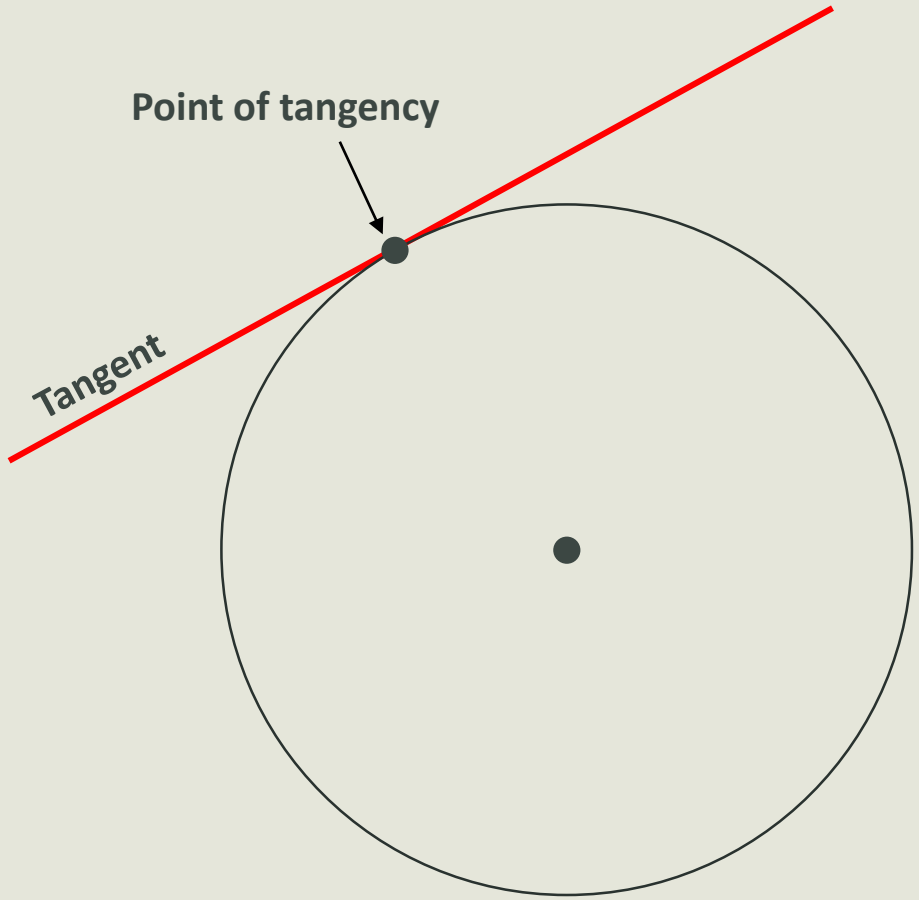
Lesson 15.3

Module 15: Angles and Segments in Circles

Tangents

Tangent – A tangent line or segment is a line or segment that touches the circle at one and only one point, and never passes inside of a circle.

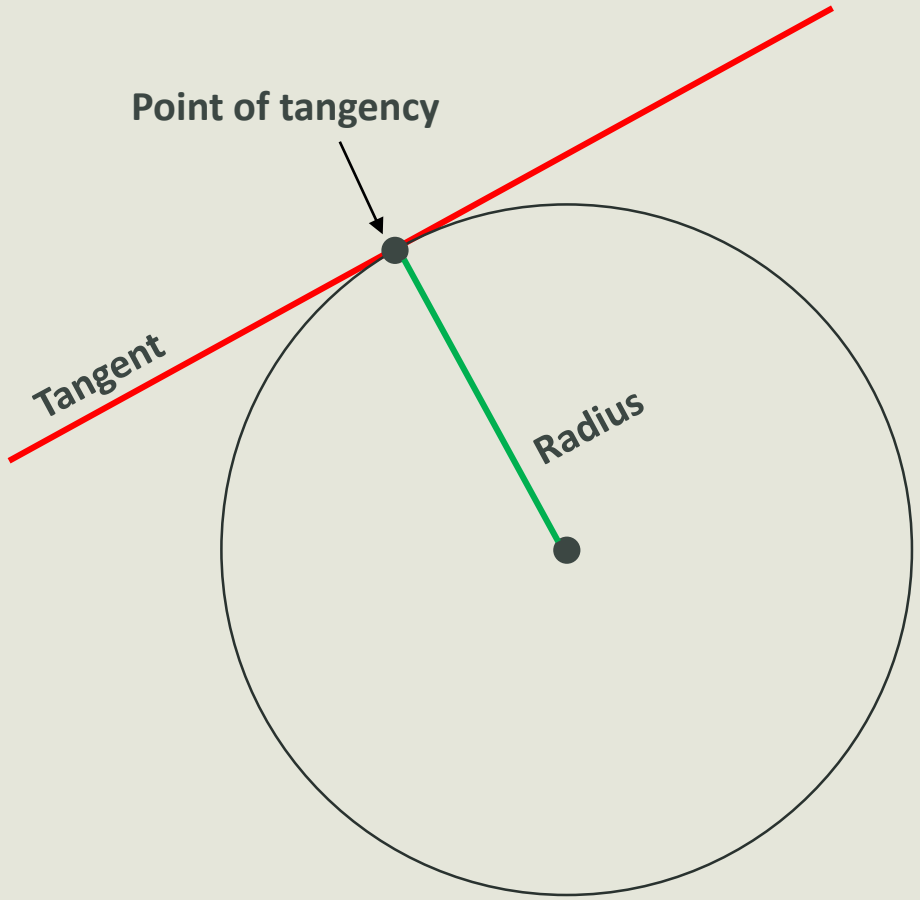


The point where a tangent intersects a circle is called the **point of tangency.**

Module 15: Angles and Segments in Circles

Tangents – Special relationships

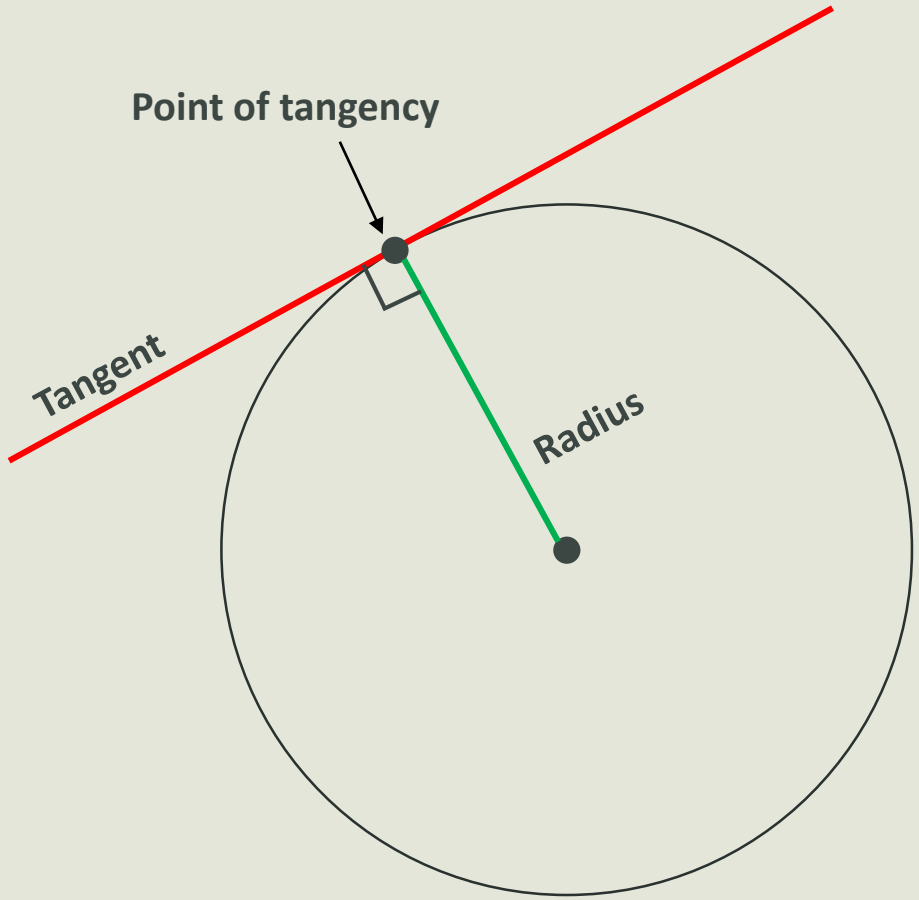
Tangent and Radius – What angle does it appear must be formed when a radius intersects with a line tangent to a circle?



Module 15: Angles and Segments in Circles

Tangents – Special relationships

Tangent and Radius – If a tangent line intersects with a radius (at the point of tangency), they will be perpendicular to each other, creating a **right angle.**



NOTE – This will be assumed knowledge on the EOC! There will never be a right angle labeled at this intersection, so you must memorize this fact.

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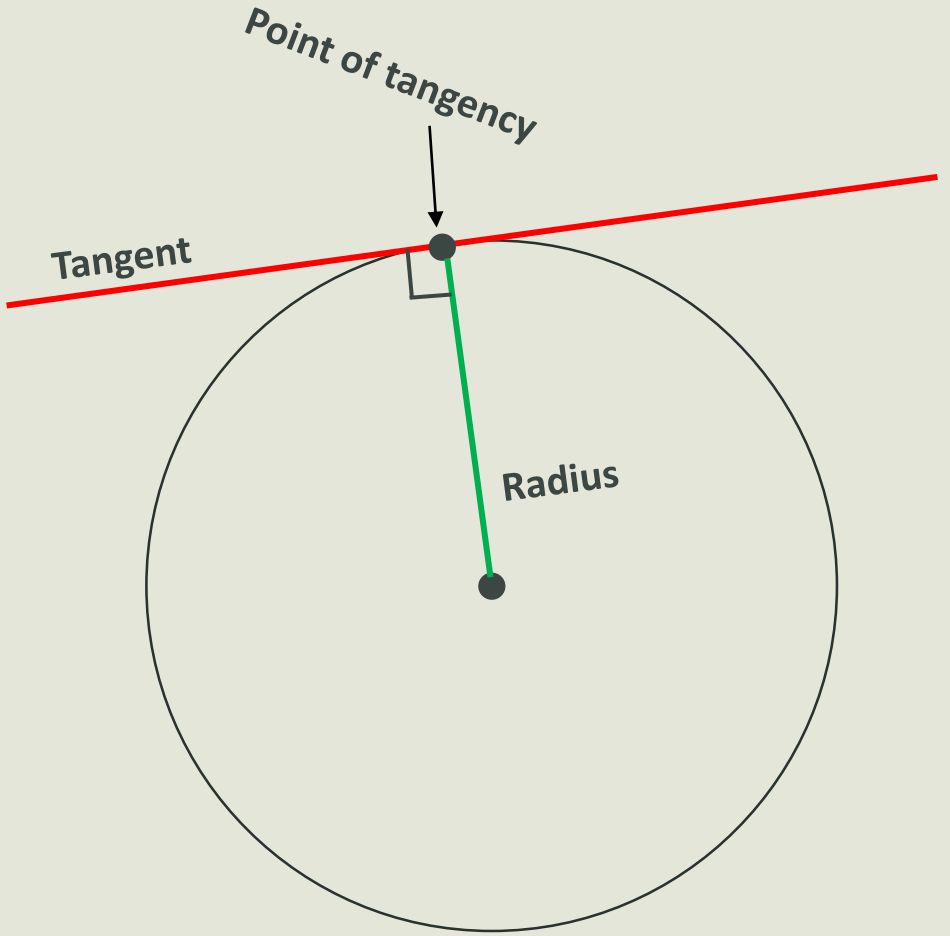
Tangents – Special relationships



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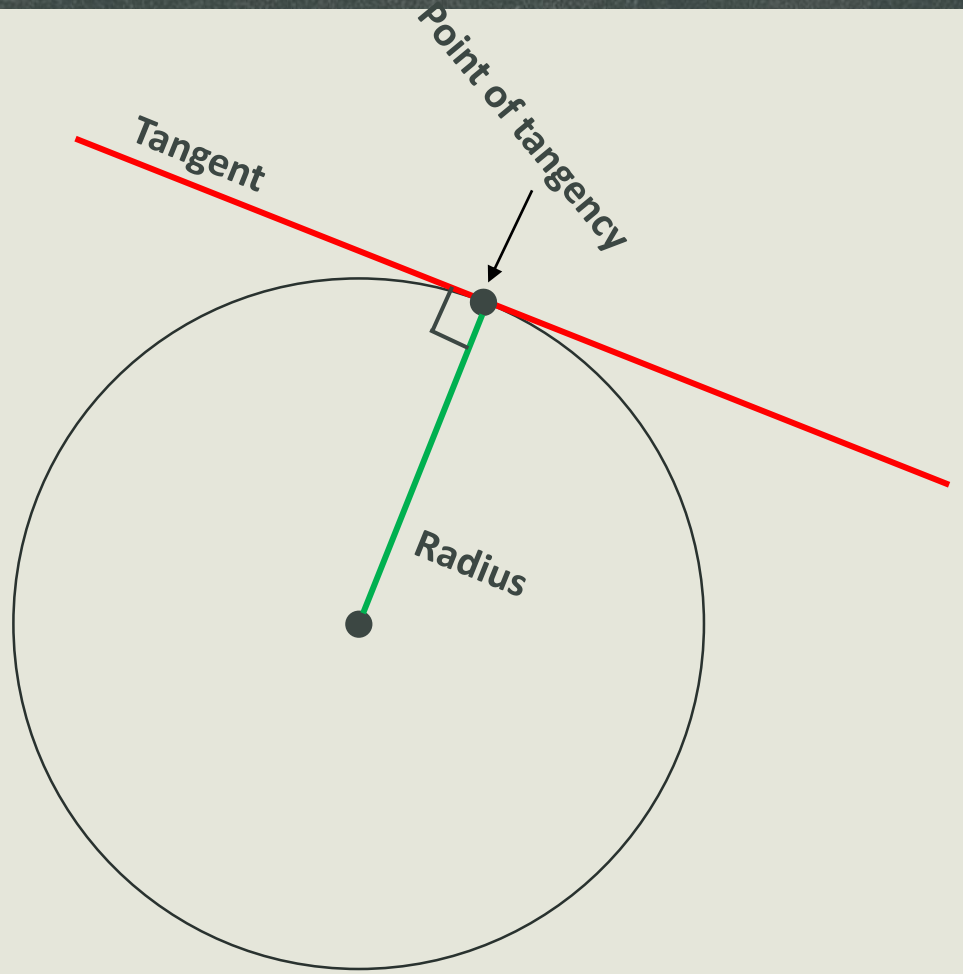
Tangents – Special relationships



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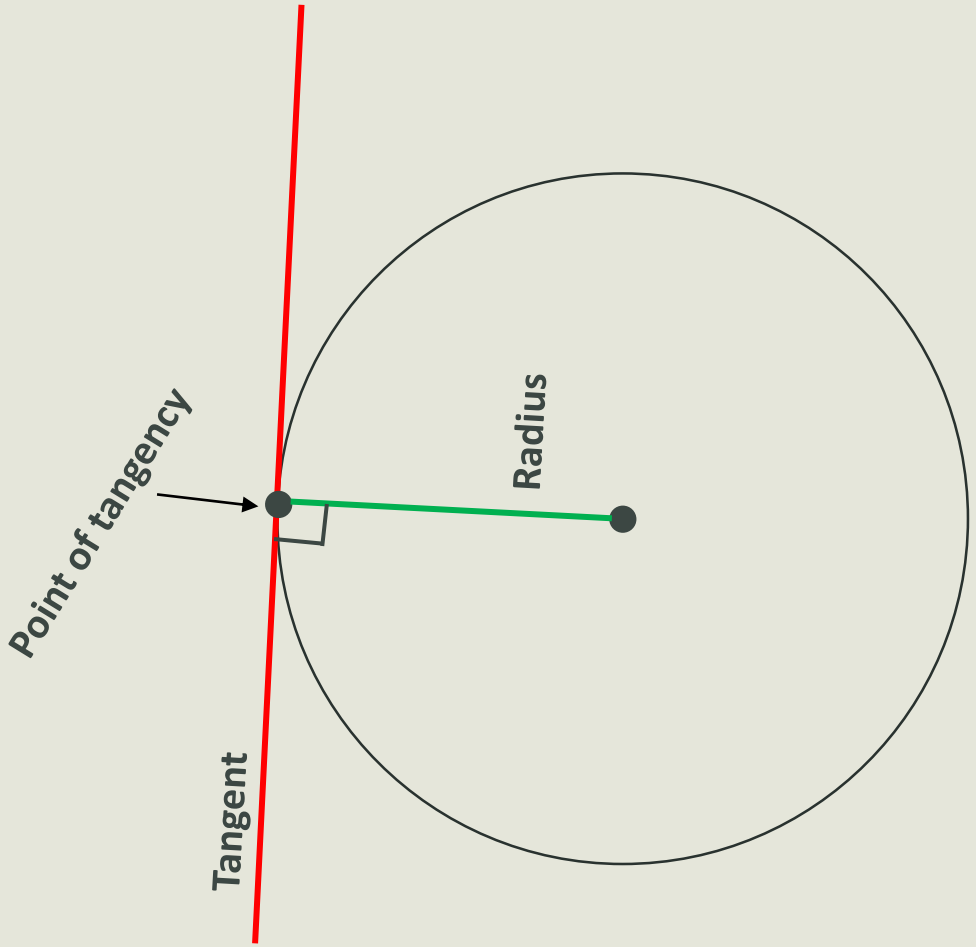
Tangents – Special relationships

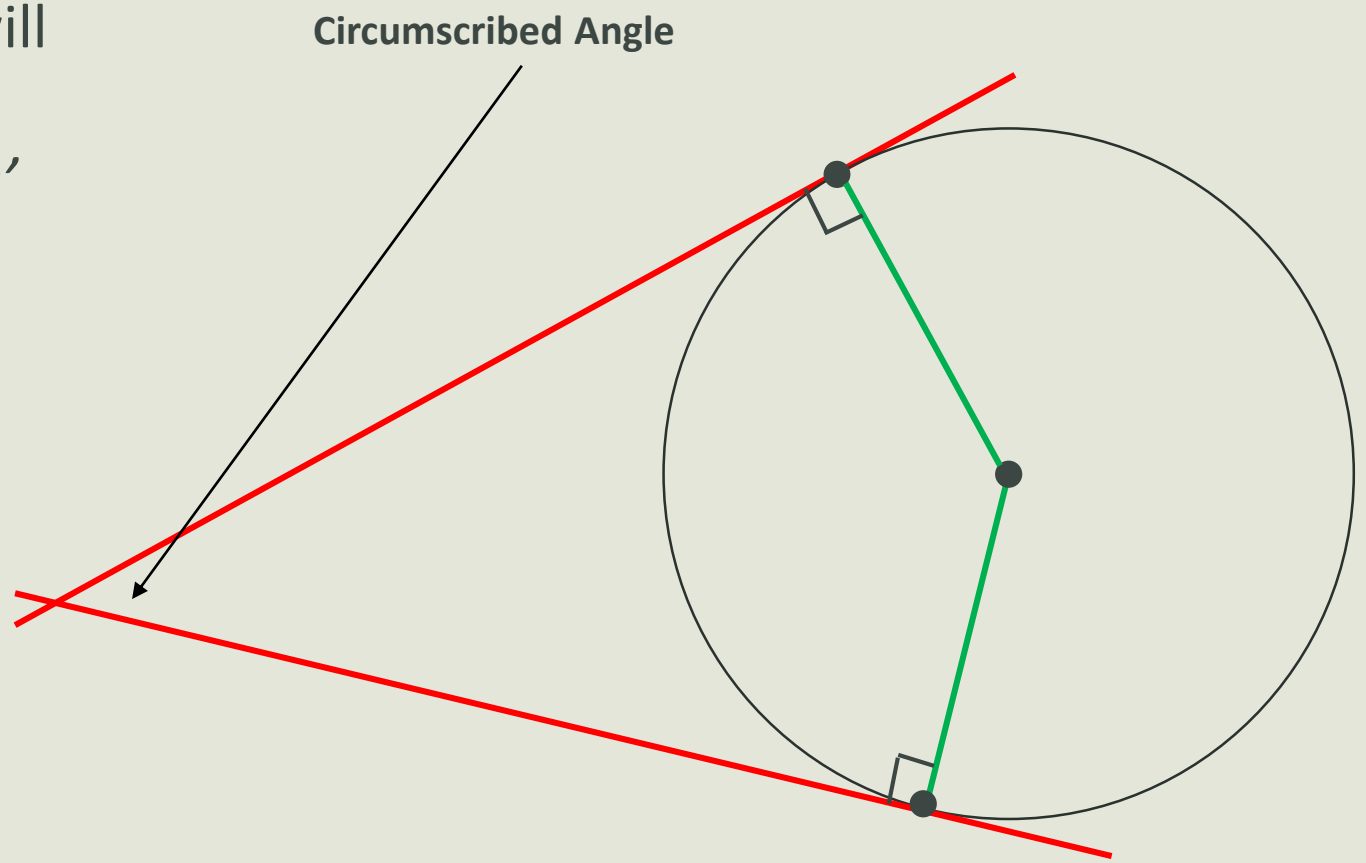


Module 15: Angles and Segments in Circles

Tangents – Special relationships

The intersection of 2 tangents – If two lines are drawn tangent to a circle, they will connect and form a special kind of quadrilateral called a kite *(unless the lines' points of tangency are 180 degrees apart, in which case the lines will be parallel!)*

The angle formed at the intersection of the tangents is called a circumscribed angle.



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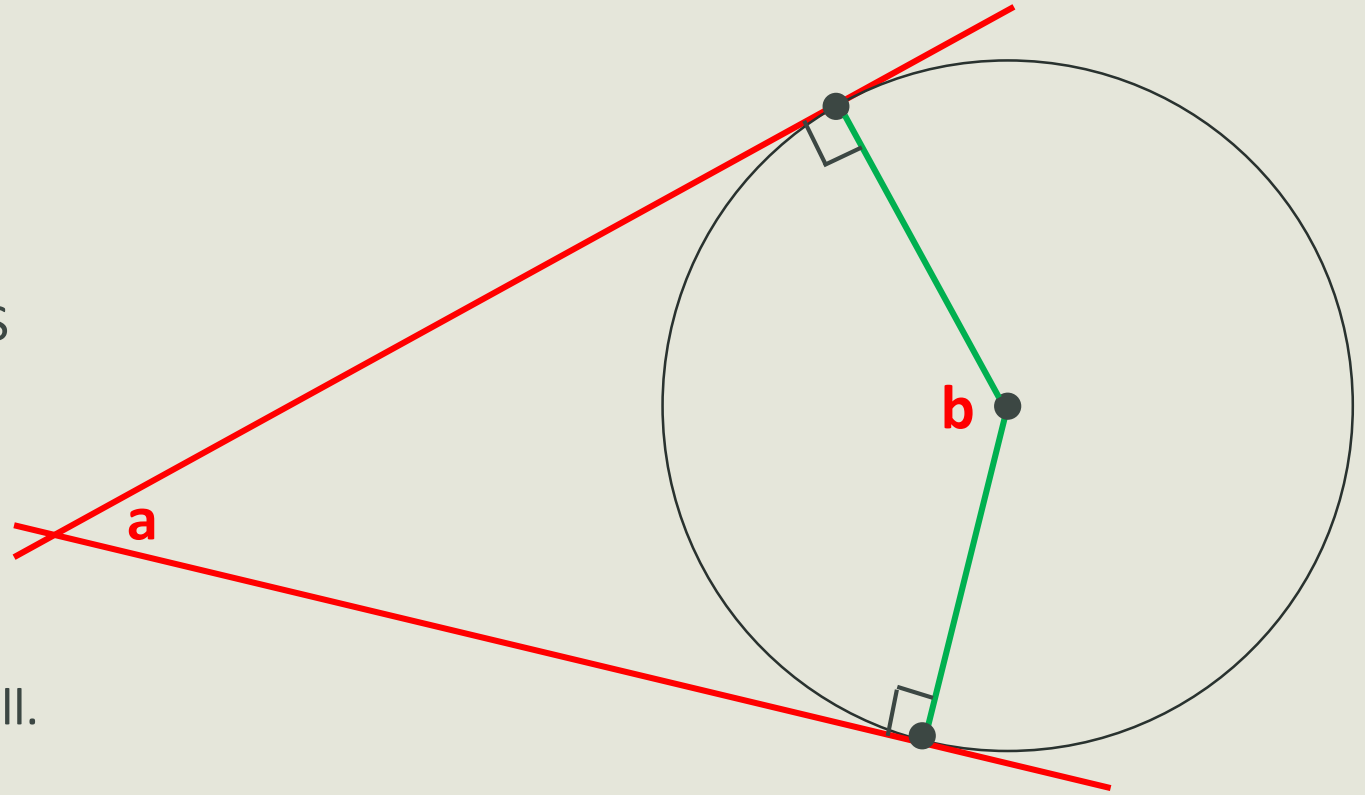
Tangents – Special relationships

Discuss the relationship between angles a and b in the diagram.

$m\angle a + m\angle b = 180^\circ$



Opposite angles in "tangent" kites are SUPPLEMENTARY

Notice that one pair of opposite sides will ALWAYS be supplementary, as each angle created at the points of tangency are 90˚

Therefore, since the total angle measure of any quadrilateral is 360˚, the remaining two angles (labeled 'a' and 'b') must be supplementary as well.

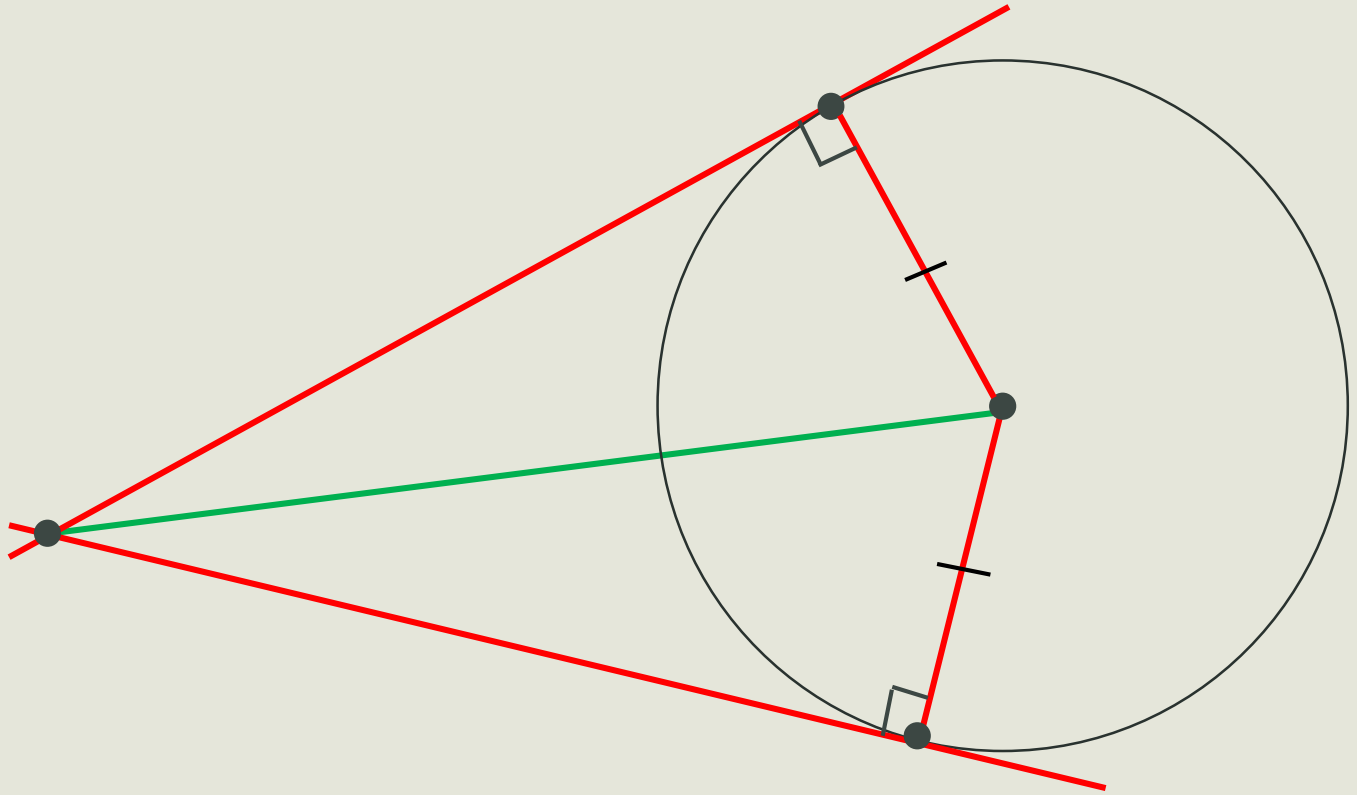
Module 15: Angles and Segments in Circles

Tangents – Special relationships

Connecting the center of the circle with the point where the two tangents intersect creates two right triangles.

What do you know about the two triangles and why?

Since each triangle shares the hypotenuse (in green), each shares a radius, and each has a right angles, the triangles are congruent by the HL triangle congruence theorem.



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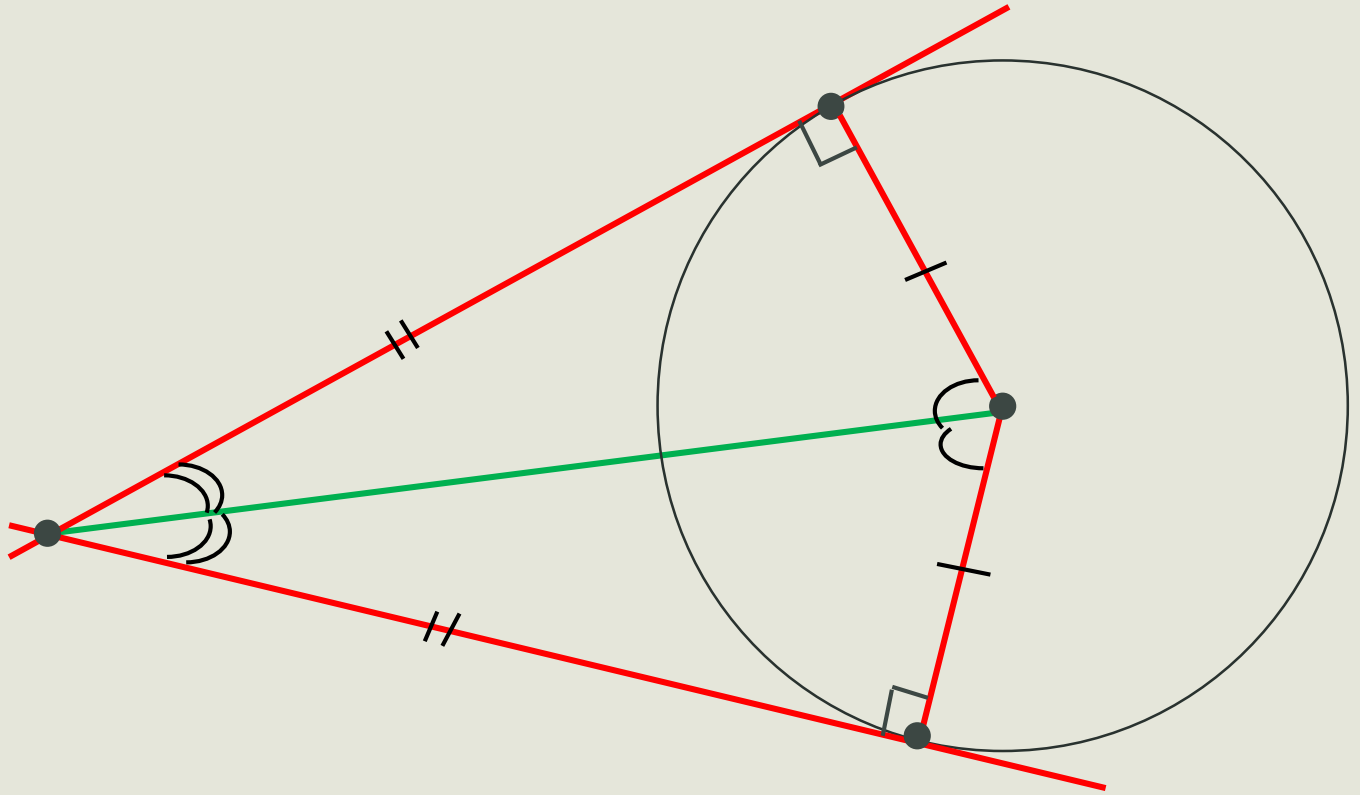
Tangents – Special relationships

By the concept that corresponding parts of congruent triangles are congruent (CPCTC), each angle and side of the triangles are congruent!

Notice that the green segment is in fact an angle bisector since it separates two pairs of congruent angles.



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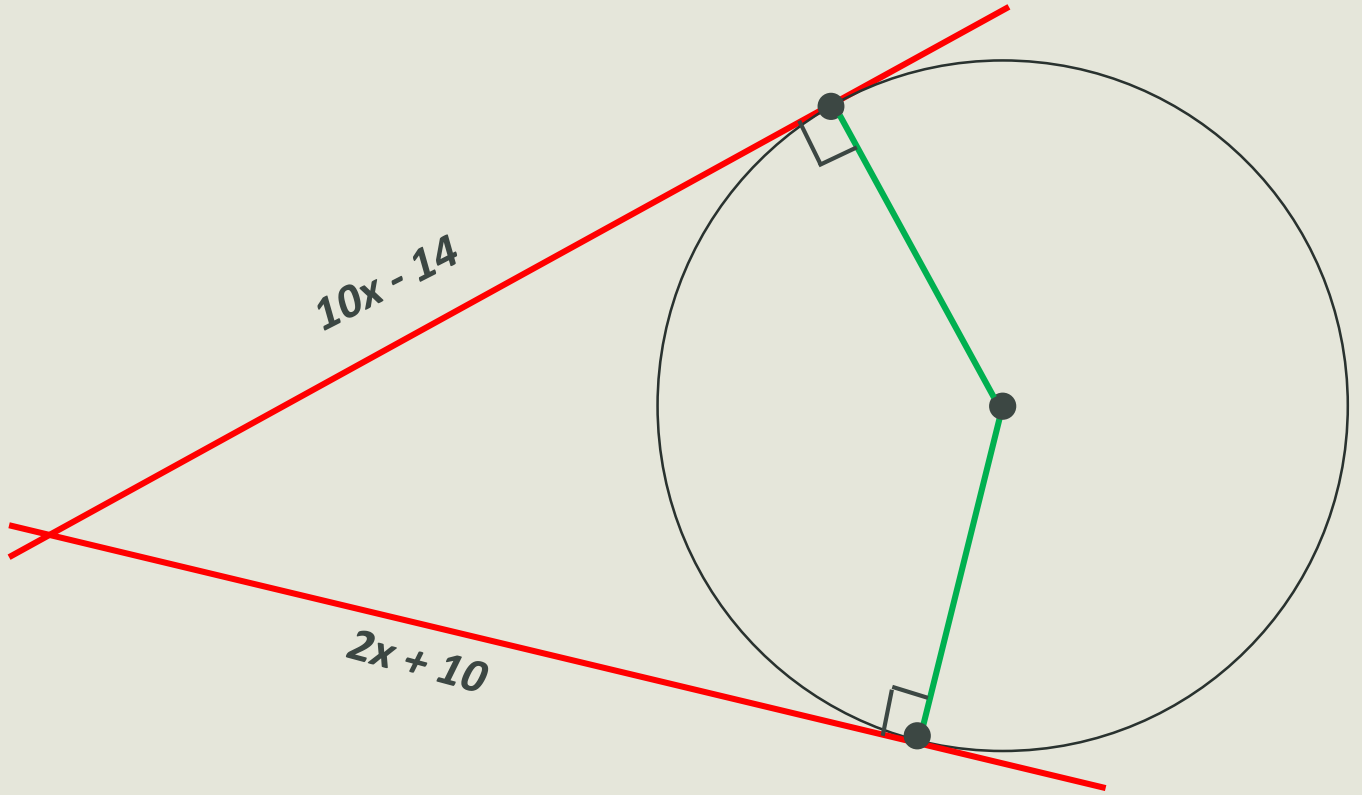
Tangents – Special relationships

These congruencies allow you to solve problems relating to the sides of the quadrilateral formed.

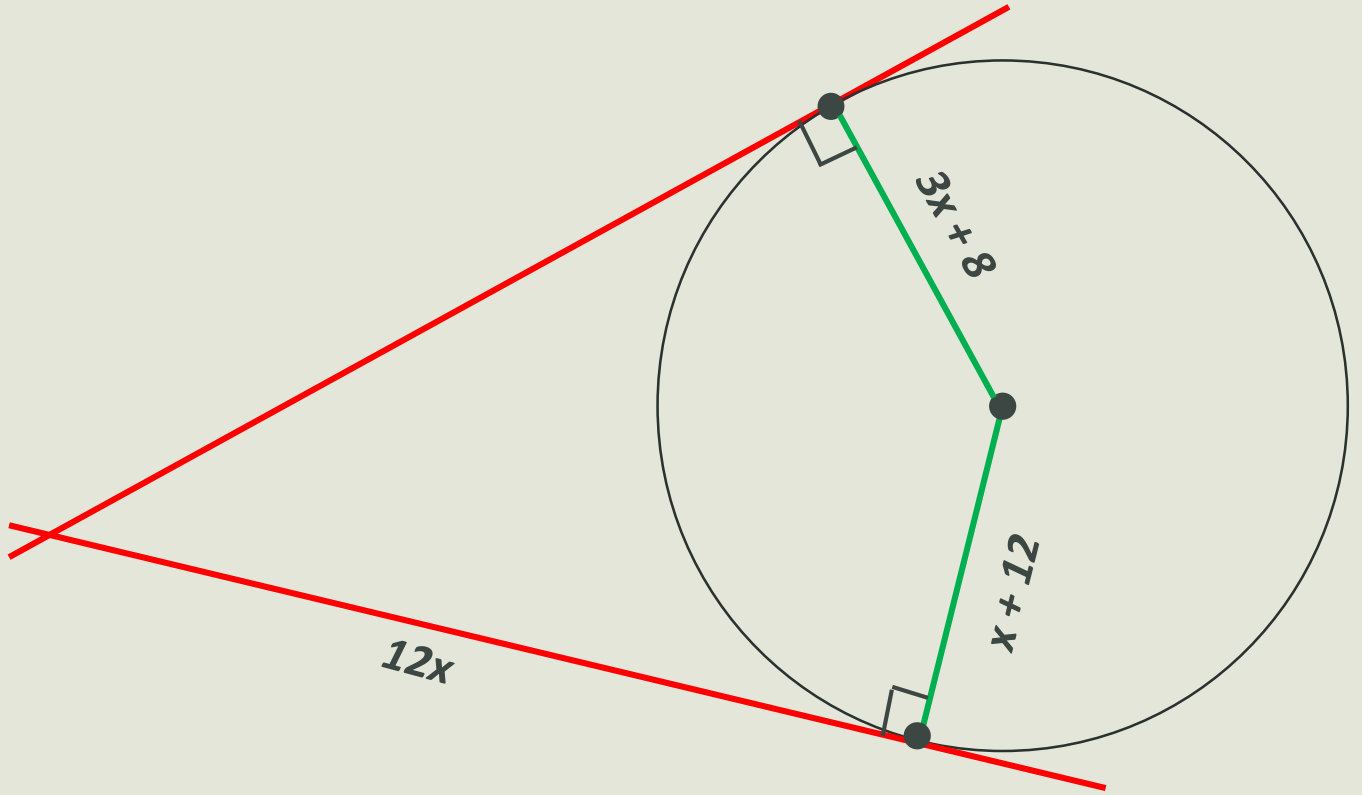
Find 'x' in the following diagram:



Module 15: Angles and Segments in Circles

Tangents – Special relationships

Find 'x' in the following diagram and use it to find the measure of each side of the quadrilateral:

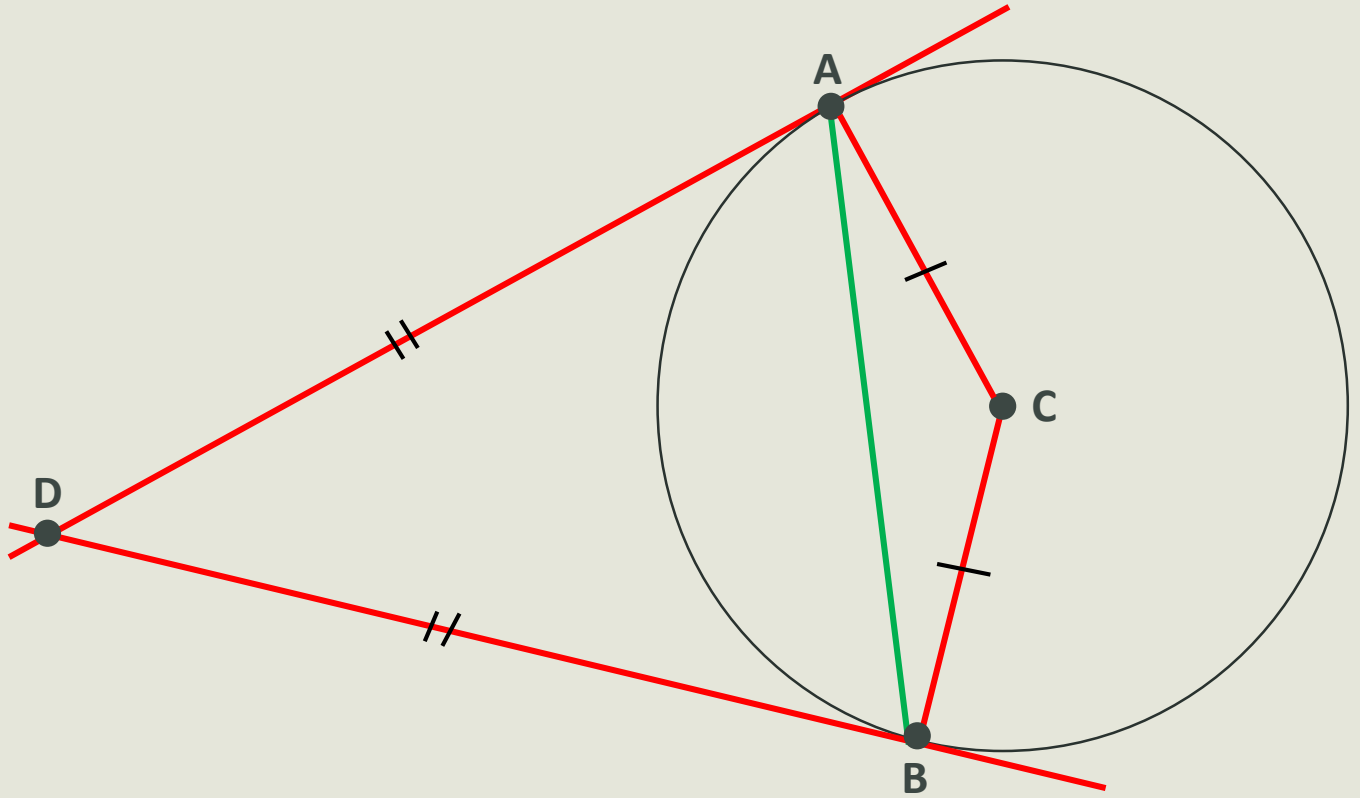


Module 15: Angles and Segments in Circles

Tangents – Solving Problems

Additional problem solving with tangents will involve a chord connecting the two points of tangency, thus creating an isosceles triangle (ABC) with CONGRUENT BASE ANGLES (∠ABC and ∠BAC).

In fact, there is another isosceles triangle (ADB) with congruent base angles (∠DAB and ∠DBA)!

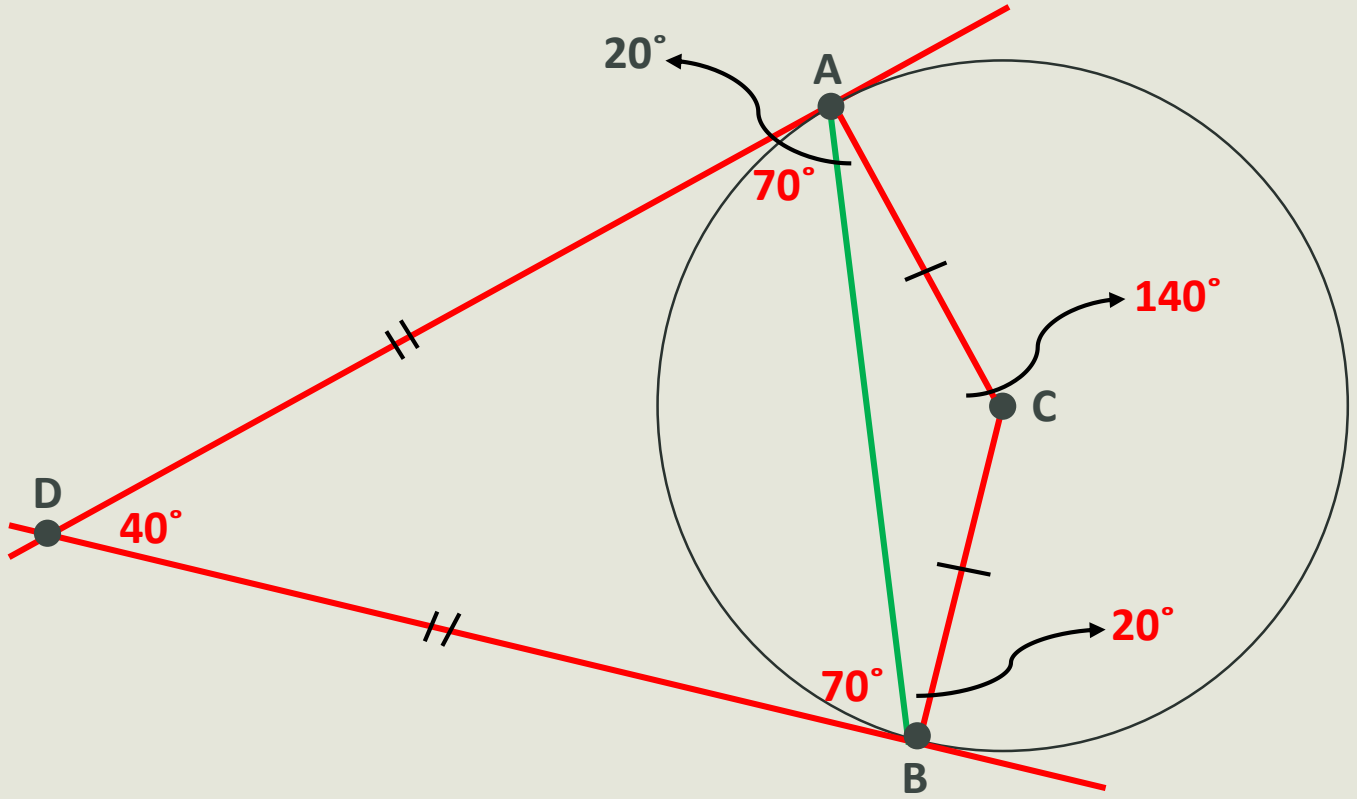


Module 15: Angles and Segments in Circles

Tangents – Solving Problems

With one angle measure, it is now possible to solve for each angle in the diagram.

Try to find each angle measure if the measure of **$\angle BAC = 20^\circ$**

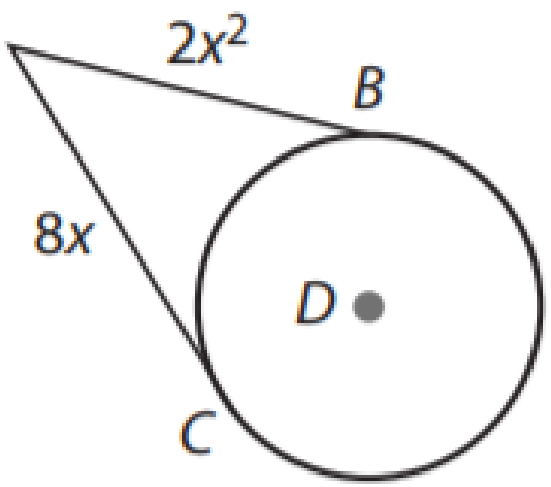


Module 15: Angles and Segments in Circles

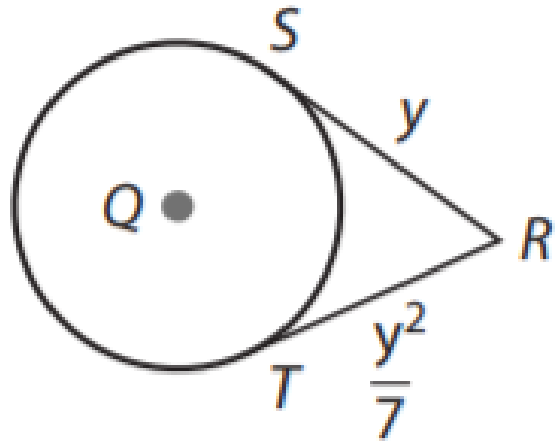
Open your book to pages 810 and 811, #'s 9-10 and 12-15

The segments in each figure are tangent to the circle at the points shown. Find each length.

9.



10.



Module 15: Angles and Segments in Circles

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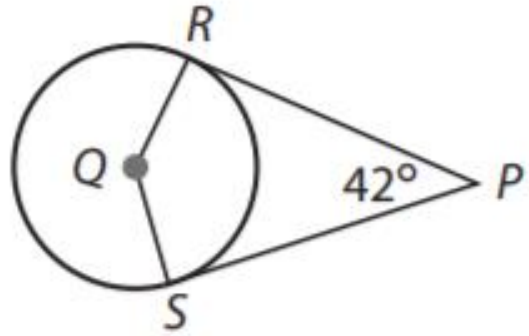
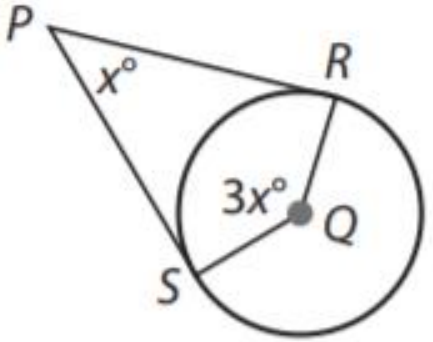
12. $\overline{PR}$ is tangent to circle Q at R and $\overline{PS}$ is tangent to circle Q at S. Find $m\angle Q$.



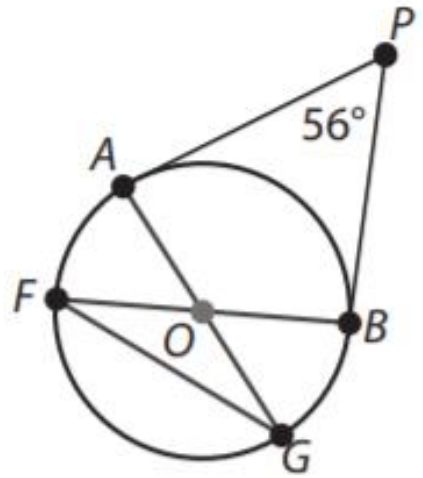
13. $\overline{PR}$ is tangent to circle Q at R and $\overline{PS}$ is tangent to circle Q at S. Find $m\angle P$.



Module 15: Angles and Segments in Circles

Open your book to pages 810 and 811, #'s 9-10 and 12-15

$\overline{PA}$ is tangent to circle O at A and $\overline{PB}$ is tangent to circle O at B, and $m\angle P = 56°$. Use the figure to find each measure.



14. $m\angle AOB$

15. $m\angle OGF$