10.1 Circles

and

Circumference

Notes

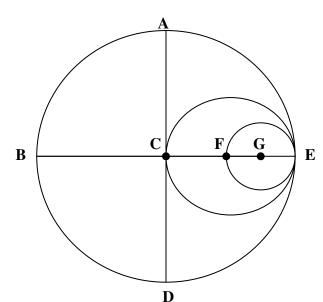# 10.1 Circles and Circumference Notes

C, F, and G are centers of circles, find the following values if CB = 20.
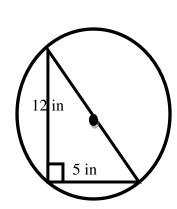

CF =

FE =

FG =

CD =

Circumference –

Ex: Find the missing measures

1. r = 12
find C and d

2. d = 7
find C and r

3. C = 77.8
find r and d

4. Find the exact circumference of the circle.
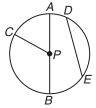

12 in

5 in

10-1 Skills Practice

Circles and Circumference

For Exercises 1–5, refer to the circle at the right.

1. Name the circle.

2. Name a radius.

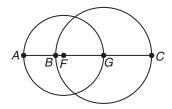3. Name a chord.

4. Name a diameter.

5. Name a radius not drawn as part of a diameter.

6. Suppose the diameter of the circle is 16 centimeters. Find the radius.

7. If $PC = 11$ inches, find AB.

The diameters of $\odot F$ and $\odot G$ are 5 and 6 units, respectively. Find each measure.

8. BF

9. AB

The radius, diameter, or circumference of a circle is given. Find the missing measures to the nearest hundredth.

10. $r = 8$ cm

$d =$ _____, $C \approx$ _____

11. $r = 13$ ft

$d =$ _____, $C \approx$ _____

12. $d = 9$ m

$r =$ _____, $C \approx$ _____

13. $C = 35.7$ in.

$d \approx$ _____, $r \approx$ _____

Find the exact circumference of each circle.

14.

3 cm

15.

8 ft

15 ft

Central Angle –

Type of arc:	Minor Arc	Major Arc	Semicircle
Definition:			
Example:			
Named:			
Arc Degree Measure Equals:			

<u>Arc Addition Postulate</u> -

Ex:
1. If $\angle$ BEC = 52° and arc BCD is a semicircle
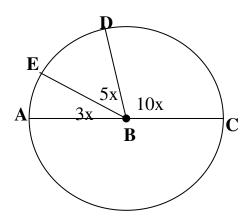
$\angle AEB$ = mBC =

$\angle CED$ = mCD =

mBCD = mACB =

2. AC is a diameter

Find $\angle ABE$ Find $\angle EBC$

<u>Arc Length</u> -

Ex: Find the length of each arc for the given angle of a circle with radius of 30cm.

1. AC if $\angle ABC = 120$ 2. DF if $\angle DEF = 45$ 3. JL if $\angle JKL = 85$
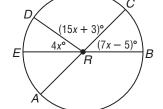
10-2 Skills Practice

Measuring Angles and Arcs

ALGEBRA In $\odot R$, $\overline{AC}$ and $\overline{EB}$ are diameters. Find each measure.

1. $m\angle ERD$ 2. $m\angle CRD$

3. $m\angle BRC$ 4. $m\angle ARB$

5. $m\angle ARE$ 6. $m\angle BRD$

In $\odot A$, $m\angle PAU = 40$, $\angle PAU \cong \angle SAT$, and $\angle RAS \cong \angle TAU$. Find each measure.

7. $m\widehat{PQ}$ 8. $m\widehat{PQR}$
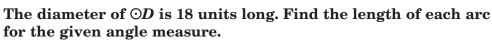
9. $m\widehat{ST}$ 10. $m\widehat{RS}$

11. $m\widehat{RSU}$ 12. $m\widehat{STP}$

13. $m\widehat{PQS}$ 14. $m\widehat{PRU}$

The diameter of $\odot D$ is 18 units long. Find the length of each arc for the given angle measure.
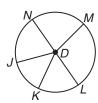
15. $\widehat{LM}$ if $m\angle LDM = 100$ 16. $\widehat{MN}$ if $m\angle MDN = 80$

17. $\widehat{KL}$ if $m\angle KDL = 60$ 18. $\widehat{NJK}$ if $m\angle NDK = 120$

19. $\widehat{KLM}$ if $m\angle KDM = 160$ 20. $\widehat{JK}$ if $m\angle JDK = 50$

Lesson 10-2
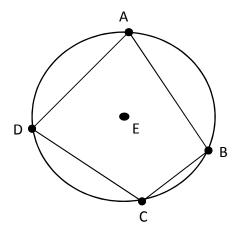
10.3 Arcs and Chords Notes

Theorem 1:

Example:

Theorem 2:

Example:

Theorem 3:

Example:

10.3 Arcs and Chords Notes

<u>Inscribed</u>:

<u>Circumscribed</u>:

All central angles of a regular polygon are congruent and add to 360°. The same is true for each arc of the circle circumscribed about the regular polygon.

Ex: Find the measure for each arc of the circle circumscribed about the given polygon:

    1. Regular Pentagon   2. Regular Hexagon
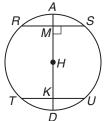
10-3 Skills Practice

Arcs and Chords

In ⊙H, $m\widehat{RS} = 82$, $m\widehat{TU} = 82$, $RS = 46$, and $\overline{TU} \cong \overline{RS}$.
Find each measure.

1. TU

2. TK

3. MS

4. $m\angle HKU$

5. $m\widehat{AS}$

6. $m\widehat{AR}$
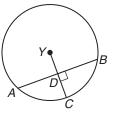
7. $m\widehat{TD}$

8. $m\widehat{DU}$

The radius of ⊙Y is 34, $AB = 60$, and $m\widehat{AC} = 71$. Find each
measure.

9. $m\widehat{BC}$

10. $m\widehat{AB}$

11. AD

12. BD

13. YD

14. DC

In ⊙X, $LX = MX$, $XY = 58$, and $VW = 84$. Find each measure.

15. YZ

16. YM

17. MX

18. MZ

19. LV

20. LX
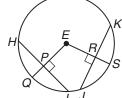
10-3 Practice

Arcs and Chords

In ⊙*E*, $m\widehat{HQ} = 48$, *HI* = *JK*, and *JR* = 7.5. Find each measure.

1. $m\widehat{HI}$

2. $m\widehat{QI}$

3. $m\widehat{JK}$
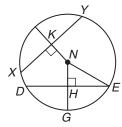
4. *HI*

5. *PI*

6. *JK*
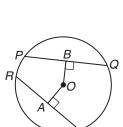
The radius of ⊙*N* is 18, *NK* = 9, and $m\widehat{DE} = 120$. Find each measure.

7. $m\widehat{GE}$

8. $m\angle HNE$

9. $m\angle HEN$

10. *HN*
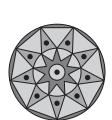
The radius of ⊙*O* = 32, $\widehat{PQ} \cong \widehat{RS}$, and *PQ* = 56. Find each measure.

11. *PB*

14. *BQ*

12. *OB*
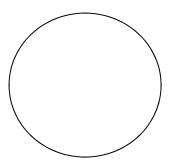
16. *RS*
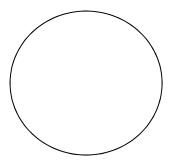
13. MANDALAS The base figure in a mandala design is a nine-pointed star. Find the measure of each arc of the circle circumscribed about the star.

Lesson 10-3

10.4 Inscribed Angles
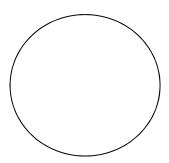
Inscribed Angle –
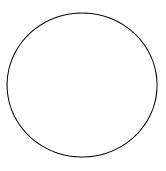
If an angle is inscribed then

If two inscribed angles intercept congruent arcs or the same arc then
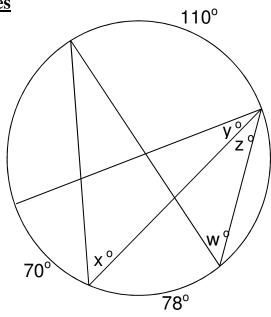
If a quadrilateral is inscribed in a circle then
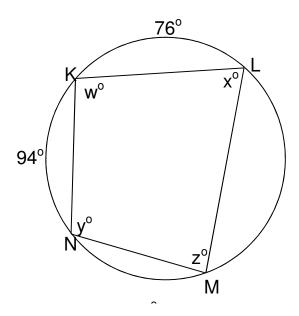
10.4 Inscribed Angles

1. Find w, x, y, and z

110°

70°

78°

x°

w°

y°

z°

2. Find w, x, y, and z

76°

K

L

94°

w°

x°

N

y°

z°

M
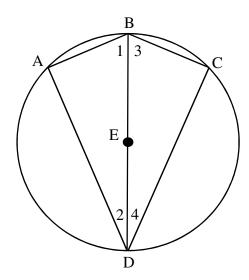
3. Find the measure of each numbered angle if:

$$m\angle 1 = 5x + 2, \quad m\angle 2 = 2x - 3$$
$$m\angle 3 = 7y - 1, \quad m\angle 4 = 2y + 10$$

B

A

1 3

C

E

2 4

D
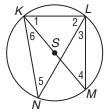
10-4 Skills Practice

Inscribed Angles

In $\odot S$, $m\widehat{KL} = 80$, $m\widehat{LM} = 100$, and $m\widehat{MN} = 60$. Find the measure of each angle.

1. $m\angle 1$

2. $m\angle 2$

3. $m\angle 3$

4. $m\angle 4$

5. $m\angle 5$

6. $m\angle 6$
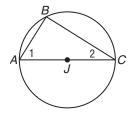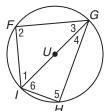
ALGEBRA Find the measure of each numbered angle for each figure.

7. $m\angle 1 = 5x - 2$, $m\angle 2 = 2x + 8$

8. $m\angle 1 = 5x$, $m\angle 3 = 3x + 10$, $m\angle 4 = y + 7$, $m\angle 6 = 3y + 11$
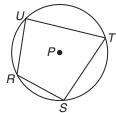
Quadrilateral $RSTU$ is inscribed in $\odot P$ such that $m\widehat{STU} = 220$ and $m\angle S = 95$. Find each measure.

9. $m\angle R$

10. $m\angle T$

11. $m\angle U$
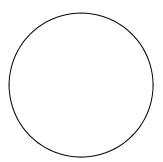
12. $m\widehat{SRU}$

13. $m\widehat{RUT}$

14. $m\widehat{RST}$

Lesson 10-4
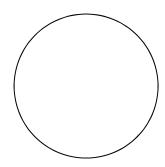
10.5 Tangents Notes
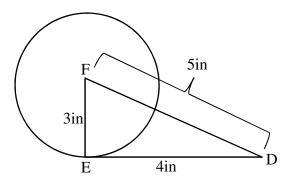
Tangent –
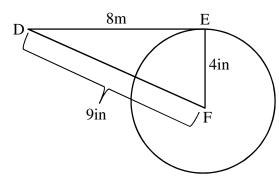
Perpendicular Tangent Theorem
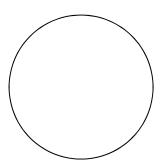
Examples: Determine if $\overline{ED}$ is tangent to circle F.

F
5in
3in
E   4in   D

8m   E
D
4in
9in   F
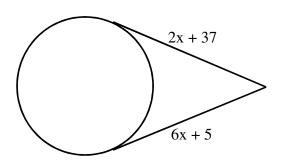
10.5 Tangents Notes
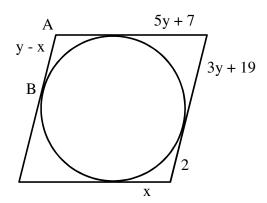
<u>"Ice Cream Cone" Theorem</u>

Examples:
Find x

2x + 37

6x + 5

Find x, y, and AB

A

5y + 7

y - x

B

3y + 19

2

x

10-5 Skills Practice
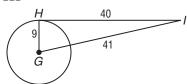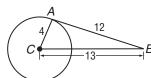
Tangents

Determine whether each segment is tangent to the given circle.

1. $\overline{HI}$
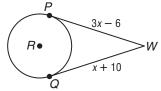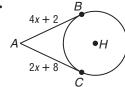
2. $\overline{AB}$
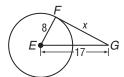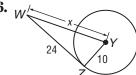
Find x. Assume that segments that appear to be tangent are tangent.

3.

4.

5.

6.
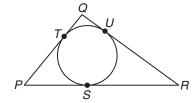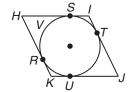
Find the perimeter of each polygon for the given information. Assume that segments that appear to be tangent are tangent.

7. $QT = 4, PT = 9, SR = 13$
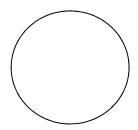
8. $HIJK$ is a rhombus, $SI = 5, HR = 13$
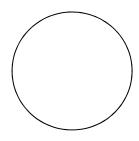
10.6 Secants, Tangents, and Angle Measures Notes
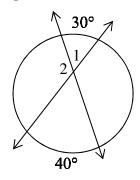
Secant –
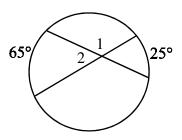
If two chords (or secants) intersect in the interior of a circle then . . .
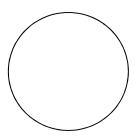
Examples: Find ∠1 and ∠2

30°

1
2

40°

65°

1
2

25°
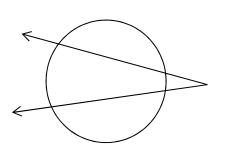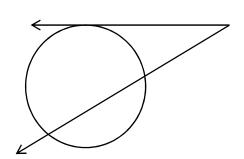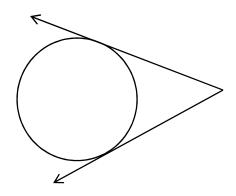
If an inscribed angle is formed by a tangent and a chord then . . .
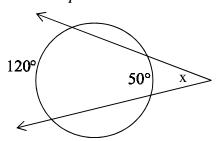
If an angle is formed in the exterior of a circle then . . .

Examples: Find x

120°
50°   x

x   47°

70°   x
150°
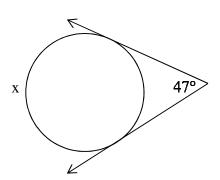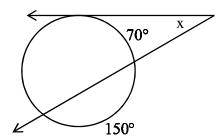
10-6 Study Guide and Intervention
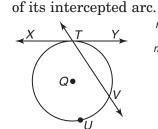
Secants, Tangents, and Angle Measures

Intersections On or Inside a Circle A line that intersects a circle in exactly two points is called a **secant**. The measures of angles formed by secants and tangents are related to intercepted arcs.

• If two secants intersect in the interior of a circle, then the measure of the angle formed is one-half the sum of the measure of the arcs intercepted by the angle and its vertical angle.

$$m\angle 1 = \frac{1}{2}(m\overset{\frown}{PR} + m\overset{\frown}{QS})$$

• If a secant and a tangent intersect at the point of tangency, then the measure of each angle formed is one-half the measure of its intercepted arc.

$$m\angle XTV = \frac{1}{2}m\overset{\frown}{TUV}$$
$$m\angle YTV = \frac{1}{2}m\overset{\frown}{TV}$$

Example 1 **Find x.**

The two secants intersect inside the circle, so x is equal to one-half the sum of the measures of the arcs intercepted by the angle and its vertical angle.

$$x = \frac{1}{2}(30 + 55)$$
$$= \frac{1}{2}(85)$$
$$= 42.5$$

Example 2 **Find y.**

The secant and the tangent intersect at the point of tangency, so the measure of the angle is one-half the measure of its intercepted arc.
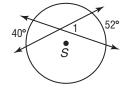
$$y = \frac{1}{2}(168)$$
$$= 84$$

Exercises

Find each measure.

1. $m\angle 1$

2. $m\angle 2$

3. $m\angle 3$

4. $m\angle 4$

5. $m\angle 5$
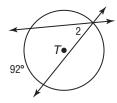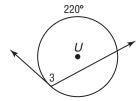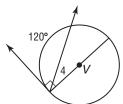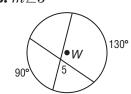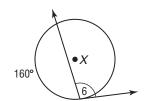
6. $m\angle 6$
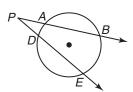
10-6 Study Guide and Intervention *(continued)*
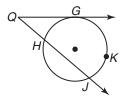
Secants, Tangents, and Angle Measures

Intersections Outside a Circle If secants and tangents intersect outside a circle, they form an angle whose measure is related to the intercepted arcs.
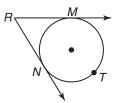
If two secants, a secant and a tangent, or two tangents intersect in the exterior of a circle, then the measure of the angle formed is one-half the positive difference of the measures of the intercepted arcs.

$\overrightarrow{PB}$ and $\overrightarrow{PE}$ are secants.

$m\angle P = \frac{1}{2}(m\widehat{BE} - m\widehat{AD})$

$\overrightarrow{QG}$ is a tangent. $\overrightarrow{QJ}$ is a secant.

$m\angle Q = \frac{1}{2}(m\widehat{GKJ} - m\widehat{GH})$

$\overrightarrow{RM}$ and $\overrightarrow{RN}$ are tangents.

$m\angle R = \frac{1}{2}(m\widehat{MTN} - m\widehat{MN})$
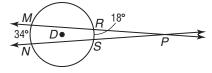
Example Find $m\angle MPN$.

$\angle MPN$ is formed by two secants that intersect in the exterior of a circle.

$m\angle MPN = \frac{1}{2}(m\widehat{MN} - m\widehat{RS})$

$\qquad = \frac{1}{2}(34 - 18)$

$\qquad = \frac{1}{2}(16)$ or 8
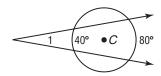
The measure of the angle is 8.

Exercises

Find each measure.

1. $m\angle 1$

2. $m\angle 2$

3. $m\angle 3$

4. x

5. x

6. x
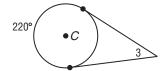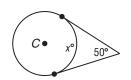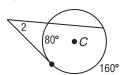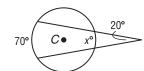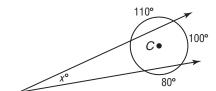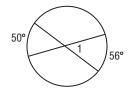
10-6 Skills Practice
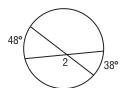
Secants, Tangents, and Angle Measures
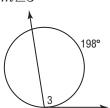
Find each measure.

1. $m\angle 1$

2. $m\angle 2$

3. $m\angle 3$
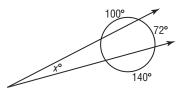
4. $m\angle 4$

5. $m\angle 5$

6. $m\angle 6$
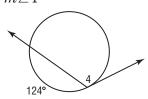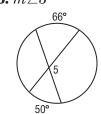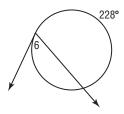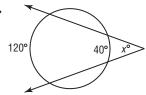
Find x. Assume that any segment that appears to be tangent is tangent.
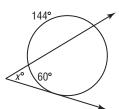
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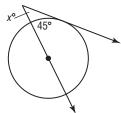
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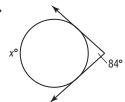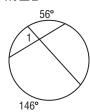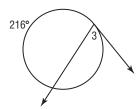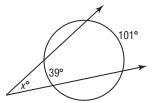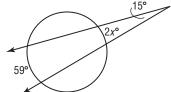**9.**
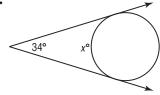
10.

11.

12.

10-6 Practice

Secants, Tangents, and Angle Measures

Find each measure.

1. $m\angle 1$

56°
1
146°

2. $m\angle 2$

134°
2

3. $m\angle 3$

216°
3

Find x. Assume that any segment that appears to be tangent is tangent.

7.

101°
39°
$x°$

8.

15°
$2x°$
59°

9.

62°
116°
$x°$

10.

63°
$x°$
$5x°$

11.

52°
$x°$

12.

37°
$x°$
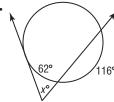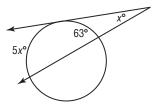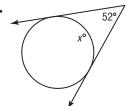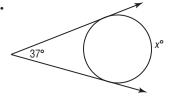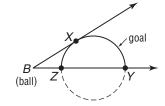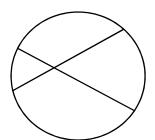
9. RECREATION In a game of kickball, Rickie has to kick the ball through a semicircular goal to score. If $m\widehat{XZ} = 58$ and the $m\widehat{XY} = 122$, at what angle must Rickie kick the ball to score? Explain.

X
goal
B
(ball)
Z
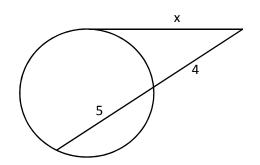Y
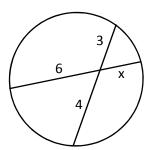
10.7 Special Segments in a Circle Notes
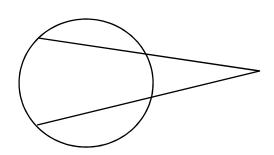
Two Chords
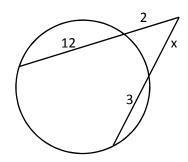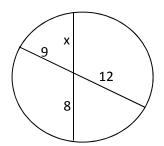

EXAMPLES: Find x in each figure
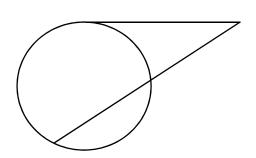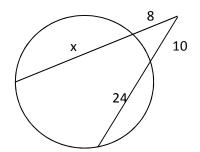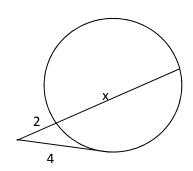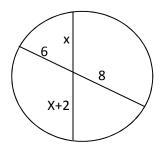

Two Secants

Tangent – Secant

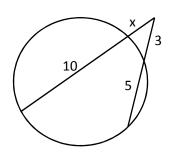# 10.7 Special Segments in a Circle Notes
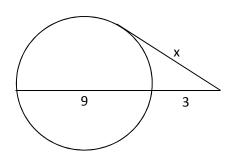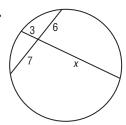
Find x in each figure

10-7 Skills Practice

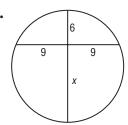### Special Segments in a Circle

Find x to the nearest tenth if necessary. Assume that segments that appear to be tangent are tangent.
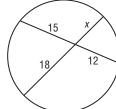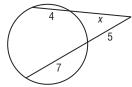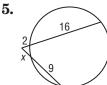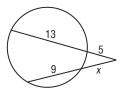
1.

2.

3.

4.

5.

6.

7.

8.

9.