# CHAPTER 10

### Think & Discuss *(p. 593)*

**1.** point $B$ **2.** one

**3.** The fireworks would not be so high above the Earth. The ships would be smaller and closer together.

### *Chapter 10 Study Guide (p. 594)*

**1.**
$$(x + 4)^2 = x^2 + 6^2$$
$$x^2 + 8x + 16 = x^2 + 36$$
$$8x - 20 = 0$$
$$8x = 20$$
$$x = \tfrac{5}{2}$$

**2.**
$$132 = \tfrac{1}{2}[(360 - x) - x]$$
$$264 = 360 - 2x$$
$$-96 = -2x$$
$$x = 48$$

**3.**
$$15(y + 15) = 24^2$$
$$15y + 225 = 576$$
$$15y = 351$$
$$y = \tfrac{117}{5} \text{ or } 23\tfrac{2}{5}$$

**4.**
$$2z^2 + 7 = 19$$
$$2z^2 = 12$$
$$z^2 = 6$$
$$z = \pm\sqrt{6}$$

**5.**
$$8^2 = x(x + 12)$$
$$64 = x^2 + 12x$$
$$x^2 + 12x - 64 = 0$$
$$(x + 16)(x - 4) = 0$$
$$x + 16 = 0 \qquad x - 4 = 0$$
$$x = -16 \qquad x = 4$$

**6.**
$$x + y = 18$$
$$3x + 4y = 64$$
$$3(18 - y) + 4y = 64$$
$$54 - 3y + 4y = 64$$
$$y = 10$$
$$x = 18 - y$$
$$x = 18 - 10$$
$$x = 8$$

Solution: (8, 10)

**7.**
$$8^2 + 9^2 = (JL)^2 \qquad \sin L = \frac{8}{\sqrt{145}} \qquad \sin J = \frac{9}{\sqrt{145}}$$
$$JL = \sqrt{145} \qquad m\angle L \approx 41.6^\circ \qquad m\angle J \approx 48.4^\circ$$
$$\approx 12.0$$

**8.** $A(-3, 0)$, $B(9, -9)$

**a.** $AB = \sqrt{(-3 - 9)^2 + (0 + 9)^2}$
$$= 15$$

**b.** midpoint of $\overline{AB} = \left(\frac{-3 + 9}{2}, \frac{0 - 9}{2}\right)$
$$= \left(3, -4\frac{1}{2}\right)$$

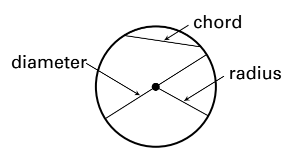
**c.**
$$m = \frac{0 + 9}{-3 - 9} = \frac{9}{-12} = -\frac{3}{4}$$
$$0 = \left(-\frac{3}{4}\right)(-3) + b$$
$$-\frac{9}{4} = b$$

equation: $y = -\frac{3}{4}x - \frac{9}{4}$

**d.** the segment with endpoints $A'(-7, 0)$ and $B'(5, -9)$

### *10.1 Guided Practice (p. 599)*

**1.**




**2.** Both a chord and a secant intersect a circle at two points. A chord is a line segment having its endpoints on the circle, while a secant is a line that passes through two points on a circle.

**3.** $m\angle CPX = 90^\circ$; According to Thm. 10.1, $\overleftrightarrow{XY}$ is perpendicular to $\overline{CP}$. Perpendicular lines form right angles. Therefore $m\angle CPX = 90^\circ$.

**4.** 6.5 cm

**5.** No; $5^2 + 5^2 \neq 7^2$, so by the Converse of the Pythagorean Thm., $\triangle ABD$ is not a right $\triangle$, so $\overline{BD}$ is not $\perp$ to $\overline{AB}$. If $\overleftrightarrow{BD}$ were tangent to $\odot C$, $\angle B$ would be a right angle. Thus, $\overleftrightarrow{BD}$ is not tangent to $\odot C$.

**6.** 4 **7.** 2 **8.** 5

### *10.1 Practice and Applications (pp. 599–602)*

**9.** $r = 7.5$ cm **10.** $r = 3.35$ in. **11.** $r = 1.5$ ft

**12.** $r = 4$ cm **13.** $d = 52$ in. **14.** $d = 124$ ft

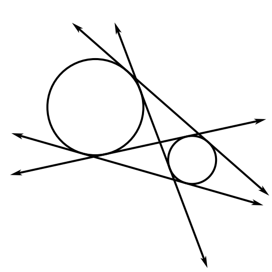
**15.** $d = 17.4$ in. **16.** $d = 8.8$ cm

**17.** $\odot C$ and $\odot G$ are congruent because they have the same radius, 22.5.

**18.** B **19.** E **20.** F **21.** D **22.** A **23.** C **24.** H

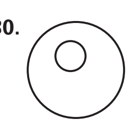
**25.** G **26.** external **27.** internal **28.** internal

**29.**

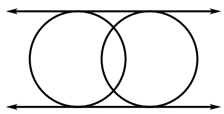


4 common tangents
(2 external, 2 internal)

**30.**



no common tangents

**31.** 

2 common external tangents

**32.** center is (2, 2)
radius is 2 units

**33.** center is (6, 2); radius is 2 units

**34.** The two circles intersect at one point, (4, 2).

**35.** The two circles have three common tangents, the lines with equations $x = 4$, $y = 0$, and $y = 4$.

**36.** No; $5^2 + 14^2 \neq 15^2$, so by the Converse of the Pythagorean Thm., $\triangle ABC$ is not a right $\triangle$, so $\overline{AB}$ is not $\perp$ to $\overline{AC}$. Then $\overleftrightarrow{AB}$ is not tangent to $\odot C$.

**37.** No; $5^2 + 15^2 \neq 17^2$, so by the Converse of the Pythagorean Thm., $\triangle ABC$ is not a right $\triangle$, so $\overline{AB}$ is not $\perp$ to $\overline{AC}$. Then, $\overleftrightarrow{AB}$ is not tangent to $\odot C$.

**38.** Yes; $16^2 + 12^2 = 20^2$, so by the Pythagorean Thm. $\triangle ABC$ is a right $\triangle$, so $\overline{AB} \perp \overline{AC}$. Therefore, $\overleftrightarrow{AB}$ is tangent to $\odot C$.

**39.** Yes; $20^2 + 21^2 = 29^2$, so by the Pythagorean Thm., $\triangle ABC$ is a right $\triangle$, so $\overline{AB} \perp \overline{AC}$. Therefore, $\overleftrightarrow{AB}$ is tangent to $\odot C$.

**40.**
$$28^2 + r^2 = (r + 8)^2$$
$$784 + r^2 = r^2 + 16r + 64$$
$$16r - 720 = 0$$
$$16r = 720$$
$$r = 45 \text{ ft}$$

**41.**
$$d = 45 + 8$$
$$= 53 \text{ ft}$$

**42.** $\overleftrightarrow{AF}$, $\overleftrightarrow{BE}$ **43.** $\overline{GD}$, $\overline{HC}$, $\overline{FA}$, or $\overline{EB}$

**44.** Yes; $\overline{HC}$ is a chord. A diameter of a circle is the longest chord of the circle.

**45.** $\overline{JK}$

**46.**
$$2x + 7 = 5x - 8$$
$$15 = 3x$$
$$x = 5$$

**47.**
$$5x^2 + 9 = 14$$
$$5x^2 = 5$$
$$x^2 = 1$$
$$x = \pm 1$$

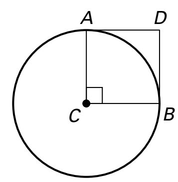
**48.**
$$2x + 5 = 3x^2 + 2x - 7$$
$$3x^2 - 12 = 0$$
$$x^2 = 4$$
$$x = \pm 2$$

**49.** $\overleftrightarrow{PS}$ is tangent to $\odot X$ at $P$, $\overleftrightarrow{PS}$ is tangent to $\odot Y$ at $S$, $\overleftrightarrow{RT}$ is tangent to $\odot X$ at $T$, and $\overleftrightarrow{RT}$ is tangent to $\odot Y$ at $R$. Then, $\overline{PQ} \cong \overline{TQ}$ and $\overline{QS} \cong \overline{QR}$. (2 tangent segments with the same exterior endpoint are $\cong$.) By the def. of congruence, $PQ = TQ$ and $QS = QR$, so $PQ + QS = TQ + QR$ by the addition prop. of equality. Then, by the Segment Addition Post. and the Substitution prop., $PS = RT$ or $\overline{PS} \cong \overline{RT}$.

**50.** $QR > QP$ **51.** $QP > QR$

**52.** The statements $QR > QP$ and $QP > QR$ cannot both be true at once. Therefore, the assumption that $\ell$ and $\overline{QP}$ are not perpendicular must be false. Then $\ell \perp \overline{QP}$.

**53.** Assume that $\ell$ is not tangent to $P$, that is, there is another point $X$ on $\ell$ that is also on $\odot Q$. $X$ is on $\odot Q$, so $QX = QP$. But the perpendicular segment from $Q$ to $\ell$ is the shortest such segment, so $QX > QP$. $QX$ cannot be both equal to and greater than $QP$. The assumption that such a point $X$ exists must be false. Then $\ell$ is tangent to $P$.

**54.** 

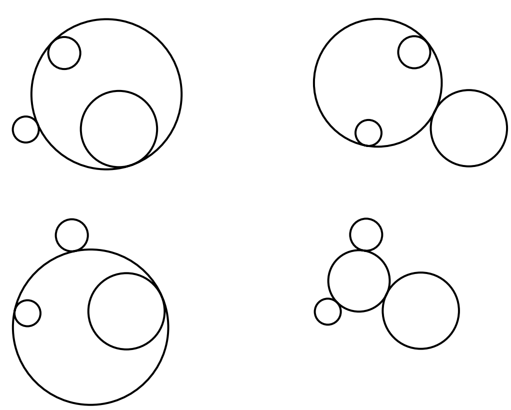

**55.** Square; $\overline{BD}$ and $\overline{AD}$ are tangent to $\odot C$ at $A$ and $B$, respectively, so $\angle A$ and $\angle B$ are right angles. Then, by the Interior Angles of a Quadrilateral Thm., $\angle D$ is also a right angle. Then $CABD$ is a rectangle. Opposite sides of a rectangle are congruent, so $\overline{CA} \cong \overline{BD}$ and $\overline{AD} \cong \overline{CB}$. But $\overline{CA}$ and $\overline{CB}$ are radii, so $\overline{CA} \cong \overline{CB}$ and by the Transitive Prop. of Congruence, all 4 sides of $CABD$ are congruent. $CABD$ is both a rectangle and a rhombus, so it is a square by the Square Corollary.

**56. a.** $m = \dfrac{5 - 3}{4 - 8} = -\dfrac{1}{2}$

**b.** The slope of $j$ is 2. Since $j$ is tangent to $\odot C$ at $P$, $\overline{CP} \perp j$. The slopes of 2 perpendicular lines are negative reciprocals of each other. The slope of $\overline{CP}$ is $-\frac{1}{2}$, so the slope of $j$ is 2.

**c.**
$$3 = 8(2) + b$$
$$-13 = b$$
$$y = 2x - 13$$

**d.** Choose any point $Q$ on the circle, determine the slope of $\overline{CQ}$, the radius to that point, and use its negative reciprocal along with the coordinates of $Q$ to find the equation.

**57.** 

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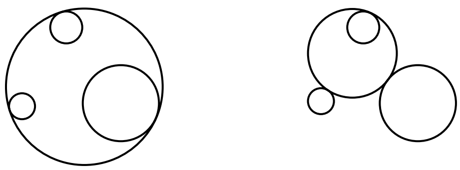


##### *10.1 Mixed Review (p. 602)*

**58.** Let $x$ represent the length of the third side.

$4 + 10 > x \qquad 4 + x > 10$

$14 > x \qquad x > 6$

$6 < x < 14$

**59.** Since the slope of $\overline{PS} = \frac{3}{8} =$ slope of $\overline{QR}$, $\overline{PS} \parallel \overline{QR}$. Since the slope of $\overline{PQ} = -3 =$ slope of $\overline{SR}$, $\overline{PQ} \parallel \overline{SR}$. Then, $PQRS$ is a parallelogram by def.

**60.** $PQ = \sqrt{125} = SR$ so $\overline{PQ} \cong \overline{SR}$.
$PS = \sqrt{41} = QR$ so $\overline{PS} \cong \overline{QR}$.
Then $PQRS$ is a parallelogram by Thm. 6.6.

**61.** $\frac{x}{11} = \frac{3}{5}$, $5x = 33$, $x = 6\frac{3}{5}$

**62.** $\frac{x}{6} = \frac{9}{2}$, $2x = 54$, $x = 27$

**63.** $\frac{x}{7} = \frac{12}{3}$, $3x = 84$, $x = 28$

**64.** $\frac{33}{x} = \frac{18}{42}$, $18x = 1386$, $x = 77$

**65.** $\frac{10}{3} = \frac{8}{x}$, $10x = 24$, $x = 2\frac{2}{5}$

**66.** $\frac{3}{x+2} = \frac{4}{x}$, $3x = 4x + 8$, $-8 = x$

**67.** $\frac{2}{x-3} = \frac{3}{x}$, $2x = 3x - 9$, $9 = x$

**68.** $\frac{5}{x-1} = \frac{9}{2x}$, $10x = 9x - 9$, $x = -9$

**69.** $14^2 + 6^2 = (AC)^2$, $AC = 2\sqrt{58} \approx 15.2$; $\tan A = \frac{6}{14}$, $m\angle A \approx 23.2°$; $\tan C = \frac{14}{6}$, $m\angle C \approx 66.8°$

**70.** $\sin 43° = \frac{10}{AB}$, $AB \approx 14.7$; $m\angle A = 90° - 43° = 47°$; $\tan 43° = \frac{10}{CB}$, $CB \approx 10.7$

**71.** $8^2 + (CB)^2 = 14^2$, $CB \approx 11.5$; $\sin B = \frac{8}{14}$, $m\angle B \approx 34.8°$; $\cos A = \frac{8}{14}$, $m\angle A \approx 55.2°$

## Lesson 10.2

##### *10.2 Guided Practice (p. 607)*

**1.** minor arc

**2.** $m\overset{\frown}{KL} = 72°$; $m\overset{\frown}{MN} = 72°$; no, $\overset{\frown}{KL}$ and $\overset{\frown}{MN}$ are not arcs of the same ⊙ nor of ≅ ⊙s.

**3.** 60° **4.** 300° **5.** 180° **6.** 100° **7.** 220° **8.** 40°

**9.** $\overline{BC}$ is a diameter; a chord that is the perpendicular bisector of another chord is a diameter.

**10.** *Sample answer:* $m\overset{\frown}{AB} = m\overset{\frown}{AC} + m\overset{\frown}{CB}$; the measure of the arc formed by two adjacent arcs is the sum of the measures of the two arcs.

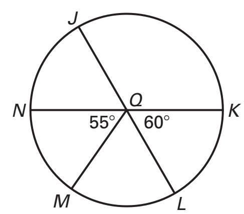
**11.** $\overline{BC} \cong \overline{CA}$, $\overset{\frown}{BD} \cong \overset{\frown}{DA}$; if a diameter of a circle is perpendicular to a chord, then the diameter bisects the chord and its arc.

##### *10.2 Practice and Applications (pp. 607–611)*

**12.** minor arc **13.** minor arc **14.** semicircle

**15.** minor arc **16.** major arc **17.** semicircle

**18.** major arc **19.** major arc **20.** 60°




**21.** 55° **22.** 300° **23.** 305°

**24.** 180° **25.** 180° **26.** 60°

**27.** 65° **28.** 60° **29.** 65°

**30.** 115° **31.** 120°

**32.** 145° **33.** 145° **34.** 145°

**35.** $\overset{\frown}{AC} \cong \overset{\frown}{KL}$ and $\overset{\frown}{ABC} \cong \overset{\frown}{KML}$; ⊙$D$ and ⊙$N$ are congruent (both have radius 4). By the Arc Add. Post., $m\overset{\frown}{AC} = m\overset{\frown}{AE} + m\overset{\frown}{EC} = 70° + 75° = 145°$. $m\overset{\frown}{KL} = 145°$ and since ⊙$D$ ≅ ⊙$N$, $\overset{\frown}{AC} \cong \overset{\frown}{KL}$; $m\overset{\frown}{ABC} = 360° - m\overset{\frown}{AC} = 360° - 145° = 215°$.

$m\overset{\frown}{KML} = m\overset{\frown}{KM} + m\overset{\frown}{ML} = 130° + 85° = 215°$ by the Arc Add. Post. Since ⊙$D$ ≅ ⊙$N$, $\overset{\frown}{ABC} \cong \overset{\frown}{KML}$.

**36.** $x + 2x - 30 = 180$, $3x = 210$, $x = 70$; $m\overset{\frown}{BC} = [2(70) - 30]° = 110°$

**37.** $4x + x = 180$, $5x = 180$, $x = 36$; $m\overset{\frown}{MB} = [4(36)]° = 144°$

**38.** $4x + 6x + 2(7x) = 360$, $24x = 360$, $x = 15$; $m\overset{\frown}{RST} = 6x° + 7x° = 13(15°) = 195°$

**39.** $\overset{\frown}{AB} \cong \overset{\frown}{CB}$; in a ⊙, 2 minor arcs are congruent if and only if their corresponding chords are congruent.

**40.** $\overline{AB} \cong \overline{CD}$; in a ⊙, 2 minor arcs are congruent if and only if their corresponding chords are congruent.

**41.** $\overline{AB} \cong \overline{AC}$; in a circle, 2 chords are congruent if and only if they are equidistant from the center.

**42.** $ED = 10$; in a circle, 2 chords are congruent if and only if they are equidistant from the center.

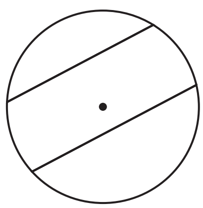
**43.** 40°; a diameter that is perpendicular to a chord bisects the chord and its arc.

**44.** 170°; 2 minor arcs are the same measure if their chords are the same measure ( $\overline{BD} \cong \overline{CE}$, so $m\widehat{BED} = 110° + 60° = 170° = m\widehat{CDE}$ ).

**45.** 15; in a circle, 2 chords are congruent if and only if they are equidistant from the center.

**46.** 7; if a diameter of a circle is perpendicular to a chord, then the diameter bisects the chord and its arc.

**47.** 40°; Vertical Angles Thm., def. of minor arc

**48.**  farther from the center

**49.** 15° **50.** 90° **51.** 3:00 A.M.

**52.** During step 1, the ski patrol marks off a chord of a circle. During steps 2 and 3, the patrol marks off a diameter of the circle, because this line is the perpendicular bisector of the chord from step 1. The midpoint of the diameter is the center of the circle.

**53.** This follows from the definition of the measure of a minor arc. (The measure of a minor arc is the measure of its central angle.) If 2 minor arcs in the same circle or congruent circles are congruent, then their central angles are congruent. Conversely, if 2 central angles of the same circle or congruent circles are congruent, then the measures of the associated arcs are congruent.

**54.** Circles may vary; *Sample answer:* to find the center, draw a chord with the straightedge and construct its perpendicular bisector. Extend the perpendicular bisector so it touches 2 points on the circle. Construct the perpendicular bisector of the chord determined by the 2 points to find its midpoint, which will be the center of the circle.

**55.** Yes; construct the perpendiculars from the center of the circle to each chord. Use a compass to compare the lengths of the segments.

**56.** $\overline{AB} \cong \overline{DC}$; $\overline{AP}$, $\overline{PB}$, $\overline{PC}$ and $\overline{PD}$ are all radii, so they are all congruent. Therefore, $\triangle APB \cong \triangle DPC$ by the SSS Congruence Post. Since the 2 triangles are congruent, $\angle APB \cong \angle DPC$ because corresponding parts of congruent triangles are congruent. By def. of congruent arcs, $\widehat{AB} \cong \widehat{DC}$.

**57.** Since $\widehat{AB} \cong \widehat{DC}$, $\angle APB \cong \angle CPD$ by the def. of congruent arcs. $\overline{PA}$, $\overline{PB}$, $\overline{PC}$, and $\overline{PD}$ are all radii of $\odot P$, so $\overline{PA} \cong \overline{PB} \cong \overline{PC} \cong \overline{PD}$. Then $\triangle APB \cong \triangle CPD$ by the SAS Congruence Post., so corresponding sides $\overline{AB}$ and $\overline{DC}$ are congruent.

**58.** You would have to use the definition of $\cong$ ⊙s and the Transitive Prop. of Cong. to show that the appropriate sides and ∠s are $\cong$.

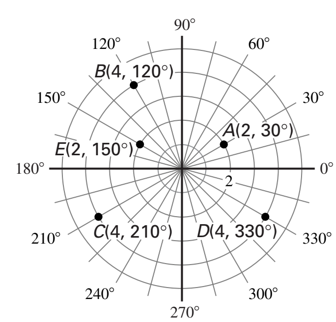
**59.** Draw radii $\overline{LG}$ and $\overline{LH}$. $\overline{LG} \cong \overline{LH}$, $\overline{LJ} \cong \overline{LJ}$, and since $\overline{EF} \perp \overline{GH}$, $\triangle LGJ \cong \triangle LHJ$ by the HL Congruence Thm. Then, corresponding sides $\overline{GJ}$ and $\overline{JH}$ are congruent as are corresponding angles $GLJ$ and $HLJ$. By the def. of congruent arcs, $\widehat{GE} \cong \widehat{EH}$.

**60.** Assume center $L$ is not on $\overline{EF}$. $\overline{GL} \cong \overline{HL}$ because both are radii. $\overline{GJ} \cong \overline{HJ}$ because $\overline{EF}$ is the perp. bisector of $\overline{GH}$ and $\overline{LJ} \cong \overline{LJ}$ by the Reflexive Prop. $\triangle GLJ \cong \triangle HLJ$ by the SSS Congruence Post. $\angle GJL \cong \angle HJL$, because corresponding parts of congruent triangles are congruent. Since $\angle GJL$ and $\angle HJL$ form a linear pair and are congruent, both must be right angles. Therefore, $\overline{JL} \perp \overline{GH}$. Then $\overline{EF}$ and $\overline{JL}$ are both perpendicular to $\overline{GH}$ through $J$. This contradicts the Perpendicular Postulate. The assumption that center $L$ is not on $\overline{EF}$ must be incorrect, so $L$ is on $\overline{EF}$. Therefore, $\overline{EF}$ is a diameter of $\odot L$.

**61.** Draw radii $\overline{PB}$ and $\overline{PC}$. $\overline{PB} \cong \overline{PC}$ and $\overline{PE} \cong \overline{PF}$. Also, since $\overline{PE} \perp \overline{AB}$ and $\overline{PF} \perp \overline{CD}$, $\triangle PEB$ and $\triangle PFC$ are right triangles and are congruent by the HL Congruence Thm. Corresponding sides $\overline{BE}$ and $\overline{CF}$ are congruent, so $BE = CF$ and by the Multiplication prop. of equality, $2BE = 2CE$. By Thm. 10.5 $\overline{PE}$ bisects $\overline{AB}$ and $\overline{PF}$ bisects $\overline{CD}$, so $AB = 2BE$ and $CD = 2CF$. Then by the Substitution Prop., $AB = CD$ or $\overline{AB} \cong \overline{CD}$.

**62.** Draw radii $\overline{PB}$ and $\overline{PC}$. $\overline{PB} \cong \overline{PC}$. $\overline{PE} \perp \overline{AB}$ and $\overline{PF} \perp \overline{DC}$, so by Thm. 10.5, $\overline{PE}$ bisects $\overline{AB}$ and $\overline{PF}$ bisects $\overline{DC}$. By the definition of bisector, $\frac{1}{2}AB = BE$ and $\frac{1}{2}DC = CF$. Since $\overline{AB} \cong \overline{DC}$, then $AB = DC$ and by the Multiplication Prop. of equality, $\frac{1}{2}AB = \frac{1}{2}DC$. Then by the Substitution Prop., $BE = CF$, so $\overline{BE} \cong \overline{CF}$. $\triangle PEB$ and $\triangle PFC$ are right triangles and are congruent by the HL Congruence Thm. Therefore, $\overline{PE} \cong \overline{PF}$ because they are corresponding sides of congruent triangles.

**63.**




**64.** 120° **65.** 90° **66.** 150° **67.** 210°

**68.** **a.** Construct the perpendicular bisector of each chord. The point at which the bisectors intersect is the center of the circle. Connect the center with any point on the circle and measure the segment drawn.

**—CONTINUED—**

**68.** —CONTINUED—

**b.** Construct ⊥s to the two tangents at the points of tangency. The intersection of the ⊥s is the center of the circle. Draw a segment from the center to any point on the circle. Measure the segment drawn.

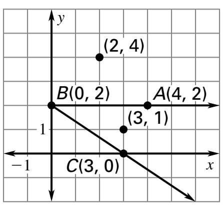
**c.** The object would have to be small enough to be traced on a piece of paper and to allow you to do constructions. If it were too small, however, it would be difficult to perform the constructions accurately.

**69.** $81 = 36 + x^2$

$x = 3\sqrt{5}$

***10.2 Mixed Review (p. 611)***

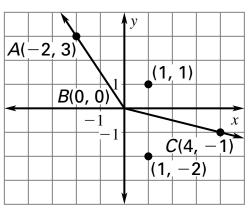
**70.**




interior: (3, 1)

exterior: (2, 4)

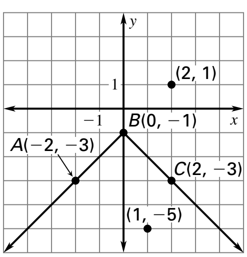
**71.**




(1, 1) lies in the interior

(−1, 2) lies in the exterior

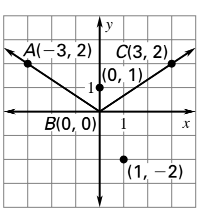
**72.**




(1, −5) lies in the interior

(2, 1) lies in the exterior

**73.**




(0, 1) lies in the interior

(1, −2) lies in the exterior

**74.** Rhombus; $PQ = QR = RS = PS = \sqrt{10}$, so $PQRS$ is a rhombus by the Rhombus Corollary.

**75.** Square; $PQ = QR = RS = PS = 3\sqrt{2}$, so $PQRS$ is a rhombus by the Rhombus Corollary; $PR = QS = 6$, so $PQRS$ is a rectangle. (A parallelogram is a rectangle if and only if its diagonals are congruent.) Then, $PQRS$ is a square by the Square Corollary.

**76.** $\frac{9}{x} = \frac{x}{16}$

$x^2 = 144$

$x = 12$

**77.** $\frac{8}{x} = \frac{x}{32}$

$x^2 = 256$

$x = 16$

**78.** $\frac{4}{x} = \frac{x}{49}$

$x^2 = 196$

$x = 14$

**79.** $\frac{9}{x} = \frac{x}{36}$

$x^2 = 324$

$x = 18$

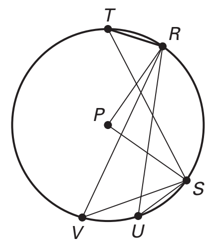
## Lesson 10.3

***Activity 10.3: Investigating Inscribed Angles (p. 612)***

*Sample answers are given.*

***Exploring the Concept***

**1–3.**



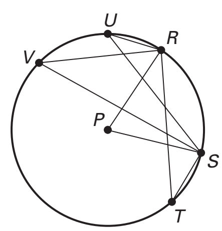

Circle 1

**Investigate**

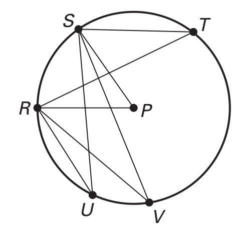
**1.**

| | $m\angle RPS$ | $m\angle RTS$ | $m\angle RUS$ | $m\angle RVS$ |
|---|---|---|---|---|
| Circle 1 | 90° | 45° | 45° | 45° |
| Circle 2 | 70° | 35° | 35° | 35° |
| Circle 3 | 56° | 28° | 28° | 28° |

**2.**




Circle 2




Circle 3

**Make a Conjecture**

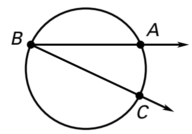
**3.** The measure of an inscribed angle is half the measure of the corresponding central angle.

**Extension**

About 77°; the star divides the ⊙ into 7 ≅ arcs, so each has measure $\frac{360°}{7}$. Each inscribed ∠ corresp. to an arc with measure $3 \cdot \frac{360°}{7} = \frac{1080°}{7}$. Then $x = \frac{1}{2} \cdot \frac{1080°}{7} = \frac{540°}{7} = 77\frac{1}{7}° \approx 77°$.

***10.3 Guided Practice (p. 616)***

**1.**




intercepted arc $\overset{\frown}{AC}$

**2.** No; according to Thm. 10.11, since the opposite angles are not supplementary, the quadrilateral cannot be inscribed in a circle.

**3.** $m\overset{\frown}{KL} = 40°$ **4.** $m\overset{\frown}{KML} = 180°$ **5.** $m\overset{\frown}{LMK} = 210°$

**6.** $x = 115$ **7.** $y = 150$, $z = 75$ **8.** $x = 95$, $y = 100$

***10.3 Practice and Applications (pp. 617–619)***

**9.** $m\overset{\frown}{CB} = 64°$ **10.** $m\overset{\frown}{BC} = 156°$ **11.** $m\overset{\frown}{BC} = 228°$

**12.** $m\angle ABC = 55°$ **13.** $m\angle ABC = 109°$

**14.** $m\angle ABC = 90°$

**15.** $x = 47$; inscribed angles $\angle EGH$ and $\angle EDH$ intercept the same arc so their measures must be the same.

**16.** $x = 90, y = 50$; $\angle MLK$ intercepts an arc whose chord is a diameter so the measure of the arc is 180° and $x = 90$; $m\angle LKM$ can be found using the Triangle Sum Thm.

**17.** $x = 45, y = 40$; inscribed angles $\angle QPR$ and $\angle QSR$ intercept the same arc and inscribed angles $\angle PQS$ and $\angle PRS$ intercept the same arc so $m\angle PQS = 40°$ and $m\angle QSR = 45°$.

**18.** $x = 90$, $y = 90$, $z = 112$ **19.** $x = 80$, $y = 78$, $z = 160$ **20.** $x = 65$, $y = 90$, $z = 180$

**21.**

$$6y + 6y + 4x = 360$$
$$12y + 4x = 360$$
$$3y + x = 90$$
$$3y + \tfrac{3}{2}y = 90$$
$$\tfrac{9}{2}y = 90$$
$$y = 20$$

$$2x = \tfrac{1}{2}(6y)$$
$$x = \tfrac{3}{2}y$$
$$x = \tfrac{3}{2}(20)$$
$$x = 30$$

$m\angle A = 60°, m\angle B = 60°, m\angle C = 60°$

**22.** $2x + 26y = 180$ Mult. by 3 $\rightarrow$ $6x + 78y = 540$

$3x + 21y = 180$ Mult. by $-2$ $\rightarrow$ $-6x - 42y = -360$

$36y = 180$

$y = 5$

$x = 25$

$m\angle A = 130°, m\angle B = 75°$

$m\angle C = 50°, m\angle D = 105°$

**23.** $4x + 24y = 180$ Mult. by 7 $\rightarrow$ $28x + 168y = 1260$

$14x + 9y = 180$ Mult. by $-2$ $\rightarrow$ $-28x - 18y = -360$

$150y = 900$

$y = 6$

$x = 9$

$m\angle A = 54°, m\angle B = 36°$

$m\angle C = 126°, m\angle D = 144°$

**24.** Yes; every angle of a square measures 90° so both pairs of opposite angles are always supplementary. Therefore the square can always be inscribed in a circle, according to Thm. 10.11.

**25.** Yes; every angle of a rectangle is a right angle so both pairs of opposite angles are always supplementary. Therefore, the rectangle can always be inscribed in a circle, according to Thm. 10.11.

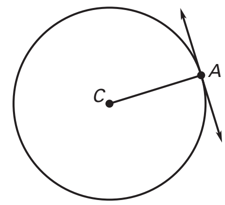
**26.** No; the opposite angles are not always supplementary, so according to Thm. 10.11, it cannot always be inscribed in a circle.

**27.** No; the opposite angles of a kite are not always supplementary, so according to Thm. 10.11, it cannot always be inscribed in a circle.

**28.** No; the opposite angles are not always supplementary, so according to Thm. 10.11, it cannot always be inscribed in a circle.

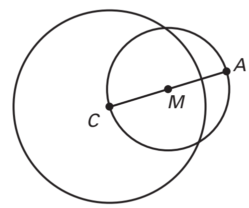
**29.** Yes; both pairs of opposite angles of an isosceles trapezoid are supplementary.

**30.**



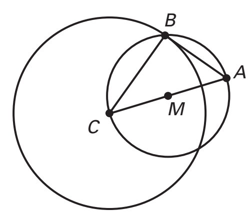

Construct a perpendicular to $\overline{AC}$ at $A$. According to Thm. 10.2, a line that is perpendicular to a radius of a circle is tangent to the circle.

**31.**




$\overline{AC}$ is a diameter of $\odot M$.

**32.**




$m\angle CBA = 90°$; since it intercepts $\overline{AC}$ which is a diameter, the measure of the intercepted arc is 180°. $\angle CBA$ is an inscribed angle so its measure is 90°.

**33.** $\overline{BA}$; a line perpendicular to a radius of a circle at its endpoint is tangent to the circle.

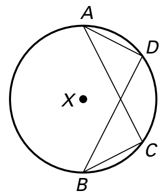
**34.** Answers may vary. *Sample answer:* $m\angle C = 90°$. When $\overleftrightarrow{CQ} \perp \overleftrightarrow{AB}$, $m\angle A = m\angle B = 45°$. As you drag $C$ toward $A$, $m\angle A$ increases and $m\angle B$ decreases. As you drag $C$ away from $A$, $m\angle A$ decreases and $m\angle B$ increases.

**35.** $\overline{QB}$; isosceles; base angles; $\angle A \cong \angle B$; Exterior Angle; $2x°$; $2x°$; 2; $\frac{1}{2}m\overset{\frown}{AC}$; $\frac{1}{2}m\overset{\frown}{AC}$

**36.** Draw the diameter containing $\overline{QB}$, intersecting the circle at a point $D$. By the proof in Ex. 35, $m\angle ABD = \frac{1}{2}m\overset{\frown}{AD}$ and $m\angle DBC = \frac{1}{2}m\overset{\frown}{DC}$. By the Arc. Add. Post., $m\overset{\frown}{AD} + m\overset{\frown}{DC} = m\overset{\frown}{AC}$. By the Angle Add. Post., $m\angle ABD + m\angle DBC = m\angle ABC$. By repeated application of the Substitution prop., $m\angle ABC = \frac{1}{2}m\overset{\frown}{AC}$.

**37.** Draw the diameter containing $\overline{QB}$, intersecting the circle at point $D$. By the proof in Ex. 35, $m\angle ABD = \frac{1}{2}m\overset{\frown}{AD}$ and $m\angle DBC = \frac{1}{2}m\overset{\frown}{DC}$. By the Arc Add. Post., $m\overset{\frown}{AD} = m\overset{\frown}{AC} + m\overset{\frown}{CD}$, so $m\overset{\frown}{AC} = m\overset{\frown}{AD} - m\overset{\frown}{CD}$ by the Subtraction prop. of equality. By the Angle Addition Post., $m\angle ABD = m\angle ABC + m\angle CBD$, so $m\angle ABC = m\angle ABD - m\angle CBD$ by the Subtraction prop. of equality. Then, by repeated application of the Substitution prop., $m\angle ABC = \frac{1}{2}m\overset{\frown}{AC}$.

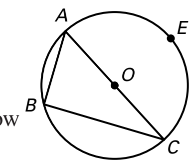
**38.** Given: $\odot X$ with inscribed angles $\angle ACB$ and $\angle ADB$




Prove: $\angle ADB \cong \angle ACB$

Proof: Inscribed $\angle$s $\angle ADB$ and $\angle ACB$ both intercept $\overset{\frown}{AB}$. So $m\angle ADB = m\overset{\frown}{AB}$ and $m\angle ACB = m\overset{\frown}{AB}$. By the Transitive Prop. of equality $m\angle ADB = m\angle ACB$ so $\angle ADB \cong \angle ACB$.

**39.** Given: $\odot O$ with inscribed $\triangle ABC$, $\overline{AC}$ is a diameter of $\odot O$.




Prove: $\triangle ABC$ is a right triangle.

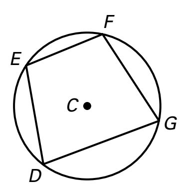
Use the Arc Addition Post. to show that $m\overset{\frown}{AEC} = m\overset{\frown}{ABC}$ and thus $m\overset{\frown}{ABC} = 180°$. Then use the Measure of an Inscribed Angle Thm. to show $m\angle B = 90°$, so that $\angle B$ is a rt. $\angle$ and $\triangle ABC$ is a rt. $\triangle$.

Given: $\odot O$ with inscribed $\triangle ABC$, $\angle B$ is a right angle

Prove: $\overline{AC}$ is a diameter of $\odot O$.

Use the Measure of an Inscribed Angle Thm., to show the inscribed right angle intercepts an arc with measure $2(90°) = 180°$. Since $\overline{AC}$ intercepts an arc that is half the measure of the circle, it must be a diameter.

**40.** Given: $DEFG$ is inscribed in a circle.




Prove: $m\angle D + m\angle F = 180°$, $m\angle E + m\angle G = 180°$

Proof: $m\angle E = \frac{1}{2}m\overset{\frown}{DGF}$;
$m\angle G = \frac{1}{2}m\overset{\frown}{DEF}$;
$m\overset{\frown}{DGF} + m\overset{\frown}{DEF} = 360°$ so
$\frac{1}{2}m\overset{\frown}{DGF} + \frac{1}{2}m\overset{\frown}{DGF} = 180°$. By the Subst. Prop.,
$m\angle E + m\angle G = 180°$. Likewise $m\angle D = \frac{1}{2}m\overset{\frown}{GFE}$ and
$m\angle F = \frac{1}{2}m\overset{\frown}{GDE}$; $m\overset{\frown}{GFE} + m\overset{\frown}{GDE} = 360°$; so
$\frac{1}{2}m\overset{\frown}{GFE} + \frac{1}{2}m\overset{\frown}{GDE} = 180°$. By the Subst. Prop.,
$m\angle D + m\angle F = 180°$

**41.** Use the carpenter's square to draw 2 diameters of the circle. (Position the vertex of the tool on the circle and mark the 2 points where the sides intersect the $\odot$. Repeat, placing the vertex at a different point on the circle. The center is the point where the diameters intersect.)

**42.** $m\angle ADB = \frac{1}{2}m\angle ACB$
$= \frac{1}{2}(80°)$
$= 40°$

B

**43.** $2(7x + 16) = 18x - 32$
$14x + 32 = 18x - 32$
$64 = 4x$
$16 = x$

C

**44.** a right triangle

**45.** $GJ$ is the geometric mean of $FJ$ and $JH$; Thm. 9.2 justifies this answer.

**46.** $FJ = 6$ in.; $JH = 2$ in.

$\frac{JH}{GJ} = \frac{GJ}{FJ}$ $\qquad$ $GK = 2(GJ)$

$\frac{2}{GJ} = \frac{GJ}{6}$ $\qquad$ $\approx 2(3.46)$

$12 = (GJ)^2$ $\qquad$ $\approx 6.92$

$GJ = 2\sqrt{3}$

$\approx 3.46$ in.

**47.** Consider $\triangle FLH$. Suppose chord $\overline{LM}$ intersects $\overline{FH}$ at a point $X$. $\overline{LM} \perp \overline{FH}$ at $X$ so $\overline{LX} \cong \overline{MX}$ because a diameter $\perp$ to a chord bisects the chord. $LX$ is the geometric mean of $FX$ and $XH$, $FX = 1$, and $XH = 7$, so

$\frac{1}{LX} = \frac{LX}{7}$ $\qquad$ $LM = 2(LX)$

$7 = (LX)^2$ $\qquad$ $\approx 2(2.65)$

$LX = \sqrt{7}$ $\qquad$ $\approx 5.3$ in.

$\approx 2.65$ in.

### *10.3 Mixed Review (p. 620)*

**48.** $-6 = -1(-2) + b$
$-8 = b$
$y = -x - 8$

**49.** $1 = 2(5) + b$
$-9 = b$
$y = 2x - 9$

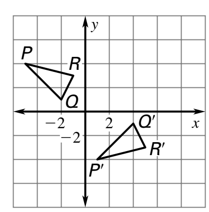
**50.** $3 = 3(0) + b$
$3 = b$
$y = 3$

**51.** $7 = \frac{4}{3}(0) + b$
$7 = b$
$y = \frac{4}{3}x + 7$

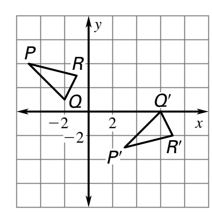
**52.** $4 = \left(-\frac{1}{2}\right)(-8)$
$0 = b$
$y = -\frac{1}{2}x$

**53.** $-12 = \left(-\frac{4}{5}\right)(-5) + b$
$-16 = b$
$y = -\frac{4}{5}x - 16$

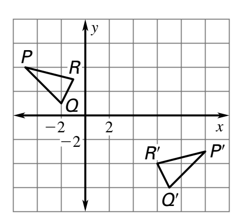
**54.**



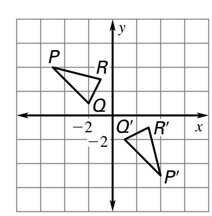

**55.**




**56.**




**57.**



**58.** $13\sqrt{6}$ **59.** $\frac{1}{2} = 0.5$ **60.** $\frac{\sqrt{3}}{2} \approx 0.8660$

**61.** $\frac{\sqrt{3}}{2} \approx 0.8660$ **62.** $\sqrt{3} \approx 1.7320$

***Quiz 1 (p. 620)***

**1.** $x = 90$; Thm. 10.1 **2.** $x = 12$; Thm. 10.3 **3.** 47°

**4.** 133° **5.** 227° **6.** 313° **7.** 180° **8.** 47° **9.** 85.2°

## Lesson 10.4

***10.4 Guided Practice (p. 624)***

**1.** The measure of each angle is equal to half the measure of the intercepted arc.

**2.** $m\overparen{STU} = 2 \cdot (105°) = 210°$

**3.** $m\angle 1 = \frac{1}{2}(55° + 65°) = 60°$

**4.** $m\angle DBR = \frac{1}{2}(190° - 60°) = 65°$

**5.** $m\angle RQU = \frac{1}{2}(270° - 90°) = 90°$

**6.** $m\angle N = \frac{1}{2}(80° - 35°) = 22.5°$

**7.** $m\angle 1 = \frac{1}{2}(88° + 88°) = 88°$

***10.4 Practice and Applications (pp. 624–627)***

**8.** $m\angle 1 = \frac{1}{2}(220°) = 110°$

**9.** $m\overparen{GHJ} = 2(140°) = 280°$

**10.** $m\angle 2 = \frac{1}{2}(180°) = 90°$

**11.** $m\overparen{DE} = 2(36°) = 72°$

**12.** $m\overparen{ABC} = 2(126°) = 252°$

**13.** $m\angle 3 = \frac{1}{2}(220°) = 110°$

**14.** $m\overparen{AB} = 2(84°) = 168°$

**15.** $144 = 5x + 17$

$127 = 5x$

$x = 25.4$

**16.** $2(8x - 29) = 10x + 50$

$16x - 58 = 10x + 50$

$6x = 108$

$x = 18$

**17.** $m\angle 1 = \frac{1}{2}(130° + 95°) = 112.5°$

**18.** $m\angle 1 = \frac{1}{2}(25° + 75°) = 50°$

**19.** $m\angle 2 = \frac{1}{2}(32° + 122°) = 77°$

$m\angle 1 = 180° - 77° = 103°$

**20.** $m\angle 1 = \frac{1}{2}(105° - 51°) = 27°$

**21.** $m\angle 1 = \frac{1}{2}(122° - 70°) = 26°$

**22.** $m\angle 1 = \frac{1}{2}(142° - 52°) = 45°$

**23.** $m\angle 1 = \frac{1}{2}(120° - 46°) = 37°$

**24.** $m\angle 1 = \frac{1}{2}(235° - 125°) = 55°$

**25.** $m\angle 1 = \frac{1}{2}(235° - 125°) = 55°$

**26.** $8a + 10 = 130$

$8a = 120$

$a = 15$

**27.** $15a = \frac{1}{2}(255 - 105)$

$15a = 75$

$a = 5$

**28.** $\frac{a}{2} = \frac{1}{2}[a + 70 - (a + 30)]$

$a = a + 70 - a - 30$

$a = 40$

**29.** 60°

**30.** 60°

**31.** 30° **32.** 90° **33.** 30° **34.** 60°

**35.** $4000^2 + (TE)^2 = 4000.01^2$

$(TE)^2 = 80.0001$

$TE \approx 8.944$

$m\angle TCE = \tan^{-1}\left(\frac{8.944}{4000}\right) \approx 0.128°$

$4000^2 + (TF)^2 = 4000.2^2$

$(TF)^2 = 1600.04$

$TF = 40.0005$

$m\angle TCF = \tan^{-1}\left(\frac{40.0005}{4000}\right) \approx 0.573°$

$m\overparen{SB} = m\angle FCB \approx 0.128 + 0.573$

$\approx 0.701°$

$\approx 0.7°$

**36.** The measure of $\angle BAC$ is equal to half the measure of $\overparen{AC}$; Theorem 10.12.

**37.** Diameter; 90°; a tangent line is $\perp$ to the radius drawn to the point of tangency.

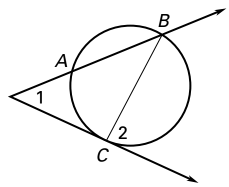
**38.** Draw $\overline{BQ}$ intersecting the $\odot$ at $P$ and let $X$ be a point on the upper semicircle. By Thm. 10.8, $m\angle PBC = \frac{1}{2}m\overparen{PC}$. By the proof of Case 1 $m\angle PBA = \frac{1}{2}m\overparen{BXP}$. By the Arc Add. Post., $m\overparen{BXP} + m\overparen{PC} = m\overparen{BPC}$. By the Angle Add. Post., $m\angle ABP + m\angle PBC = m\angle ABC$. By repeated application of the Substitution Prop., $m\angle ABC = \frac{1}{2}m\overparen{BPC}$.

**39.** The proof would be similar, using the Angle Addition and Arc Addition Postulates, but you would be subtracting $m\angle PBC$ and $m\overset{\frown}{PC}$ instead of adding.

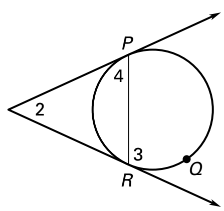
**40.** Reasons

1. Given
2. Through any 2 points there is exactly 1 line.
3. $\angle ACB$; Exterior Angle Thm.
4. Measure of an Inscribed $\angle$ Thm.
5. Measure of an Inscribed $\angle$ Thm.
6. Substitution Property
7. Distributive Property

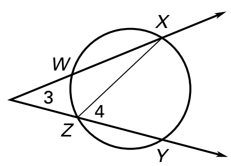
**41.**




Case 1: Draw $\overline{BC}$. Use the Exterior Angle Thm. to show that $m\angle 2 = m\angle 1 + m\angle ABC$, so that $m\angle 1 = m\angle 2 - m\angle ABC$. Then use Thm. 10.12 to show that $m\angle 2 = \frac{1}{2}m\overset{\frown}{BC}$ and the Measure of an Inscribed Angle Thm. to show that $m\angle ABC = \frac{1}{2}m\overset{\frown}{AC}$. Then $m\angle 1 = \frac{1}{2}(m\overset{\frown}{BC} - m\overset{\frown}{AC})$.




Case 2: Draw $\overline{PR}$. Use the Exterior Angle Thm. to show that $m\angle 3 = m\angle 2 + m\angle 4$, so that $m\angle 2 = m\angle 3 - m\angle 4$. Then use Thm. 10.12 to show that $m\angle 3 = \frac{1}{2}m\overset{\frown}{PQR}$ and $m\angle 4 = \frac{1}{2}m\overset{\frown}{PR}$. Then, $m\angle 2 = \frac{1}{2}(m\overset{\frown}{PQR} - m\overset{\frown}{PR})$.




Case 3: Draw $\overline{XZ}$. Use the Exterior Angle Thm. to show that $m\angle 4 = m\angle 3 + m\angle WXZ$, so that $m\angle 3 = m\angle 4 - m\angle WXZ$. Then use the Measure of an Inscribed Angle Thm. to show that $m\angle 4 = \frac{1}{2}m\overset{\frown}{XY}$ and $m\angle WXZ = \frac{1}{2}m\overset{\frown}{WZ}$. Then, $m\angle 3 = \frac{1}{2}(m\overset{\frown}{XY} - m\overset{\frown}{WZ})$.

**42.** E **43.** C

**44.** $\angle R$ is a right angle; circle $P$ is inscribed in $\triangle QRS$; $T$, $U$, and $V$ are points of tangency. By Thm. 10.1, $\overline{PT} \perp \overline{QR}$ and $\overline{PV} \perp \overline{RS}$, so $\angle RTP$ and $\angle RVP$ are right angles. Using the Interior Angles of a Quadrilateral Thm. $\angle TPV$ is a right angle. By the Rectangle Corollary, quad. $TPVR$ is a rectangle; $\overline{TP} \cong \overline{PV} \cong \overline{RV} \cong \overline{TR}$, so by the Rhombus Corollary, quad. $TPVR$ is a rhombus. By the Square Corollary, quad $TPVR$ is a square. According to Thm. 10.3, $\overline{QT} \cong \overline{QU}$ and $\overline{SU} \cong \overline{SV}$. Using the Segment Addition Postulate, $QT + TR = QR$ and $SV + VR = SR$. Since $RV = r = TR$, by Substitution Prop. $SV + r = SR$ and $QT + r = QR$. The perimeter of $\triangle QRS = QT + r + SV + r + QS$ and perim $= QR + RS + QS$, so $QR + QS + RS = QT + r + SV + r + QS$. By the Addition and Subtraction Properties of Equality, $2r = QR + RS - QT - SV$ or $2r = QR + RS - (QT + SV)$. By substitution, $2r = QR + RS - (QU + US)$. $QU + US = QS$. Therefore $r = \frac{1}{2}(QR + RS - QS)$.

**45.** $r = \frac{1}{2}(3 + 4 - 5)$

$r = 1$

***10.4 Mixed Review (p. 627)***

**46.** $\frac{9}{12} = \frac{12}{LM}$ $\quad$ $\frac{25}{LP} = \frac{LP}{16}$

$9LM = 144$ $\quad$ $LP^2 = 400$

$LM = 16$ $\quad$ $LP = 20$

**47.** $\frac{9}{LP} = \frac{LP}{4}$

$36 = (LP)^2$

$LP = 6$

**48.** $(r + 10)^2 = r^2 + 22^2$

$r^2 + 20r + 100 = r^2 + 484$

$20r = 384$

$r = 19.2$ ft

**49.** $x = 25$

**50.** $2x - 5 = x + 3$

$x = 8$

**51.** $6x + 12 = 10x + 4$

$8 = 4x$

$2 = x$

## Lesson 10.5

***Activity 10.5 Investigating Segment Lengths (p. 628)***

**Investigate**

1. yes; yes; yes
3. The products are equal.
4. The products remain equal.

**Conjecture**

5. The product of the segments of intersecting chords are equal.

**Investigate**

6. The products are equal.

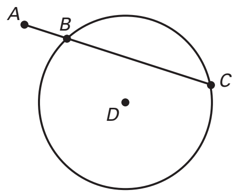
**Conjecture**

7. The product of the length of the external segment of one secant and the total length of the secant is equal to the product of the total length of the other secant and the length of its external segment.

***Extension***

Tangent; $(EA)^2 \approx EC \cdot ED$; the square of the length of the tangent segment is equal to the product of the lengths of the secant segment and its external segment.

***10.5 Guided Practice (p. 632)***

**1.** 


External segment is $\overline{AB}$

**2.** $HF \cdot HJ = HG \cdot HK$

**3.** 15; 18

$x \cdot 15 = 10 \cdot 18$

$15x = 180$

$x = 12$

**4.** 12; 15

$12 \cdot x = 15 \cdot 40$

$12x = 600$

$x = 50$

**5.** 16; $x + 8$

$6 \cdot 16 = 8 \cdot (x + 8)$

$96 = 8x + 64$

$32 = 8x$

$4 = x$

**6.** 2

$4^2 = 2 \cdot (2 + x)$

$16 = 4 + 2x$

$12 = 2x$

$6 = x$

**7.** 9

$x^2 = 4 \cdot 9$

$x^2 = 36$

$x = 6$

**8.** $x + 3$; $2^2$

$x \cdot (x + 3) = 2^2$

$x^2 + 3x = 4$

$x^2 + 3x - 4 = 0$

$(x + 4)(x - 1) = 0$

$x = -4 \quad x = 1$

Solution: $x = 1$

**9.** The segment from you to the center of the aviary is a secant segment that shares an endpoint with the segment that is tangent to the aviary. Let $x$ be the length of the internal secant segment (twice the radius of the aviary) and use Thm. 10.7. Since $40(40 + x) \approx 60^2$, the radius is about $\frac{50}{2}$, or 25 ft.

***10.5 Practice and Applications (pp. 632–634)***

**10.** 9; 15

$9x = 180$

$x = 20$

**11.** 45; 27

$45x = 1350$

$x = 30$

**12.** 16

$x^2 = 144$

$x = 12$

**13.** $12 \cdot 35 = 15+(5 + x)$

$420 = 225 + 15x$

$195 = 15x$

$13 = x$

**14.** $4x = 16 \cdot 7$

$4x = 112$

$x = 28$

**15.** $24x = 12 \cdot 17$

$24x = 204$

$x = 8.5$

**16.** $15x = 10(x + 1)$

$15x = 10x + 10$

$5x = 10$

$x = 2$

**17.** $72 = 2x^2$

$36 = x^2$

$6 = x$

**18.** $72x = 40(78)$

$x = 43\frac{1}{3}$

**19.** $4(22) = 6(6 + x)$

$88 = 36 + 6x$

$x = 8\frac{2}{3}$

**20.** $x^2 = 12(48)$

$x^2 = 576$

$x = 24$

**21.** $64 = x(12 + x)$

$64 = 12x + x^2$

$x^2 + 12x - 64 = 0$

$(x + 16)(x - 4) = 0$

$x = -16 \quad x = 4$

Solution: $x = 4$

**22.** $144 = x(10 + x)$

$x^2 + 10x - 144 = 0$

$(x + 18)(x - 8) = 0$

$x = -18 \quad x = 8$

Solution: $x = 8$

**23.** $121 = x(x + 9)$

$x^2 + 9x - 121 = 0$

$$x = \frac{-9 \pm \sqrt{81 - 4(1)(-121)}}{2(1)} = \frac{-9 \pm \sqrt{565}}{2}$$

$x \approx 7.38$ or $x \approx -16.38$

Solution: $x \approx 7.38$

**24.** $x(x + 29) = 15(50)$

$x^2 + 29x - 750 = 0$

$$x = \frac{-29 \pm \sqrt{841 - 4(1)(-750)}}{2(1)} = \frac{-29 \pm \sqrt{3841}}{2}$$

$x \approx 16.49$ or $x \approx -45.49$

Solution: $x \approx 16.49$

**25.** $400 = 8(8 + x)$

$400 = 64 + 8x$

$336 = 8x$

$x = 42$

$400 = y(30 + y)$

$y^2 + 30y - 400 = 0$

$(y + 40)(y - 10) = 0$

$y = -40 \quad y = 10$

Solution: $y = 10$

**26.** $8(18) = 12(x)$

$x = 12$

$y^2 = 2(26)$

$y = 2\sqrt{13}$

**27.** $3(14) = 6x$

$x = 7$

$8^2 = y(y + 13)$

$64 = y^2 + 13y$

$0 = y^2 + 13y - 64$

$$y = \frac{-13 \pm \sqrt{13^2 - 4(1)(-64)}}{2} = \frac{-13 \pm 5\sqrt{17}}{2}$$

$y \approx 3.81$ or $y \approx -16.81$

Solution: $y \approx 3.81$

**28.** $15(12) = 10CN$

$CN = 18$

**29.** 4.875 ft; the diameter through $A$ bisects the chord into two 4.5 ft segments. Use Thm. 10.15 to find the length of the part of the diameter containing $A$. Add this length to 3 and divide by 2 to get the radius.

**30.** $(BA)^2 = 12{,}500(20{,}500)$

$BA = 2500\sqrt{41} \approx 16{,}008$ mi

$BC = BA \approx 16{,}008$ mi

**31.** Draw $\overline{AD}$ and $\overline{BC}$. Then inscribed angles $\angle EBC$ and $\angle EDA$ intercept the same arc, so $\angle EBC \cong \angle EDA$. $\angle E \cong \angle E$ by the Reflexive Prop. of Congruence, so $\triangle BCE \sim \triangle DAE$ by the AA Similarity Thm. Then, since lengths of corresponding sides of similar triangles are proportional,

$$\frac{EA}{EC} = \frac{ED}{EB}.$$

By the Cross Product Prop., $EA \cdot EB = EC \cdot ED$.

**32.** $\overline{EA}$ is tangent to a circle; $\overline{ED}$ is a secant of the same circle. Draw $\overline{AC}$ and $\overline{AD}$. $\angle ADE$ is an inscribed $\angle$, so $m\angle ADE = \frac{1}{2}m\overset{\frown}{AC}$. $\angle CAE$ is formed by a tangent and a chord so $m\angle CAE = \frac{1}{2}m\overset{\frown}{AC}$. Then $\angle ADE \cong \angle CAE$. Since $\angle E \cong \angle E$ by the Reflexive Prop. of Cong., $\triangle ACE \sim \triangle DAE$ by the AA Similarity Post. Then since lengths of corresponding sides of $\sim$ ⊿s are proportional,

$$\frac{EA}{EC} = \frac{ED}{EA}.$$

By the Cross Products Property, $(EA)^2 = EC \cdot ED$.

**33.** $1(1) = 8000x$

$x = \frac{1}{8000}$ mi

**34.** $\frac{1}{8000} \cdot \frac{5280}{1} \cdot \frac{12}{1} \approx 8$ in.

**35.** The distances over which most of the inhabitants of Earth are able to see are relatively short and the curvature of Earth over such distances is so small as to be unnoticeable.

**36.** $(AB)^2 = AC(AD)$

**37.** $(AE)^2 = AC(AD)$

**38.** $AB = AE$; By applying the substitution property and using the results from Exercises 36 and 37, the two are equal since $(AB)^2 = (AE)^2$ and both $AB$ and $AE$ are positive.

**39.** *Sample answer*: Conjecture: If tangent segments to two intersecting ⊙s share a common endpoint outside the 2 ⊙s, the tangent segments are ≅. The conjecture is not true in general, however. Let $A$ be the common endpoint of the tangent segments and $C$ and $D$ be the points of intersection of the 2 ⊙s. The conjecture is true if and only if $A$, $C$, and $D$ are collinear.

***10.5 Mixed Review (p. 635)***

**40.** $AB = \sqrt{25 + 4}$

$= \sqrt{29} \approx 5.39$

Midpoint $= \left(-\frac{1}{2}, 4\right)$

**41.** $AB = \sqrt{36 + 64}$

$= 10$

Midpoint $= (3, 0)$

**42.** $AB = \sqrt{81 + 225}$

$\approx 17.49$

Midpoint: $\left(-\frac{7}{2}, \frac{3}{2}\right)$

**43.** $AB = \sqrt{81 + 144}$

$= 15$

Midpoint: $\left(-\frac{11}{2}, 1\right)$

**44.** $AB = \sqrt{64 + 169}$

$\approx 15.26$

Midpoint: $\left(4, -\frac{9}{2}\right)$

**45.** $AB = \sqrt{196 + 0}$

$= 14$

Midpoint: $(-2, -2)$

**46.** $-1 = \frac{1}{2}(-2) + b$

$0 = b$

$y = \frac{1}{2}x$

**47.** $8 = -\frac{3}{2}(6) + b$

$17 = b$

$y = -\frac{3}{2}x + 17$

**48.** $9 = 1(0) + b$

$9 = b$

$y = x + 9$

**49.** $-4 = -\frac{1}{3}(2) + b$

$-\frac{10}{3} = b$

$y = -\frac{1}{3}x - \frac{10}{3}$

**50.** $-1 = -5(-10) + b$

$-51 = b$

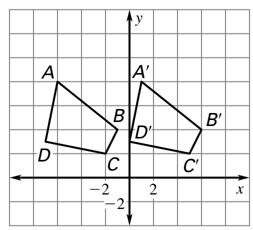
$y = -5x - 51$

**51.** $9 = \frac{3}{7}(-6) + b$

$\frac{81}{7} = b$

$y = \frac{3}{7}x + \frac{81}{7}$

**52.**



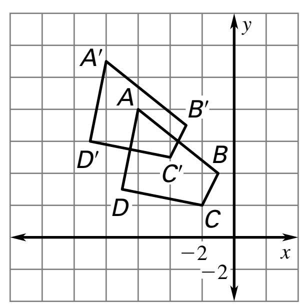

$A(-6, 8)$, $B(-1, 4)$,

$C(-2, 2)$, $D(-7, 3)$

$A'(1, 8)$, $B'(6, 4)$,

$C'(5, 2)$, $D'(0, 3)$

**53.**



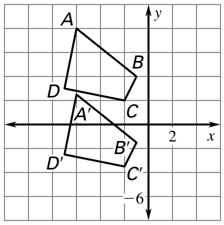

$A(-6, 8)$, $B(-1, 4)$,

$C(-2, 2)$, $D(-7, 3)$

$A'(-8, 11)$, $B'(-3, 7)$,

$C'(-4, 5)$, $D'(-9, 6)$

**54.**




$A(-6, 8), B(-1, 4), C(-2, 2), D(-7, 3)$

$A'\left(-6, 2\frac{1}{2}\right), B'\left(-1, -1\frac{1}{2}\right), C'\left(-2, -3\frac{1}{2}\right), D'\left(-7, -2\frac{1}{2}\right)$

***Quiz 2 (p. 635)***

**1.** 202

**2.** $x = \frac{1}{2}(110 + 168)$
$= 139$

**3.** $28 = \frac{1}{2}(82 - x)$
$56 = 82 - x$
$x = 26$

**4.** $16x = 100$
$x = 6.25$

**5.** $8(18) = x(x + 18)$
$x^2 + 18x - 144 = 0$
$(x + 24)(x - 6) = 0$
$x = -24 \quad x = 6$
Solution: $x = 6$

**6.** $100 = x(x + 15)$
$x^2 + 15x - 100 = 0$
$(x + 20)(x - 5) = 0$
$x = -20 \quad x = 5$
Solution: $x = 5$

**7.** Solve $20(2r + 20) = 49^2$ (Thm. 10.17) or solve $(r + 20)^2 = r^2 + 49^2$ (the Pythagorean Thm.); 50.025 ft.

## Lesson 10.6

***10.6 Guided Practice (p. 638)***

**1.** $(x - h)^2 + (y - k)^2 = r^2$, where $(h, k)$ is the center of the ⊙ and $r$ is the radius.

**2.** The center is (3, 4) and the radius is $\sqrt{9} = 3$ units. Place the point of a compass at (3, 4), set the radius at 3 units, and swing the compass to draw a full circle.

**3.** Center: (0, 0); radius: 2; $x^2 + y^2 = 4$

**4.** Center: (2, 0); radius: 4; $(x - 2)^2 + y^2 = 16$

**5.** Center: (−2, 2); radius: 2; $(x + 2)^2 + (y - 2)^2 = 4$

**6.** $r = \sqrt{1 + 9}$
$= \sqrt{10}$
$x^2 + y^2 = 10$

***10.6 Guided Practice and Applications (pp. 638–640)***

**7.** center: (4, 3); radius: 4

**8.** center: (5, 1); radius: 5

**9.** center:(0, 0); radius: 2

**10.** center: (−2, 3); radius: 6

**11.** center: (−5, −3); radius: 1

**12.** center: $\left(\frac{1}{2}, -\frac{3}{4}\right)$; radius: $\frac{1}{2}$

**13.** center: (−3, 2); radius: 2; $(x + 3)^2 + (y - 2)^2 = 4$

**14.** center: (0, 1); radius: 2; $x^2 + (y - 1)^2 = 4$

**15.** center: (3, 3); radius: 1; $(x - 3)^2 + (y - 3)^2 = 1$

**16.** center: (0.5, 1.5); radius: 2.5;
$(x - 0.5)^2 + (y - 1.5)^2 = 6.25$

**17.** center: (2, 2); radius: 4; $(x - 2)^2 + (y - 2)^2 = 16$

**18.** center: (0, 0); radius: 6; $x^2 + y^2 = 36$

**19.** $x^2 + y^2 = 1$

**20.** $(x - 4)^2 + y^2 = 16$

**21.** $(x - 3)^2 + (y + 2)^2 = 4$

**22.** $(x + 1)^2 + (y + 3)^2 = 36$

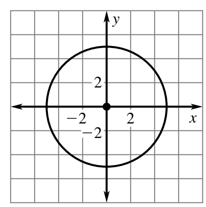
**23.** $r = \sqrt{9}$
$= 3$
$x^2 + y^2 = 9$

**24.** $r = \sqrt{9 + 16}$
$= 5$
$(x - 1)^2 + (y - 2)^2 = 25$

**25.** $r = \sqrt{4 + 0}$
$= 2$
$(x - 3)^2 + (y - 2)^2 = 4$

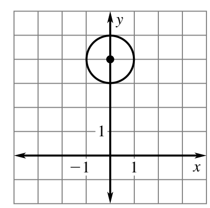
**26.** $(x + 5)^2 + (y - 3)^2 = 16$

**27.**



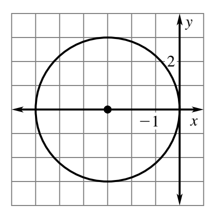

$x^2 + y^2 = 25$

**28.**



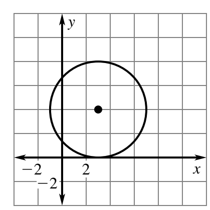

$x^2 + (y - 4)^2 = 1$

**29.**



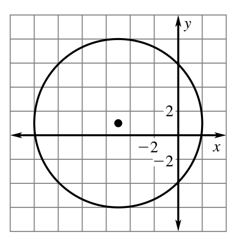

$(x + 3)^2 + y^2 = 9$

**30.**



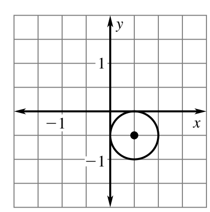

$(x - 3)^2 + (y - 4)^2 = 16$

**31.**




$(x + 5)^2 + (y - 1)^2 = 49$

**32.**

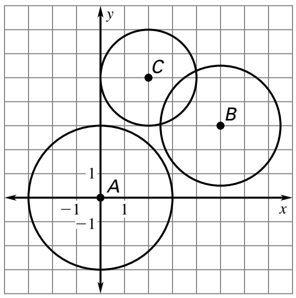



$\left(x - \frac{1}{2}\right)^2 + \left(y + \frac{1}{2}\right)^2 = \frac{1}{4}$

**33.** exterior **34.** interior **35.** on the circle **36.** exterior

**37.** interior **38.** on the circle **39.** exterior **40.** interior

**41.** $A: x^2 + y^2 = 9$, $B: (x - 5)^2 + (y - 3)^2 = 6.25$, $C: (x - 2)^2 + (y - 5)^2 = 4$




**42.** $J$: $A$; $K$: $B$; $L$: $B$ and $C$; none; $N$: $C$

**43.** $(x + 3)^2 + y^2 = 1$ **44.** $(x - 3)^2 + y^2 = 49$

**45.** Answers may vary.

**46.** Any way it is rolled, the width is the same.

**47.**

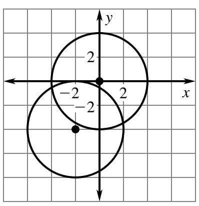



image:
$(x + 2)^2 + (y + 4)^2 = 16$

**48.** $(x - p)^2 + (y - q)^2 = q^2$ **49.** D **50.** C

**51.** Yes; let $P$ be the point of intersection and $r$ the radius of $\odot B$. Since the $\odot$s are externally tangent, $\overline{AP}$ and $\overline{PB}$ are $\perp$ to the tangent line at $P$. Thus point $B$ lies on the line through $A$ and $P$. Point $B$ also lies on the circle with center $P$ and radius $r$. Use these facts to write two equations in terms of the coordinates of point $B$ and solve this system. Point $B$ is the solution to this system that lies outside circle $A$. Use the coordinates of point $B$ and the radius to write the equation for circle $B$.

**52.** $3 = \sqrt{(3)^2 + (b - 0)^2}$

$9 = 9 + b^2$

$b = 0$

**53.** $5 = \sqrt{25 + (b + 2)^2}$

$25 = 25 + (b + 2)^2$

$0 = (b + 2)^2$

$b = -2$

***10.6 Mixed Review (p. 640)***

**54.** kite, rhombus, rectangle, parallelogram

**55.** parallelogram, rectangle, rhombus, kite, isosceles trapezoid

**56.** kite, rhombus, rectangle, parallelogram

**57.** $\langle -6, 7\rangle$; 9.2

**58.** $\langle -8, -2\rangle$; 8.2

**59.** $\langle 3, -11\rangle$; 11.4

**60.** $\langle 2, 13\rangle$; 13.2

**61.** No; $P$ is not equidistant from the sides of $\angle A$.

**62.** Yes; $P$ is equidistant from the sides of $\angle A$.

## Lesson 10.7

***Activity 10.7 (p. 641)***

*Investigate*

**1.** Yes; $m$ and $k$ are $\parallel$ and the distance from $m$ to $k$ is $AB$, so $Y$ is $AB$ units from $k$. $\odot P$ has radius $AB$, so $Y$ is $AB$ units from $P$. This is also true of point $Z$.

**2.** If $B$ is dragged to the right, $m$ moves up and circle $P$ gets larger. If $B$ is dragged to the left, $m$ moves down and circle $P$ gets smaller; yes

**3.** parabola

*Conjecture*

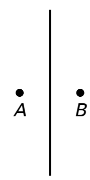
**4.** The set of points in a plane that are equidistant from a line and a point in the plane is a parabola.

*Extension*

The locus of points equidistant from $(0, \frac{1}{4})$ and the line $y = -\frac{1}{4}$ is the parabola with equation $y = x^2$.

***10.7 Guided Practice (p. 645)***

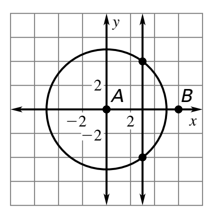
**1.** exterior **2.**




The locus of points that are equidistant from $A$ and $B$ form the segment of the perpendicular bisector of $\overline{AB}$ that lies on the paper.

**3.** B **4.** A **5.** D **6.** C

**7.**

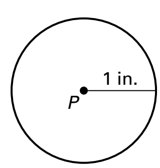



The two points on the intersection of the $\perp$ bisector of $\overline{AB}$ and $\odot A$ with radius 5

**8.** The intersection of $\odot C$ with radius 3 and $\odot D$ with radius 5; 2, 1, or 0 points depending on whether the distance between $C$ and $D$ is less than, equal to, or greater than, $3 + 5 = 8$ units.

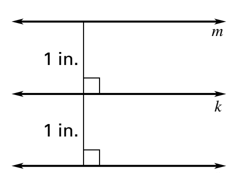
***10.7 Practice and Applications (pp. 645–647)***

**9.**

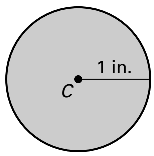



The points on $\odot P$ with radius 1 inch

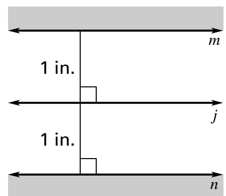
**10.**



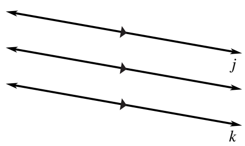

The 2 lines parallel to $k$ on opposite sides of $k$ and 1 in. away

**11.** 

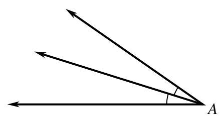

The points on ⊙$C$ with radius 1 inch and the points in the interior of ⊙$C$

**12.** 

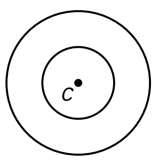

The points on and beyond 2 lines parallel to $j$ on opposite sides of $j$ and 1 in. from $j$

**13.** 

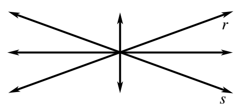

A line ∥ to both $j$ and $k$ and halfway between them

**14.** 

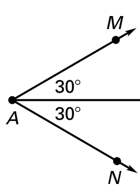

The bisector of $\angle A$

**15.** 

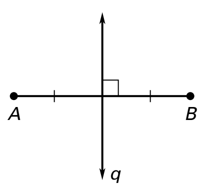

A ⊙ with center $C$ and radius half that of the original ⊙

**16.** 


The bisectors of all 4 ∠s formed by the intersection of $r$ and $s$

**17.** 


All points except A on two rays, $\overrightarrow{AM}$ and $\overrightarrow{AN}$, such that $m\angle MAN = 60°$ and $\overrightarrow{AB}$ is the bisector of $\angle MAN$

**18.** 


Line $q$, the ⊥ bisector of $\overline{AB}$

**19.** $x = 3$

**20.** $y = 3$

**21.** $M(1, 1)\quad K(5, 5)$

midpoint $= (3, 3)$

$m = \dfrac{5 - 1}{5 - 1} = 1,$

so ⊥ bisector has slope $= -1$

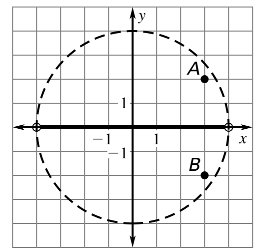
$3 = -1(3) + b$

$6 = b$

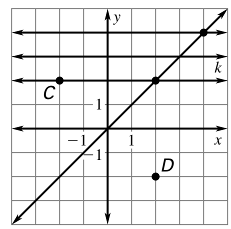
$y = -x + 6$

**22.** $(x - 5)^2 + (y - 5)^2 = 9$

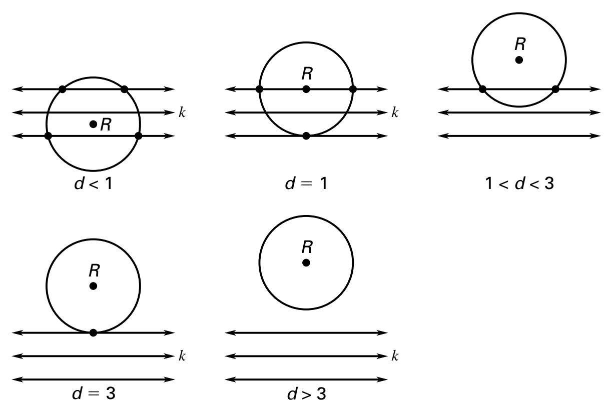
**23.** $y = 4, y = -2$

**24.** 

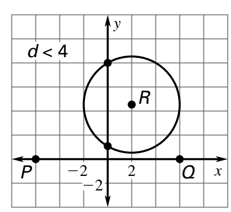

points on the $x$-axis with $x$-coordinate greater than $-4$ and less than 4

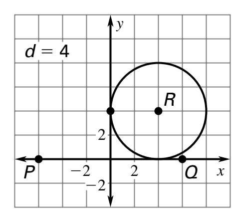
**25.** 

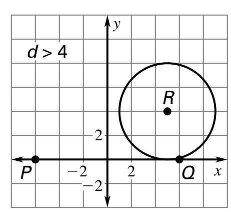

2 points, (2, 2) and (4, 4), the intersections of $y = x$ with $y = 2$ and $y = 4$

**26.** 

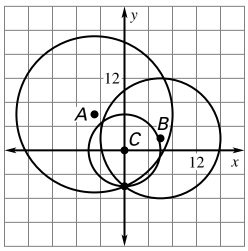

Let $d$ be the distance from $R$ to $k$; the locus of points is 4 points if $d < 1$, 3 points if $d = 1$, 2 points if $1 < d < 3$, 1 point if $d = 3$, and 0 points if $d > 3$.

**27.** 


Let $d$ be the distance from $R$ to the ⊥ bisector of $\overline{PQ}$; the locus of points is 2 points if $d < 4$, 1 point if $d = 4$, and 0 points if $d > 4$.

**28.** 

**29.** (0, −6)

**30.** $d = \sqrt{(0 - (-3))^2 + (-6 - 20)^2}$

$d = \sqrt{9 + 676}$

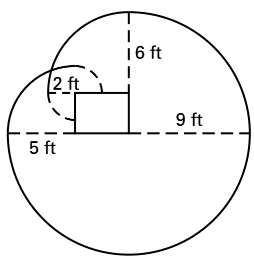
$\approx 26.2$ mi

No; your friend is more than 14 mi from the epicenter.

**31.** Let $d$ be the distance from $P$ to $k$. If $0 < d < 4$, the locus is 2 points. If $d = 4$, the locus is 1 point. If $d > 4$, the locus is 0 points.

**32.** the ⊙ with center at the midpoint of $\overline{AB}$ and radius $\frac{1}{2}AB$

**33.** D **34.** C **35.** 1 ft = 0.5 cm




***10.7 Mixed Review (p. 647)***

**36.** 22 **37.** 69 **38.** 70

**39.** $12x = 210$

$x = 17.5$

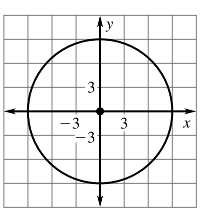
**40.** $9(30) = 10(10 + x)$

$270 = 100 + 10x$

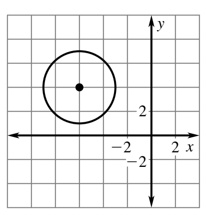
$x = 17$

**41.** $x^2 = 16(36)$

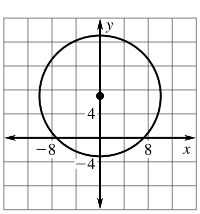
$x = 24$

**42.** 

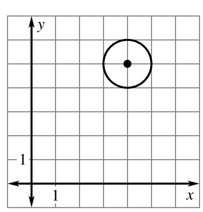
$x^2 + y^2 = 81$

**43.** 

$(x + 6)^2 + (y - 4)^2 = 9$

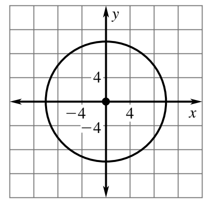
**44.** 

$x^2 + (y - 7)^2 = 100$

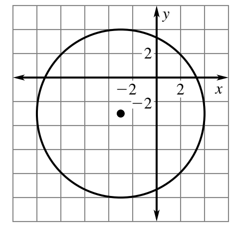
**45.** 

$(x - 4)^2 + (y - 5)^2 = 1$

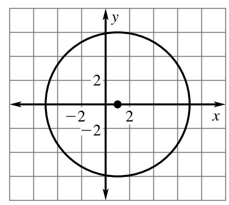
***Quiz 3 (p. 648)***

**1.** 

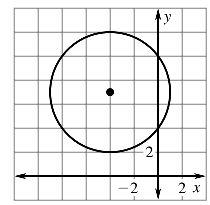
$x^2 + y^2 = 100$

**2.** 

$(x + 3)^2 + (y + 3)^2 = 49$

**3.** 

$(x - 1)^2 + y^2 = 36$

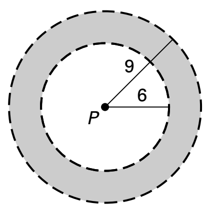
**4.** 

$(x + 4)^2 + (y - 7)^2 = 25$

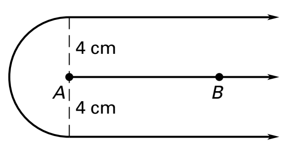
**5.** $r = \sqrt{25 + 49}$

$= \sqrt{74}$

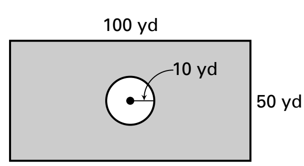
$(x - 2)^2 + (y + 2)^2 = 74$

**6.** 


The points that are in both the exterior of the ⊙ with center $P$ and radius 6 units and the interior of the circle with center $P$ and radius 9 units

**7.** 


A set of points formed by 2 rays on opposite sides of $\overrightarrow{AB}$, each ∥ to $\overrightarrow{AB}$ and 4 cm from it, and a semicircle with center $A$ and radius 4 cm

**8.** 


The points that are on the field and on or outside the circle whose center is the center of the field and whose radius is 10 yd

***Math & History (p. 648)***

**1.** June 21: 75 min

Dec. 21: 46 min

## Chapter 10 Review (pp. 650–652)

### *10.1 Tangents to Circles*

**1.** $\overline{BN}$ **2.** $C$, $D$, or $R$ **3.** $\overline{BF}$ or $\overline{BN}$ **4.** $P$ **5.** $\overline{QE}$

**6.** $\overleftrightarrow{BC}$ **7.** $\overleftrightarrow{BF}$ **8.** $R$

**9.** Yes; $\overleftrightarrow{BC}$ is tangent to $\odot P$ at point $B$ so $\overleftrightarrow{BC} \perp \overline{PB}$ (Thm 10.1).

**10.** According to Thm. 10.3, since the segments from point $S$ are tangent to $\odot Q$, they are congruent. So $\overline{SC} \cong \overline{SD}$ and $\triangle SCD$ is isosceles.

### *10.2 Arcs and Chords*

**11.** 62° **12.** 118° **13.** 239° **14.** 85° **15.** 275°

**16.** 324°

### *10.3 Inscribed Angles*

**17.** True; the sides of the triangles opposite the inscribed angles are diameters, so the inscribed angles are right angles.

**18.** False; in kite $ABCD$, the diagonals are $\perp$ so $\overline{AC} \perp \overline{DB}$. Then $m\angle AED = 90°$. If $m\angle ACD = \frac{1}{2} m\angle AED = \frac{1}{2}(90°) = 45°$, then $m\angle DAE = 45°$ as well. $ABCD$ is a kite, so $\overline{AD} \cong \overline{AB}$. Then $\triangle AED \cong \triangle AEB$ (HL Cong. Thm.) and $m\angle BAE = 45°$. This would make $\angle DAB$ a right angle and so make $\overline{DB}$ a diameter, which would mean that $E$ and $F$ would be the same point and the diagonals of $ABCD$ would bisect each other. That contradicts the given that $ABCD$ is a kite. So the assumption that $m\angle ACD = \frac{1}{2} m\angle AED$ must be false.

**19.** True; $ABCD$ is inscribed in a circle, so opposite angles are supplementary.

### *10.4 Other Angle Relationships in a Circle*

**20.** 112 **21.** 55 **22.** 64 **23.** 94

### *10.5 Segment Lengths in Circles*

**24.** $16x = 80$

$x = 5$

**25.** $10(x + 10) = 12(37)$

$10x + 100 = 444$

$x = 34.4$

**26.** $400 = x(30 + x)$

$x^2 + 30x - 400 = 0$

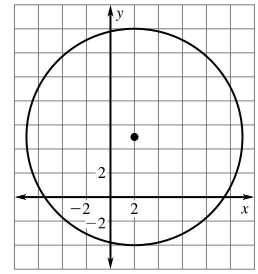
$(x + 40)(x - 10) = 0$

$x = -40, x = 10$

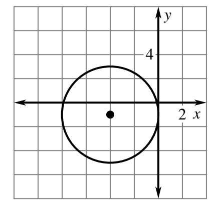
Solution: $x = 10$

### *10.6 Equations of Circle*

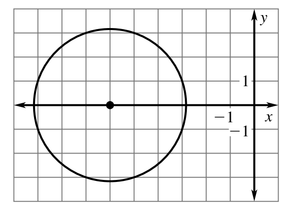
**27.** $(x - 2)^2 + (y - 5)^2 = 81$




**28.** $(x + 4)^2 + (y + 1)^2 = 16$

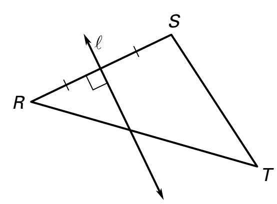



**29.** $(x + 6)^2 + y^2 = 10$



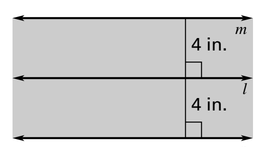

### *10.7 Locus*

**30.**



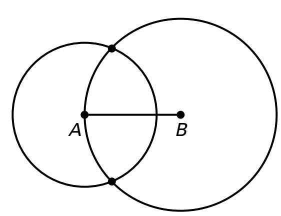

The perpendicular bisector of $\overline{RS}$ contains the points equidistant from $R$ and $S$.

**31.**




Parallel lines 4 in. from ℓ and every point between ℓ and each line

**32.**




Two points where the circles with center $B$ and radius 4 cm and center $A$ and radius 3 cm intersect

## Chapter 10 Test (p. 653)

**1.** Thm. 10.3; HL Congruence Thm.

**2.** $4^2 + (JK)^2 = 8^2$

$JK = 4\sqrt{3} \approx 6.9$

$(MP)^2 + 4^2 = 5^2$ $\quad$ $(MK)^2 + 4^2 = 8^2$

$(MP)^2 = 9$ $\quad$ $(MK)^2 = 48$

$MP = 3$ $\quad$ $MK = 4\sqrt{3}$

$PK = 4\sqrt{3} + 3$

**3.** $\triangle KJH$ and $\triangle KMH$ are rt $\triangle$s because tangents are $\perp$ to radii at the points of tangency. $\overline{HJ}$ and $\overline{HM}$ are radii of $\odot H$ so they are $\cong$. $\overline{HK} \cong \overline{HK}$ by the Reflexive Prop. of Congruence. So $\triangle KJH \cong \triangle KMH$ by the HL Cong. Thm. $\angle KHM \cong \angle KHJ$ because they are corresponding angles. By the defs. of congruence, minor arcs, and congruent arcs, $\widehat{LM} \cong \widehat{JL}$.

**4.** $\triangle HMK$ is a $30° - 60° - 90°\triangle$, short leg: 4; long leg: $4\sqrt{3}$; hypotenuse: 8.

$m\angle MHK = 60° = m\angle JHK$

$m\angle MHJ = 120° = m\widehat{JM}$

$m\angle MHP = \tan^{-1}\frac{PM}{HM} = \tan^{-1}\frac{3}{4} \approx 36.9°$

$m\angle PHJ = m\angle MHJ + m\angle MHP = 156.9° = m\widehat{JN}$

**5.** According to Thm. 10.5, since $\overline{AD} \perp \overline{FB}$, $\overline{FH} \cong \overline{BH}$ and $\widehat{FA} \cong \widehat{BA}$.

**6.** $\overline{FE} \cong \overline{BC}$ so by Thm. 10.4 $\widehat{FE} \cong \widehat{BC}$.

**7.** $\overline{FB} \cong \overline{EC}$ and $\widehat{FB} \cong \widehat{EC}$

**8.** $m\angle 1 = 72.5°$

$m\angle 2 = 145°$

**9.** $m\angle 1 = 90°$

$m\angle 2 = 90°$

$m\angle 3 = 45°$

**10.** $m\angle 1 = 120°$

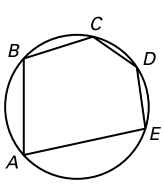
$m\angle 2 = 75°$

**11.** $m\angle 1 = 29°$

$m\angle 2 = 66°$

$m\angle 3 = 37°$

**12.**




**a.** supplementary

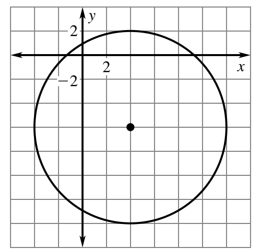
**b.** congruent

$m\angle CDE = 2m\angle CAE$

$m\angle CBE = m\angle CAE$

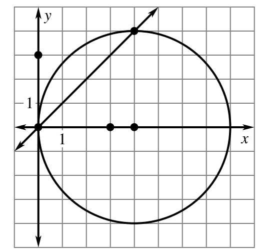
**13.** $3x = 18$, $x = 6$ $\quad$ **14.** $3(12) = x(9)$, $x = 4$ $\quad$ **15.** $x^2 = 3(12)$, $x = 6$

**16.**




$(x - 4)^2 + (y + 6)^2 = 64$

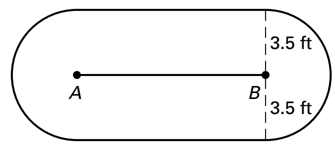
**17.**




Two points, (0, 0) and (4, 4), where the line $y = x$ and circle with center (4, 0) and radius 4 units intersect

**18.** $(x - 30)^2 + (y - 30)^2 = 900$

**19.**




Let $A$ and $B$ be the ends of the cable. The locus consists of the points on or inside a region bounded by two semicircles with centers $A$ and $B$ and radius 3.5 ft and two segments on opp. sides of $\overline{AB}$, both $\parallel$ to $\overline{AB}$ and 3.5 ft from $\overline{AB}$.

### Chapter 10 Standardized Test (pp. 654–655)

**1.** D **2.** C **3.** E **4.** B **5.** B **6.** C **7.** A

**8.** $d = \sqrt{25 + 9}$

$= \sqrt{34}$

Midpoint $= (1, 5)$

$(x - 1)^2 + (y - 5)^2 = 34$

A

**9.** D

**10.** $x^2 + 15 + 6x^2 - 10 = 180$

$7x^2 + 5 = 180$

$7x^2 = 175$

$x = 5$

**11.** $m\angle E = 40°$

$m\angle F = 135°$

$m\angle G = 140°$

$m\angle H = 45°$

**12.** $m\widehat{FG} = 50°$

$m\widehat{EF} = 40°$

$m\widehat{EH} = 240°$

**13.** $\triangle ABC$ is inscribed in the $\odot$ and $\overline{BC}$ is the hypotenuse. The hypotenuse of an inscribed right triangle is a diameter.

**14.** $P: \left(\frac{3}{2}, 2\right)$

$d = \sqrt{9 + 16}$

$= 5$

$r = \frac{5}{2}$

**15.** $\left(x - \frac{3}{2}\right)^2 + (y - 2)^2 = \frac{25}{4}$

**16.** the point $\left(\frac{3}{2}, 2\right)$

**17.** **a.** $10x = 30$, $x = 3$ **b.** $x^2 = 18(32)$, $x = 24$ **c.** $180°$

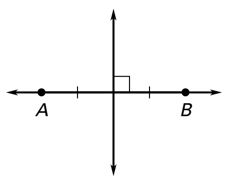
**d.** $90°$ **e.** $45°$ **f.** $45°$

**18.** $\overset{\frown}{BC} \cong \overset{\frown}{CD}$; Their corresponding chords are congruent so by Thm. 10.4 the arcs are congruent.

**19.**
$$120° = \tfrac{1}{2}(180° + m\overset{\frown}{AG})$$
$$240° = 180° + m\overset{\frown}{AG}$$
$$60° = m\overset{\frown}{AG}$$

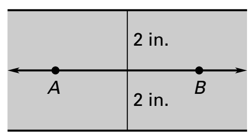
**20.**
$$m\overset{\frown}{BH} = 180° - x°$$
$$m\overset{\frown}{HD} = x°$$
$$16 = \tfrac{1}{2}(180 - x - x)$$
$$32 = 180 - 2x$$
$$2x = 148$$
$$x = 74$$
$$m\overset{\frown}{BH} = 106°,\ m\overset{\frown}{HD} = 74°$$

**21.**



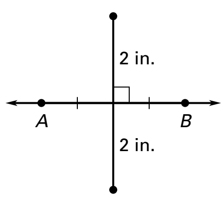

all points on the perpendicular bisector of $\overline{AB}$

**22.**




all points on the lines parallel to and 2 in. from $\overleftrightarrow{AB}$ and all points less than 2 in. from $\overleftrightarrow{AB}$

**23.**



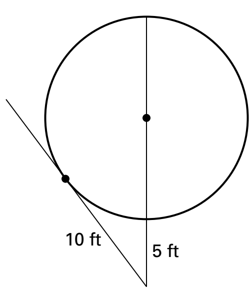

A 4 in. segment of the ⊥ bisector of $\overline{AB}$ with midpoint the midpoint of $\overline{AB}$

**24.** 100

**25.** $m\angle 1 = 80°$; $m\angle 2 = 40°$; $m\angle 3 = 25°$

**26.** Farther away; this will increase the measure of the smaller intercepted arc and thereby decrease $m\angle B$.

**27.**




**28.**
$$5(5 + d) = 100$$
$$25 + 5d = 100$$
$$d = 15 \text{ ft}$$
$$r = 7.5 \text{ ft}$$

Use Pyth. Thm or Thm. 10.17.

### Algebra Review (pp. 656–657)

**1.** $A = lw$

$\frac{A}{l} = w$

**2.** $V = \frac{4}{3}\pi r^3$

$\sqrt[3]{\frac{3V}{4\pi}} = r$

$\frac{\sqrt[3]{6\pi^2 V}}{2\pi} = r$

**3.** $A = \frac{1}{2}bh$

$\frac{2A}{b} = h$

**4.** $A = \frac{1}{2}h(b_1 + b_2)$

$\frac{2A}{h} - b_2 = b_1$

**5.** $A = \pi r^2$

$\sqrt{\frac{A}{\pi}} = r$

$\frac{\sqrt{A\pi}}{\pi} = r$

**6.** $C = 2\pi r$

$\frac{C}{2\pi} = r$

**7.** $V = S^3$

$\sqrt[3]{V} = S$

**8.** $P = 2l + 2w$

$\frac{P - 2w}{2} = l$

$\frac{P}{2} - w = l$

**9.** $V = lwh$

$\frac{V}{lw} = h$

**10.** $V = \pi r^2 h$

$\frac{V}{\pi r^2} = h$

**11.** $S = 6s^2$

$\sqrt{\frac{S}{6}} = s$

$\frac{\sqrt{6S}}{6} = s$

**12.** $9^2 + b^2 = c^2$

$b = \sqrt{c^2 - a^2}$

**13.** $5 + x$ **14.** $x^2 + \sqrt{2}$ **15.** $2x - 14$ **16.** $3x - 6$

**17.** $(x + 2) - 9x$ **18.** $\frac{1}{2}x + 3x$

**19.** $5x - 7 = 13$

$5x = 20$

$x = 4$

**20.** $2x - 16 = 10$

$2x = 26$

$x = 13$

**21.** $2x + 14x = 48$

$16x = 48$

$x = 3$

**22.** $\frac{1}{2}x = 3(x + 5)$

$x = 6x + 30$

$-5x = 30$

$x = -6$

**23.** $x = 0.30(120)$

$x = 36$

**24.** $x = 0.15(340)$

$x = 51$ miles

**25.** $x = 0.71(200)$

$x = 142$

**26.** $x = 0.50(25)$

$\$12.50 = x$

**27.** $34 = x(136)$

$x = 25\%$

**28.** $11 = x(50)$

$x = 22\%$

**29.** $200 = x(50)$

$x = 400\%$

**30.** $8 = x(52)$

$x \approx 15.38\%$

**31.** $3 = 0.30x$

$x = 10$

**32.** $16 = 0.64x$

$x = 25$ meters

**33.** $25.95(0.08) = \$2.08$

**34.** $3 = x(18)$

$x \approx 16.67\%$

**35.** $\frac{5x}{10x^2} = \frac{1}{2x}$

**36.** $\frac{16a^3}{8a} = 2a^2$

**37.** $\frac{(5x^2 + x)}{5x + 1} = \frac{x(5x + 1)}{5x + 1}$

$= x$

**38.** $\frac{9w^3 + 27w}{3w^3 + 9w} = \frac{9w(w^2 + 3)}{3w(w^2 + 3)}$

$= 3$

**39.** $\frac{5a + 10}{5a - 40} = \frac{5(a + 2)}{5(a - 8)}$

$= \frac{a + 2}{a - 8}$

**40.** $\frac{5x^2 + 15x}{30x^2 - 5x} = \frac{5x(x + 3)}{5x(x - 1)}$

$= \frac{x + 3}{6x - 1}$

**41.** $\frac{14d^2 - 2d}{6d^2 + 8d} = \frac{2d(7d - 1)}{2d(3d + 4)}$

$= \frac{7d - 1}{3d + 4}$

**42.** $\frac{2y - 12}{24 - 2y} = \frac{2(y - 6)}{2(12 - y)}$

$= \frac{y - 6}{12 - y}$

**43.** $\frac{36s^2 - 4s}{4s^2 - 12s} = \frac{4s(9s - 1)}{4s(s - 3)}$

$= \frac{9s - 1}{s - 3}$

**44.** $\frac{-5h + 1}{h + 1}$

**45.** $\frac{t^2 - 1}{t^2 + 2t + 1} = \frac{(t + 1)(t - 1)}{(t + 1)(t + 1)}$

$= \frac{t - 1}{t + 1}$

**46.** $\frac{m^2 - 4m + 4}{m^2 - 4} = \frac{(m - 2)^2}{(m - 2)(m + 2)}$

$= \frac{m - 2}{m + 2}$