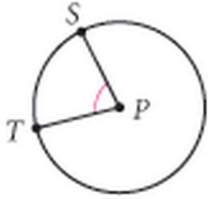
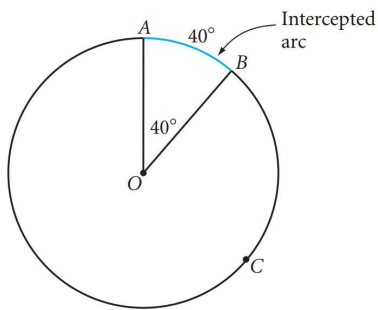


Lesson 6.1 – Tangent Properties

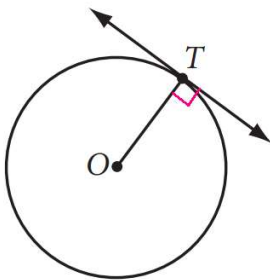
Central Angle - A central angle is an angle whose vertex is the center of the circle and whose sides pass through the circle.



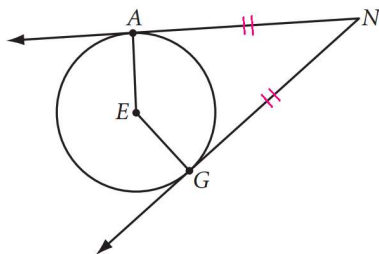
Intercepted Arc - $\angle BOA$ is said to intercept \widehat{AB} because the arc is within the angle. The measure of an arc is defined to be the measure of its central angle.



Tangent Conjecture - A tangent to a circle is perpendicular to the radius drawn to the point of tangency.



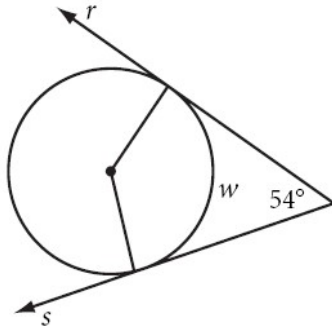
Tangent Segments Conjecture - Tangent segments to a circle from a point outside the circle are congruent.



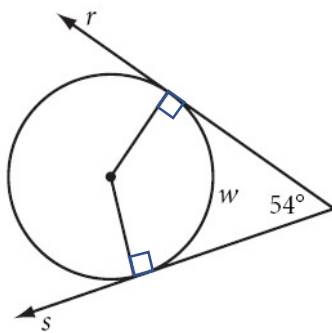
Example 1: Find the missing measure.

Rays r and s are tangents.

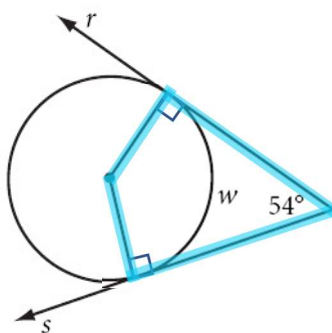
$w =$ _____



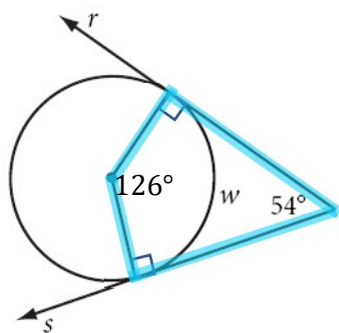
A tangent to a radius makes a right angle.



We can then look at the quadrilateral.



Remember that angles of a quadrilateral add to 360° . $360 - (90 + 90 + 54) = 360 - 234 = 126$

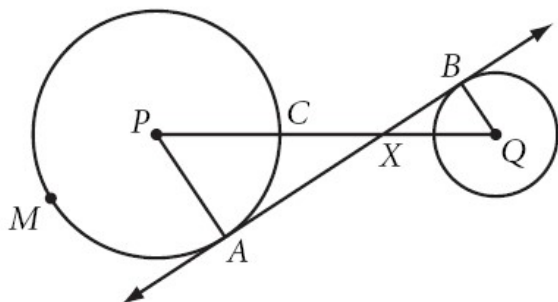


Since the measure of an arc must be the same as the measure of the central angle that forms it,
 $w = 126^\circ$.

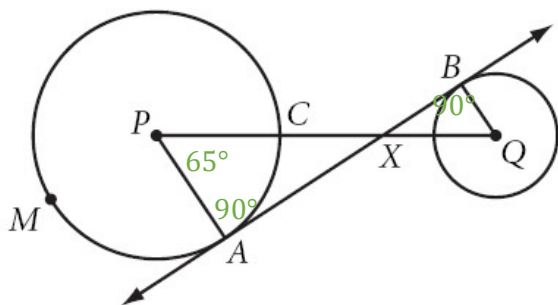
Example 2: Find the missing measure.

\overleftrightarrow{AB} is tangent to both circles and $m\widehat{AMC} = 295^\circ$.

$m\angle BQX = \underline{\hspace{2cm}}$

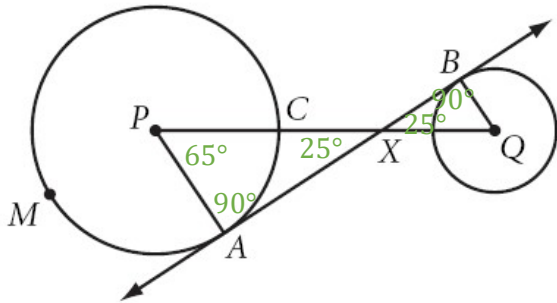


If $m\widehat{AMC} = 295^\circ$, then $m\widehat{AC} = 65^\circ$. Since arc measures are equal to the measures of the central angles that form $m\angle APC = 65^\circ$. We also know that \overline{AP} and \overline{QB} are radii to tangent \overleftrightarrow{AB} . So, $m\angle PAX = 90^\circ$ and $m\angle QBX = 90^\circ$.



We can solve $\triangle APX$.

$180^\circ - (65^\circ + 90^\circ) = 25^\circ$. Vertical angles are congruent.



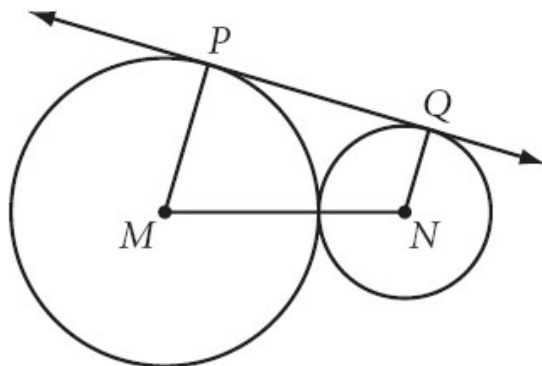
We can now solve $\triangle BQX$. $180^\circ - (25^\circ + 90^\circ) = 65^\circ$.

$$m\angle BQX = 65^\circ$$

Example 3: Complete.

\overline{PQ} is tangent to two externally tangent noncongruent circles, M and N .

- $m\angle NQP = \underline{\hspace{2cm}}$, $m\angle MPQ = \underline{\hspace{2cm}}$
- What kind of quadrilateral is $MNQP$? Explain your reasoning.



\overline{MP} is a radius that intersects tangent line \overline{PQ} at the point of tangency, so they must be perpendicular.

$$m\angle MPQ = 90^\circ$$

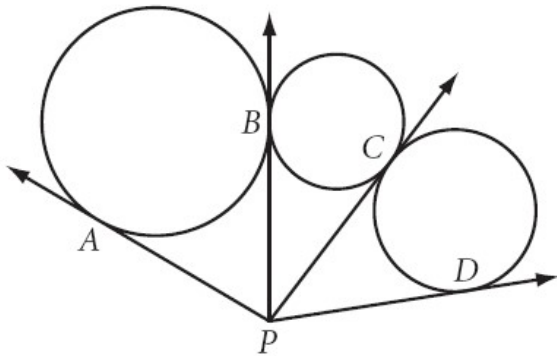
\overline{NQ} is a radius that intersects tangent line \overline{PQ} at the point of tangency, so they must be perpendicular.

$$m\angle NQP = 90^\circ$$

Since corresponding angles would be congruent, we know that $\overline{MP} \parallel \overline{NQ}$. Since the circles are not congruent, we know that $\overline{MN} \nparallel \overline{PQ}$. **So, the quadrilateral has one pair of parallel sides and is a trapezoid.**

Example 4: Explain why $\overline{PA} \cong \overline{PD}$.

\overline{PA} , \overline{PB} , \overline{PC} , and \overline{PD} are tangents.



Since \overline{PA} and \overline{PB} are tangent to the same circle from the same point outside the circle, we know that $\overline{PA} \cong \overline{PB}$.

Since \overline{PB} and \overline{PC} are tangent to the same circle from the same point outside the circle, we know that $\overline{PB} \cong \overline{PC}$.

Since \overline{PC} and \overline{PD} are tangent to the same circle from the same point outside the circle, we know that $\overline{PC} \cong \overline{PD}$.

So, $\overline{PA} \cong \overline{PB} \cong \overline{PC} \cong \overline{PD}$.