Section 3.5 Constructions—Parallel and Perpendicular Lines

# Objective 1: Constructing Parallel and Perpendicular Lines

**1. Construct the line parallel to a given line through a given point not on the line.**

 **Given:** Line *l* and point *N* not on line *l*.

 **Construct:** Line *m* through point *N* with .

 **Step 1:** Label two points *H* and *J* on line *l*. Draw line .

**Step 2:** At point *N*, construct angle 1 so that . Label the new point K and the line through points N and K as line m. .

**2. Construct the line perpendicular to a given line at a given point on the line.**

 **Given:** Point *P* on line *l*.

 **Construct:** Line  with .

**Step 1:** Construct two points on line *l* that are equidistant from point *P*. Label the points *A* and *B*.

**Step 2:** Open the compass wider so that the compass opening is greater than . With the compass tip on point *A*, draw an arc above point *P*.

**Step 3:** Without changing the compass setting, place the compass tip on point *B*. Draw an arc that intersects the arc from Step 2. Label the point of intersection *C*.

 **Step 4:** Draw line . .

**3. Construct the perpendicular to a given line through a given point not on the line.**

**Given:** Line *l* and point *R* not on *l*.

 **Construct:** Line  with .

**Step 1:** Open the compass to a size greater than the distance from point *R* to line *l*. With the compass tip on point *R*, draw an arc that intersects line *l* at two points. Label the points *E* and *F*.

**Step 2:** Place the compass tip on point *E* and make a large arc with radius equal to the length of segment *ER* or greater.

**Step 3:** Without changing the compass setting, place the compass tip on point *F*. Draw an arc that intersects the arc from Step 2 at least once and not at point *R*. Label the point of intersection *G*.

 **Step 4:** Draw line . .

**Objective 2: Constructing Geometric Shapes**

a. Draw a segment with length *a* and a segment with length *b*, . Construct a quadrilateral *PQRS* with , , and .

b. Draw a segment with length *c*. Construct a square with sides of length *c*.

c. Draw a segment with length *a* and a segment with length *b*, . Construct a rectangle with a side of length *a* and a diagonal of length *b*.

d. Is it possible to construct a triangle with side lengths *a*, *b*, and *c* and such that ? If so, construct it. If not, explain why such a triangle is not possible.

e. Is it possible to construct a triangle with side lengths *a*, *b*, and *c* such that ? If so, construct it. If not, explain why such a triangle is not possible.