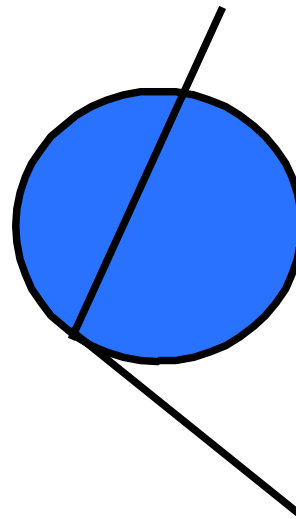
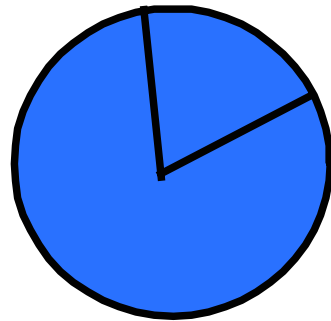
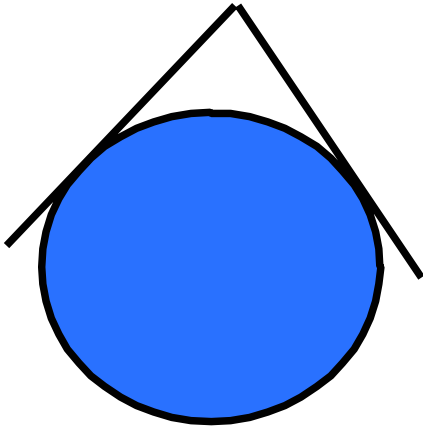


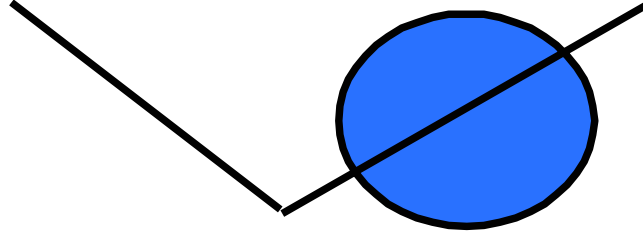
## 9.4 Angles Formed by Secants and Tangents

### Warm-Up

A circle and an angle are drawn in the same plane. Find all the possible ways in which the circle and angle intersect at two points.



Possibilities are as follows: The circle intersects the angle at the vertex and on one ray. The circle is inside the angle with the intersection points at tangents to the circle. One ray intersects the circle at two points other than the vertex. The vertex is in the interior of the circle and the circle intersects each ray at one point.



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Activity 1 Vertex on Circle Secant and Tangent (Case 1a)

### Checkpoint 1

The relationship is the same as that between an inscribed angle and its intercepted arc.

### Checkpoint 2

The measure of an acute secant-tangent angle with its vertex on a circle is one-half the measure of its intercepted arc.

### Checkpoint 3

The measure of an obtuse secant-tangent angle with its vertex on a circle is one-half the measure of its intercepted arc.

## Checkpoint 4 Theorem

If a tangent and secant (or a chord) intersect on a circle at the point of tangency, then the measure of the angle formed is one-half the measure of its intercepted arc.

9.4.1

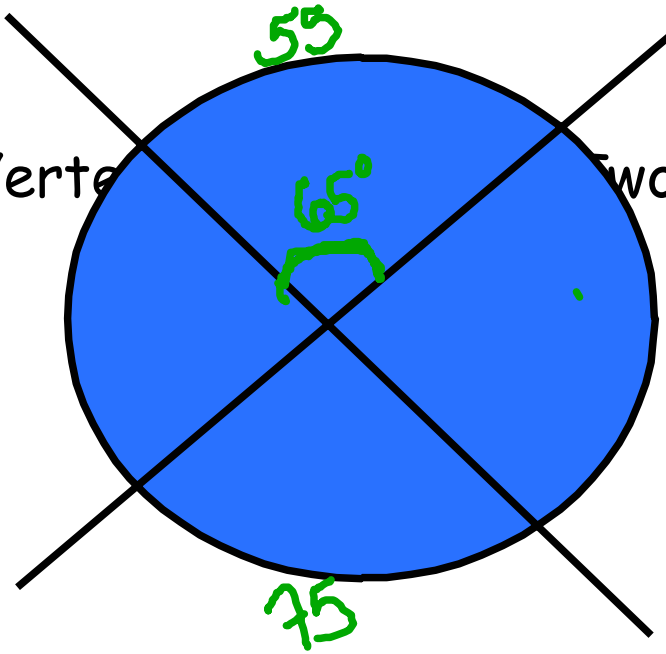
Activity 2 Vertex Inside Circle Two Secants (Case 2)

## Checkpoint Theorem

The measure of an angle formed by two secants or chords that intersect in the interior of a circle is one-half the sum of the measures of the arcs intercepted by the angle and its vertical angle.

9.4.2

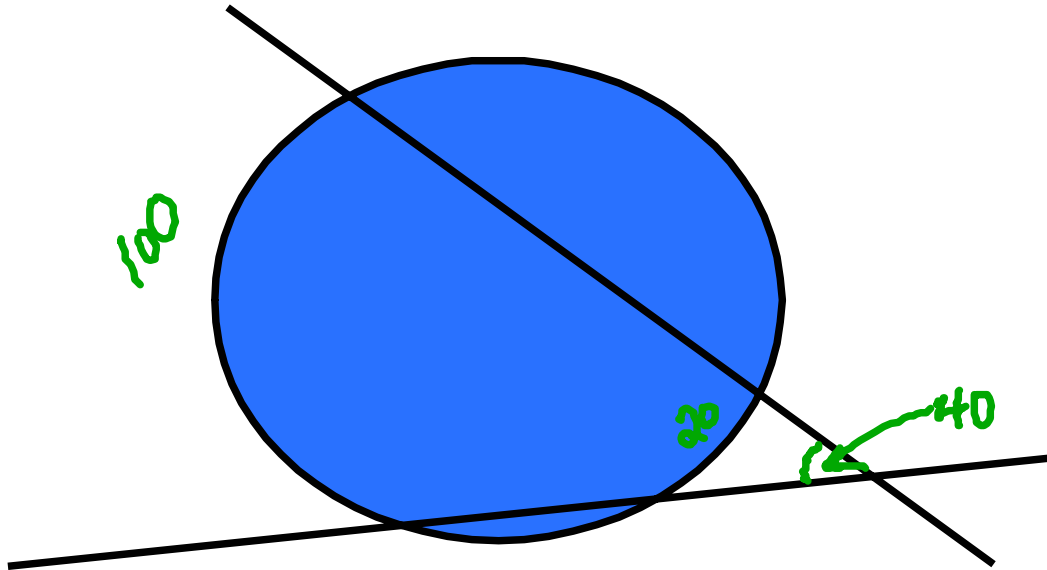
Activity 3 Vertex Angle Formed by Two Secants (Case 3b)



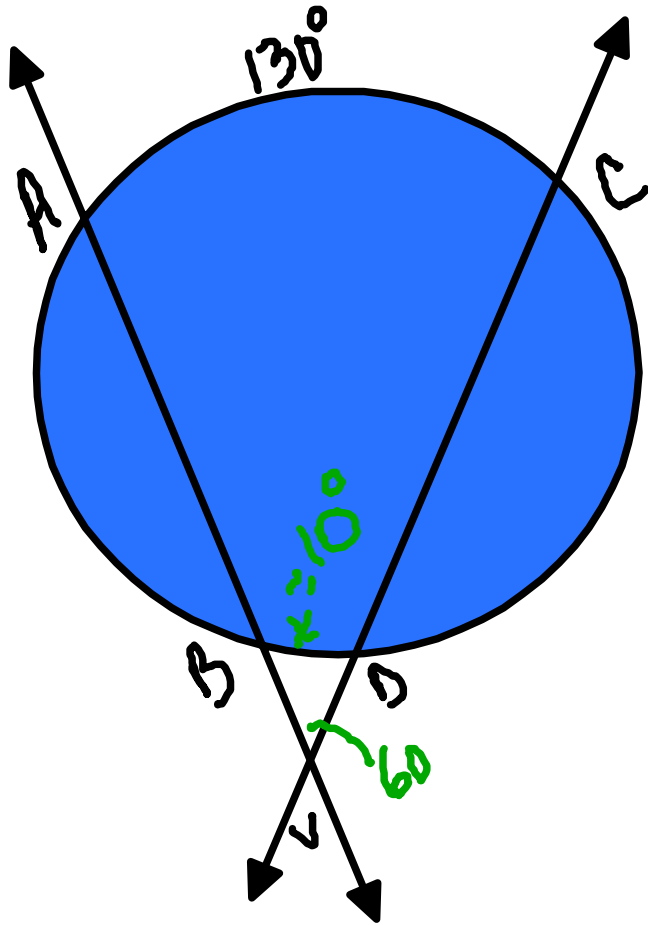
## Checkpoint Theorem

The measure of an angle formed by two secants that intersect in the exterior of a circle is one-half the difference of the measures of the intercepted arcs.

9.4.3



Given  $m\angle AVC = 60^\circ$  and  $m\widehat{AC} = 130^\circ$ , find  $m\widehat{BD}$ .



$$\begin{aligned} \frac{130 - x}{2} &= 60 \\ 130 - x &= 120 \\ -x &= -10 \\ x &= 10 \end{aligned}$$

Given:  $\overleftrightarrow{XY}$  is tangent to circle T at point X.  $m\widehat{UV}$  is 90 degrees;  $m\widehat{VX}$  is 130 degrees; and  $m\widehat{UW}$  is 20 degrees. Find

- measure of angle WXY;  $\frac{120}{2} = 60^\circ$
- measure of angle 1; and  $\frac{90+120}{2} = 105$
- measure of angle 2.  $\frac{130-20}{2} = 55^\circ$

