment as one side, construct an equilateral triangle.
This method may also be used to construct a 60° angle.

1. Begin with line segment *TU*.	
2. Center the compass at point *T*, and set the compass radius to *TU*. Draw an arc as shown.	
3. Keeping the same radius, center the compass at point *U* and draw another arc intersecting the first one. Let point *V* be the point of intersection.	
4. Draw line segments *TV* and *UV*. Triangle *TUV* is an equilateral triangle, and each of its interior angles has a measure of 60°.	

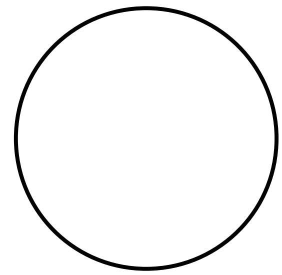
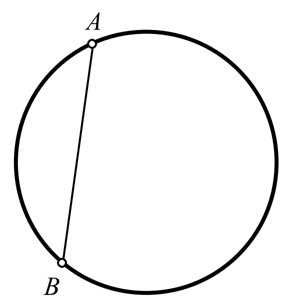
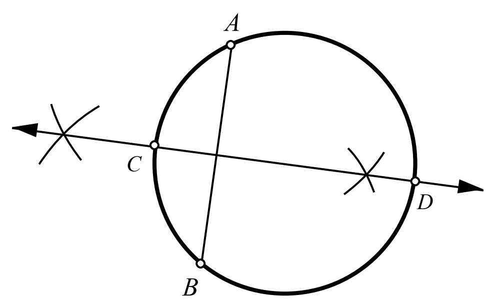
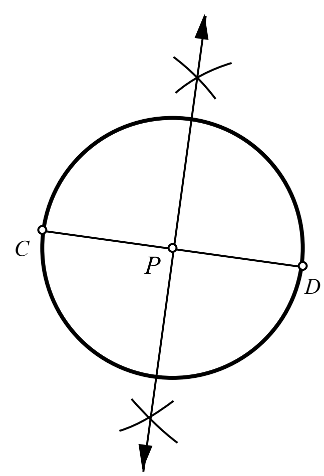
Divide a line segment into n congruent line segments.
In this example, n = 5.

1. Begin with line segment *AB*. It will be divided into five congruent line segments.	
2. Draw a ray from point *A*. Use the compass to step off five uniformly spaced points along the ray. Label the last point *C*.	
3. Draw an arc with the compass centered at point *A*, with radius *BC*. Draw a second arc with the compass centered at point *B*, with radius *AC*. Label the intersection point *D*. Note that *ACBD* is a parallelogram.	
4. Use the compass to step off points along line segment *DB*, using the same radius that was used for the points along line segment *AC*.	
5. Use the straightedge to connect the corresponding points. These line segments will be parallel. They cut line segments *AC* and *DB* into congruent segments. Therefore, they must also cut line segment *AB* into congruent segments.	

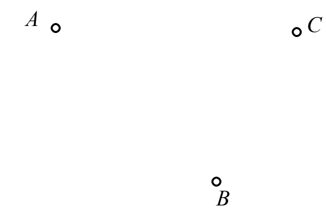
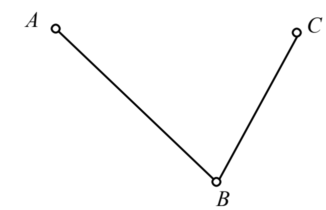
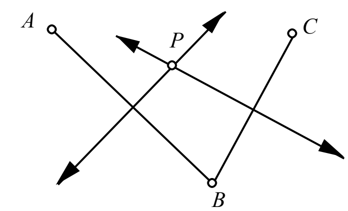
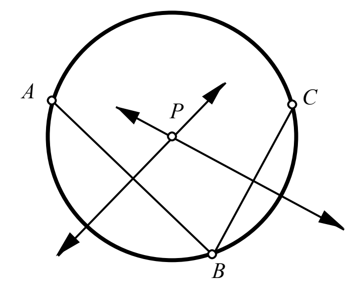
Given a circle, its center point, and a point on the exterior of the circle, construct a line through the exterior point, tangent to the circle.

1. Begin with a circle centered on point *C*. Point *P* is on the exterior of the circle.	
2. Draw line segment *CP*, and construct point *M*, the midpoint of line segment *CP*. (For the construction of the midpoint, refer to the perpendicular bisector construction, on page 1.)	
3. Center the compass on point *M*. Draw a circle through points *C* and *P*. It will intersect the other circle at two points, *R* and *S*.	
4. Points *R* and *S* are the tangent points. Lines *PR* and *PS* are tangent to the circle centered on point *C*.	

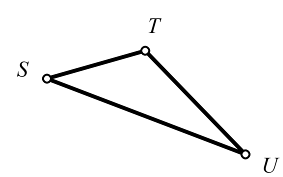
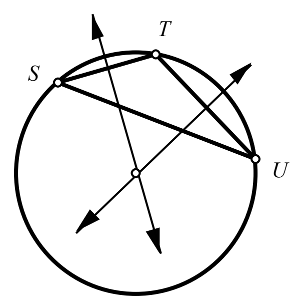
Construct the center point of a given circle.

1. Begin with a circle, but no center point.	
2. Draw chord *AB*.	
3. Construct the perpendicular bisector of chord *AB*. Let *C* and *D* be the points where it intersects the circle. (Refer to the construction of a perpendicular bisector, on page 1.)	
4. Chord *CD* is a diameter of the circle. Construct point *P*, the midpoint of diameter *CD*. Point *P* is the center point of the circle. (Refer to the construction of the midpoint of a line segment, on page 1.)	

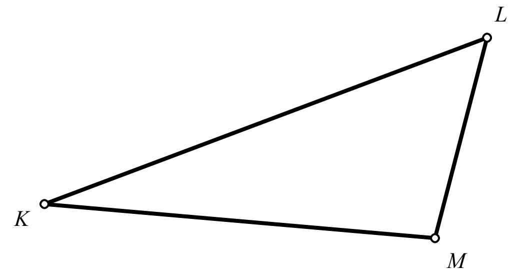
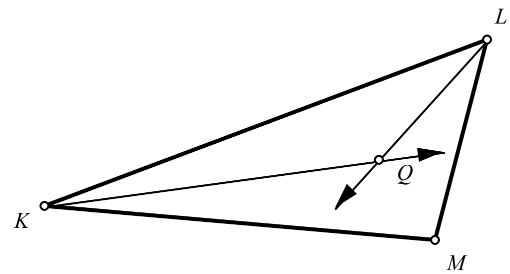
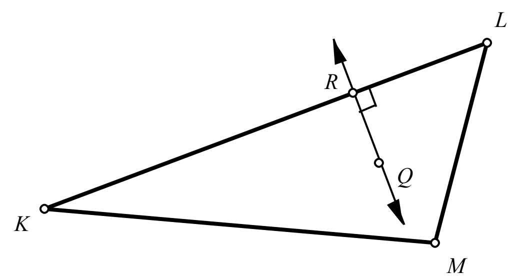
Given three noncollinear points, construct the circle that includes all three points.

1. Begin with points *A*, *B*, and *C*.	
2. Draw line segments *AB* and *BC*.	
3. Construct the perpendicular bisectors of line segments *AB* and *BC*. (Refer to the perpendicular bisector construction, on page 1.) Let point *P* be the intersection of the perpendicular bisectors.	
4. Center the compass on point *P*, and draw the circle through points *A*, *B*, and *C*.	

Given a triangle, circumscribe a circle.

1. Begin with triangle *STU*.	
2. If a circle is circumscribed around the triangle, then all three vertices will be points on the circle, so follow the instructions above, for construction of a circle through three given points.	

Given a triangle, inscribe a circle.

1. Begin with triangle *KLM*.	
2. Construct the bisectors of $\angle K$ and $\angle L$. (Refer to the angle bisector construction, on page 4.) Let point *Q* be the intersection of the two angle bisectors.	
3. Construct a line through point *Q*, perpendicular to line segment *KL*. Let point *R* be the point of intersection. (Refer to the construction of a perpendicular line through a given point, on page 3.)	
4. Center the compass on point *Q*, and draw a circle through point *R*. The circle will be tangent to all three sides of a triangle.