5/14 Aim: Angles formed by 2 secants or secant and tangent.

Do now

Homework worksheet
1) If \( PQ \) is a diameter and \( PQ \parallel TX \), what is \( \angle R \)?

\[
\frac{180 - 70}{110} = 55.
\]

2) If \( AB \) is a diameter, \( \angle ABC = 74^\circ \), \( \angle ADC = 32^\circ \), what is \( \angle BCD \)?

\[
\frac{74 - 32}{144} = \frac{180}{32}.
\]

3) If \( E \) is a diameter and \( \angle EFG = 80^\circ \), what is \( \angle EGD \)?

4) If \( AB \) is a diameter, \( \angle ABE = 90^\circ \), \( \angle BDE = 40^\circ \), what is \( \angle AED \)?

5) If \( AB \) is a diameter, \( \angle ABC = 80^\circ \), \( \angle BDE = 36^\circ \), what is \( \angle BDE \)?

6) If \( AB \) is a diameter, \( \angle ABE = 90^\circ \), \( \angle BDE = 40^\circ \), what is \( \angle AED \)?

7) If \( AB \) is a diameter, \( \angle ABE = 90^\circ \), \( \angle BDE = 40^\circ \), what is \( \angle AED \)?

8) If \( AB \) is a diameter, \( \angle ABE = 90^\circ \), \( \angle BDE = 40^\circ \), what is \( \angle AED \)?

9) If \( AB \) is a diameter, \( \angle ABE = 90^\circ \), \( \angle BDE = 40^\circ \), what is \( \angle AED \)?

10) If \( AB \) is a diameter, \( \angle ABE = 90^\circ \), \( \angle BDE = 40^\circ \), what is \( \angle AED \)?

11) If \( AB \) is a diameter, \( \angle ABE = 90^\circ \), \( \angle BDE = 40^\circ \), what is \( \angle AED \)?
Examples: #1-13: Find x

1) $x = 130^\circ$

3) $x = \frac{310 - 150}{2} = \frac{160}{2} = 80^\circ$

4) $x = \frac{210}{2} = 105^\circ$

6) $x = \frac{236}{2} = 118^\circ$

7) $x = \frac{236}{2} = 118^\circ$

8) $x = \frac{168}{2} = 84^\circ$
A small fragment of something brittle, such as pottery, is called a shard. The accompanying diagram represents the outline of the shard from a small round plate that was found at an archaeological dig.

If BC is a tangent to arc AB at B and m<ABC = 45, what is the measure of arc AB, the outside of the shard?

1) 45  
2) 90  
3) 135  
4) 225
2. In the diagram below, PA is tangent to circle O, and AB is a chord. If \( m\angle C \) = 300, find the measure of \( \angle BAP \).
Two tangents PA and PB are drawn to circle O from an external point P. If the measure of major arc AB is 250, find the measure of ∠P.
Two tangents to circle from an external point intercept of major arc of 360. Find the number of degrees in the angle formed by the two tangents.

In a circle, two tangents from an external point intercept of major arc of 240. Find the number of degrees in the angle formed by the two tangents.

Two tangents are drawn to circle O from an external point P. If the measure of major arc is 280, find the measure of <P.

Two tangents PA and PB are drawn to circle O from an external point P. If the measure of major arc is three times the minor arc, find the measure of <APB.

Two tangents are drawn to circle O from an external point P. If the measure of minor arc is 100, find the measure of <P.
NOTES

Tangent-Secant:

Secant-Secant:

2)

3)

4)
Central angle AOB =

\[ \angle AOB = 78 \]

then \( \overline{AB} = \)

Inscribed angle GHI =

\[ \angle GHI = 81 \]

then \( \angle GHI = \)

Tangent PA and chord DA are drawn to circle O.

\[ \angle DAP = \]

then \( \overline{DA} = \)

two tangents (snow cone)

\[ \angle ABP = \]

\[ \angle ACB = 258 \]

then \( \angle P = \)

Diameter and tangents

\[ \angle ABP = \]
Secant-secant

The angle formed by two secants that intersect outside the circle is:

\[ \text{Outside angle} = \frac{(\text{big arc} - \text{small arc})}{2} \]

\[ < P = \frac{\overarc{BD} - \overarc{AC}}{2} \]

Secants \( \overline{PAB} \) and \( \overline{PCD} \)

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Tangent and Secant

\[ \text{Outside angle} = \frac{(\text{big arc} - \text{small arc})}{2} \]

\[ < P = \frac{\overarc{CB} - \overarc{AC}}{2} \]

\( \overline{PC} \) tangent
\( \overline{PAB} \) secant

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1. \( \overline{40^\circ} \) and \( x \) in a tangent-secant diagram.

2. \( 80^\circ \) angle and \( x \) in a secant-secant diagram.

3. \( 100^\circ \) and \( x \) in a tangent-tangent diagram.

4. \( 20^\circ \) and \( x \) in a tangent-tangent diagram.
5. \[\text{Angle formed by secants} \] 
\[x = 150 - 40 = 110^\circ\]

6. \[\text{Angle formed by secants} \] 
\[x = 2(35) = 70^\circ\]

7. \[\text{Triangle } \triangle ABC \text{ is isosceles; find } x. \]

8. \[\text{Find } x. \]

9. \[\text{Find } \angle ABC. \]

10. \[\text{Find } m\widehat{AB}. \]

11. \[\text{Find } m\widehat{AC}. \]
11. \[ \angle 1 \]

12. Circle O has diameter AOC. From point P, outside the circle, tangent PA and secant PBC are drawn. If \( \angle APC = 43 \), find the measure of \( \angle BC \).

13. The accompanying diagram represents circular pond O with docks located at points A and B. From a cabin located at C, two sightings are taken that determine an angle of 30° for tangents CA and CB.

What is \( \angle CAB \)?

(1) 30°
(2) 60°
(3) 75°
(4) 150°

14. Point P lies outside circle O, which has a diameter of \( \overline{AOC} \). The angle formed by tangent \( PA \) and secant \( PBC \) measures 30°. Sketch the conditions given above and find the number of degrees in the measure of minor arc CB. (Hint: Image should look like #12)

15. In the accompanying diagram of circle O, diameter \( \overline{AB} \) is extended through B to external point P, tangent PF is drawn to point C on the circle, and \( \angle BOC = 72\). Find \( \angle CPC \).

(Not drawn to scale)
3) In the accompanying diagram, \( PA \) is tangent to circle \( O \) at \( A \) and \( PRC \) is a secant.

4) In the accompanying diagram, \( \overline{AD} \) is tangent to the circle at \( D \) and \( \overline{ABC} \) is a secant.

5) In the diagram below, \( PA \) is tangent to the circle at \( A \) and \( PRC \) is a secant.

6) In the accompanying diagram, \( \overline{AB} \) is tangent to circle \( O \) at \( B \) and \( \overline{ACD} \) is a secant.
5) In the diagram below, secant $AB$ and tangent $VH$ are drawn to circle $O$.  

12) If $m \angle Q = 140^\circ$, find $m \angle P$.

13) If $m \angle Q = 240^\circ$, find $m \angle P$.

14) In the diagram below, $PA$ and $PB$ are tangent to circle $O$ from $P$.

If $m \angle P = (x - 20)^\circ$ and $m \angle AOB = (2x + 50)^\circ$, find
(a) $m \angle AOB$
(b) $m \angle APB$
(c) $m \angle APO$
In a circle, two tangents from an external point intercept a major arc of $240^\circ$. Find the number of degrees in the angle formed by the tangents.

Two tangents to a circle from an external point intercept a minor arc whose measure is $110^\circ$. Find the measure of the angle formed by the tangents.

Examples: #1-10: Find $x$

1) $\angle D = 46^\circ$, $\angle B = ?$

Tangents $PQ$ and $PR$ are drawn to circle $O$ from $P$ in the figure below.

12) If $\angle QOR = 140^\circ$, find $\angle P$.

13) If $\angle QOR = 240^\circ$, find $\angle P$. 