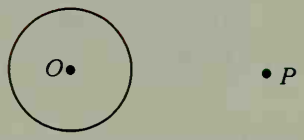
Construction 9

Given a point outside a circle, construct a tangent to the circle from the given point.

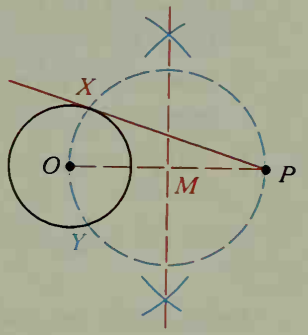
Given: Point P outside $\odot O$

Construct: A tangent to $\odot O$ from P



Procedure:

1. Draw $\overline{OP}$.
2. Find the midpoint M of $\overline{OP}$ by constructing the perpendicular bisector of $\overline{OP}$.
3. Using M as center and MP as radius, draw a circle that intersects $\odot O$ in a point X.
4. Draw $\overrightarrow{PX}$.



$\overrightarrow{PX}$ is tangent to $\odot O$ from P. $\overrightarrow{PY}$, not drawn, is the other tangent from P.

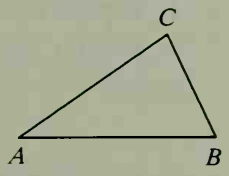
Justification: If you draw $\overline{OX}$, $\angle OXP$ is inscribed in a semicircle. Then $\angle OXP$ is a right angle and $\overrightarrow{PX} \perp \overline{OX}$. Because $\overrightarrow{PX}$ is perpendicular to radius $\overline{OX}$ at its outer endpoint, $\overrightarrow{PX}$ is tangent to $\odot O$.

Construction 10

Given a triangle, circumscribe a circle about the triangle.

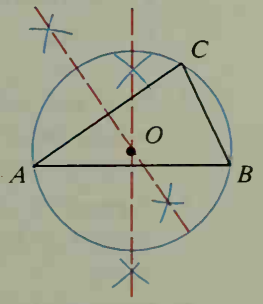
Given: $\triangle ABC$

Construct: A circle passing through A, B, and C



Procedure:

1. Construct the perpendicular bisectors of any two sides of $\triangle ABC$. Label the point of intersection O.
2. Using O as center and OA as radius, draw a circle.



Circle O passes through A, B, and C.

Justification: See Theorem 10-2 on page 387.