

LESSON 9

Constructions of Polygons

You can also use tools such as a compass and a straightedge to construct various polygons.

EXAMPLE A Construct an equilateral triangle.

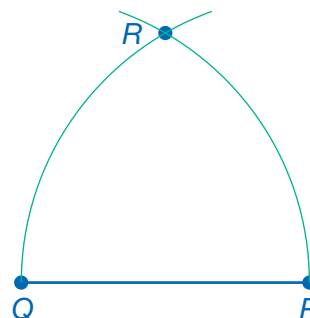
1

Use a straightedge to draw line segment QP for the base of the triangle.



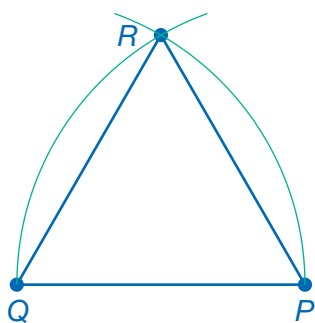
2

Set the span of your compass so that the compass point is on point Q and the pencil is on point P . Make a curve above the line. Without changing the compass span, move the compass point to point P . Then make another curve to intersect the first one. Label the intersection as point R .



3

Use your straightedge to draw \overline{QR} and \overline{PR} .



The same compass span was used to set the distance from point Q to point R and the distance from point P to point R . So, \overline{QR} and \overline{PR} must have the same length. Since the compass span you used to create point R matches the distance from point Q to point P , \overline{QP} must have the same length as \overline{QR} and \overline{PR} .

▶ Triangle PQR is an equilateral triangle.

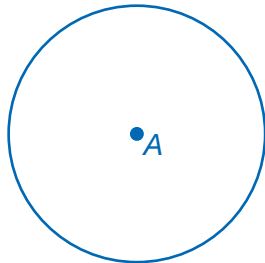
CHECK

Using a ruler and a protractor, check that all sides and angles are congruent.

EXAMPLE B Construct a regular hexagon inscribed in a circle.

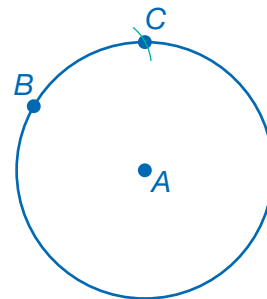
1

Draw a point and label it as point A . Then use your compass to construct a circle with point A as the center.



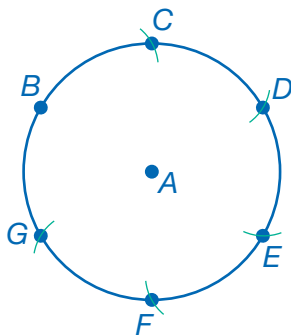
2

When a regular hexagon is inscribed in a circle, the length of each side of the hexagon is equal to the radius of the circle. So, begin by marking point B anywhere on the circle. Set the span of the compass by placing the compass point on point B and the pencil tip on point A . Now, with the compass point still on point B , draw a curve that intersects the circle. Label the point of intersection as point C .



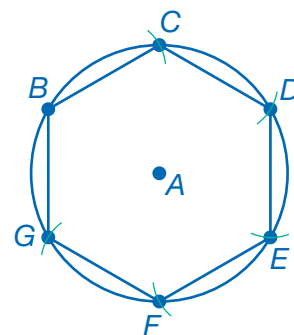
3

Place the compass point on point C . Without adjusting the span of the compass, draw another curve that intersects the circle. Repeat this process three more times, going around the circle. Label the points of intersection as points D , E , F , and G .



4

Use your straightedge to draw lines to connect adjacent points.



► Regular hexagon $BCDEFG$ is inscribed in circle A .

TRY

On a separate sheet of paper, construct a regular hexagon inscribed in a circle.

EXAMPLE C Construct a square.

1

Use a straightedge to construct \overline{RS} as the base of the square.



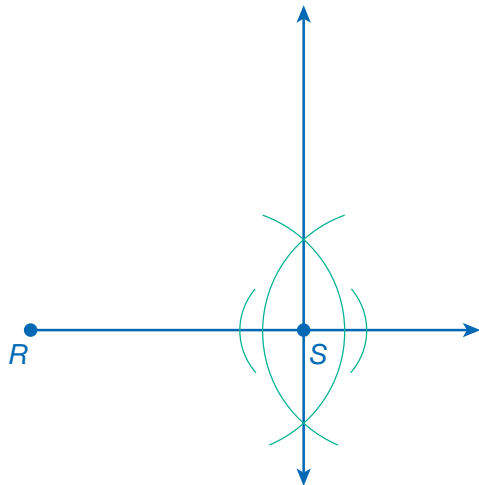
2

Use your straightedge to extend the segment past point S to form \overrightarrow{RS} . With the compass point on point S , set the compass span between points R and S . Then draw two curves on \overrightarrow{RS} that are the same distance from point S , but on opposite sides.



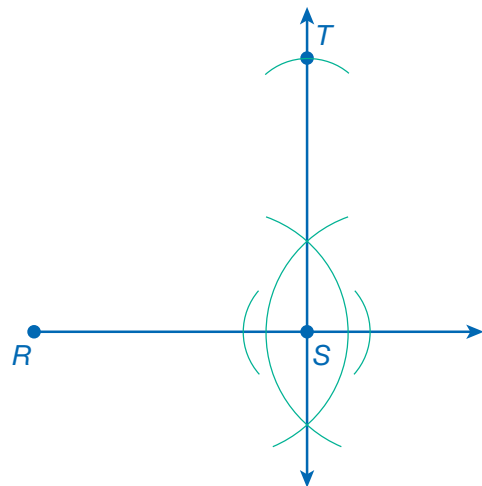
3

Construct a line perpendicular to \overrightarrow{RS} at point S .



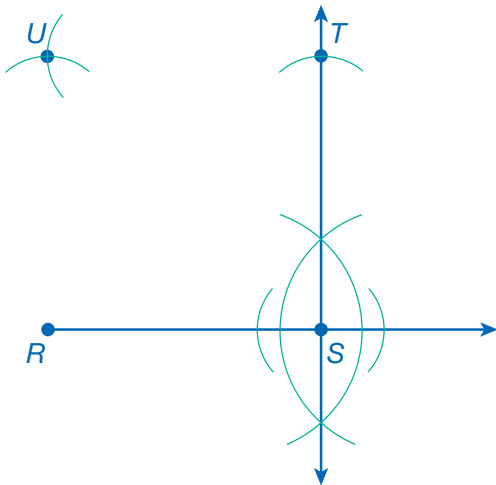
4

Set the compass span to the length of \overline{RS} by placing the compass point on point S and the pencil on point R . Then, with the compass point still on point S , draw a curve above \overrightarrow{RS} that intersects the perpendicular line. Label the point of intersection as point T .



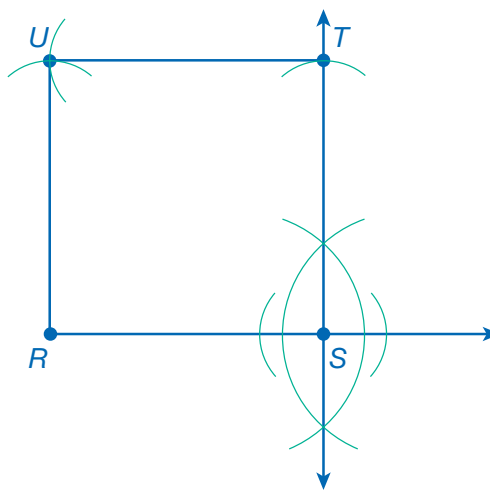
5

Without changing the compass span, set the compass point on point T . Draw a curve above point R . Then, again without changing the compass span, place the compass point on point R . Draw a curve that intersects the curve you just drew from point T . Label the point of intersection as point U .



6

Use your straightedge to draw lines that connect points R and U and points T and U



► Figure $RSTU$ is a square.

TRY

Once you have found point T in the construction above, you can try a different approach to constructing a square. Construct a line perpendicular to \overrightarrow{ST} at point T , then construct a line perpendicular to \overrightarrow{RS} at point R . How will you find point U ?

Practice

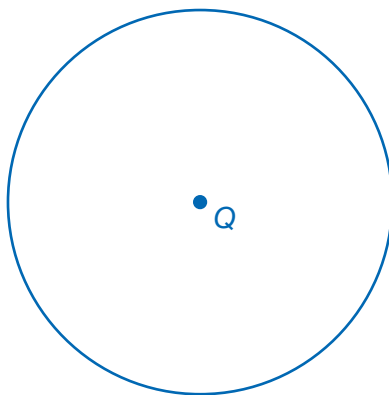
1. Construct square $PQRS$, using \overline{PQ} as the base of the square.



2. Construct equilateral triangle FGH , using \overline{FG} as the base of the triangle.



3. Inscribe regular hexagon $RSTUVW$ inside circle Q .



4. Construct equilateral triangle ABC , using \overline{AB} as the base of the triangle.



5. Construct a circle, using point J as the center and \overline{JK} as the radius. Then inscribe regular hexagon $KLMNOP$ inside circle J .



6. **THINK CRITICALLY** In Example C, you constructed square $RSTU$. Once you found point T , how could you have used the construction of parallel lines to complete the figure? Describe the steps you would use.

