9.5 Extra Practice

1. $\sin F = \frac{12}{13} \approx 0.9231$, $\sin G = \frac{5}{13} \approx 0.3846$, $\cos F = \frac{5}{13} \approx 0.3846$, $\cos G = \frac{12}{13} \approx 0.9231$
2. $\sin F = \frac{65}{97} \approx 0.6701$, $\sin G = \frac{72}{97} \approx 0.7423$, $\cos F = \frac{72}{97} \approx 0.7423$, $\cos G = \frac{65}{97} \approx 0.6701$
3. $\sin F = \frac{\sqrt{2}}{2} \approx 0.7071$, $\sin G = \frac{\sqrt{2}}{2} \approx 0.7071$, $\cos F = \frac{\sqrt{2}}{2} \approx 0.7071$, $\cos G = \frac{\sqrt{2}}{2} \approx 0.7071$
4. cos 81°
5. cos 60°
6. cos 13°
7. sin 75°
8. sin 7°
9. sin 45°
10. $x \approx 2.5$, $y \approx 8.7$
11. $m \approx 15.5$, $n \approx 47.6$
12. $c \approx 10.7$, $d \approx 14.7$
13. $a \approx 13.1$, $b \approx 30.9$
14. **a.** about 110.3 ft
    b. about 181.3 ft

9.6 Explorations

1. **a.** $\sin A = \cos A = \sin B = \cos B = \frac{\sqrt{2}}{2}$; $m\angle A = m\angle B = 45°$
   b. $\sin A = \cos B = \frac{\sqrt{3}}{2}$, $\cos A = \sin B = \frac{1}{2}$; $m\angle A = 60°$, $m\angle B = 30°$
2. **a.** $m\angle A \approx 59.0°$, $m\angle B \approx 31.0°$
   b. $m\angle A \approx 63.4°$, $m\angle B \approx 26.6°$
3. You can find the ratio of two side lengths that gives the value of the sine, cosine, or tangent of an angle. If you recognize the ratio from a special right triangle, then you can find the measure of the angle that way. Otherwise, you can use the inverse sine, cosine, or tangent feature of your calculator to approximate the measure of the angle.
4. about 67.4°, about 22.6°

9.6 Extra Practice

1. $\angle F$
2. $\angle E$
3. about 11.5°
4. 45°
5. about 70.7°
6. about 62.9°
7. $AC = 6\sqrt{5}$, $m\angle A \approx 63.4°$, $m\angle C \approx 26.6°$
8. $ED = 72$, $m\angle C \approx 73.7°$, $m\angle D \approx 16.3°$
9. $LM \approx 1.8$, $MN \approx 2.4$, $m\angle N = 38°$
10. $YZ \approx 37.1$, $XZ \approx 32.5$, $m\angle Y = 61°$
11. about 28.7°

9.7 Explorations

1. **a.** 29.74°, 3.16, 0.157, 97.13°, 6.32, 0.157, 53.13°, 5.1, 0.157; $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$
   b. Check students' work; In any given triangle, the ratio of the sine of an angle measure to the length of the opposite side is the same as the ratio of the sine of any other angle measure to the length of its opposite side.
2. **a.** 5.1, 26.0, 3.16, 9.99, 6.32, 39.94, 53.13°, 26.0; $a^2 + b^2 - 2ab \cos C = c^2$
   b. Check students' work; In any given triangle, the length of one side squared, c^2, equals $a^2 + b^2 - 2ab \cos C$, where a and b are the lengths of the other two sides, and $\angle C$ is the angle opposite side c.
3. For any triangle with sides of length a, b, and c, where the angles opposite each of the respective sides are $\angle A$, $\angle B$, and $\angle C$, the Law of Sines (Thm. 9.9) is $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$, and the Law of Cosines (Thm. 9.10) is $c^2 = a^2 + b^2 - 2ab \cos C$. Both of these equations can be manipulated to solve for different values.
4. Use the Law of Sines (Thm. 9.9) to solve a triangle when you know the measures of two angles and any side, or when you know two sides and one nonincluded angle. Use the Law of Cosines (Thm. 9.10) when you know the measures of two sides and their included angle, or when you know the measures of all three sides.

9.7 Extra Practice

1. about −0.7071
2. about −0.3584
3. about −9.5144
4. about 61.8 square units
5. about 85 square units
6. $m\angle C = 100°$, $a \approx 33.7$, $c \approx 43.3$
7. $m\angle B \approx 39.3°$, $m\angle C \approx 58.7°$, $c \approx 21.6$
8. $m\angle A \approx 38.2°$, $m\angle B = 120°$, $m\angle C \approx 21.8°$

Chapter 10

Maintaining Mathematical Proficiency

1. $x^2 - 13x + 36$
2. $k^2 - k - 42$
3. $y^2 - 8y - 65$
4. $6r^2 + 11r + 3$
5. $-12m^2 + 23m - 10$
6. $42w^2 + 29w - 5$
7. $x \approx -7.36$, $x \approx 1.36$
8. $p \approx -0.35$, $p \approx 14.35$
9. $z \approx -15.55$, $z \approx -0.45$
10. $z \approx -5.37$, $z \approx 0.37$
11. $x \approx -3.45$, $x \approx 1.45$
12. $c \approx -0.62$, $c \approx 1.62$

10.1 Explorations

1. segment with endpoints on the circle; line that intersects a circle at two points; line in the plane of a circle that intersects the circle at exactly one point; segment whose endpoints are the center and any point on a circle; chord that contains the center of the circle
2. **a. and b.** Check students' work.
   c. The distance is the radius and half the diameter.
3. A chord is a segment with endpoints that lie on a circle. A diameter is a chord that passes through the center of a circle. A radius is a segment with one endpoint on the center of a circle and one endpoint on the circle. A secant line is a line that passes through two points on a circle. A tangent line is a line that passes through only one point on a circle.
4. diameters; A diameter is a chord that passes through the center of a circle.
5. Use two pencils tied together with a string that is 4 inches long.

10.1 Extra Practice

1. Answers may include $\overline{AB}$, $\overline{AD}$, $\overline{AF}$

2. Answers may include $\overline{CE}$, $\overline{DF}$

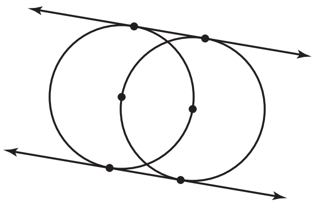
3. $\overline{DF}$

4. $\overleftrightarrow{DE}$

5. line through point *B*

6. point *B*

7. 2



8. Both tangents are external.

9. $BD = \sqrt{10^2 - 5.5^2} \approx 8.4$

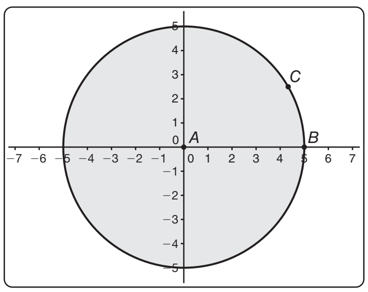
10. $x \approx 0.6$

10.2 Explorations

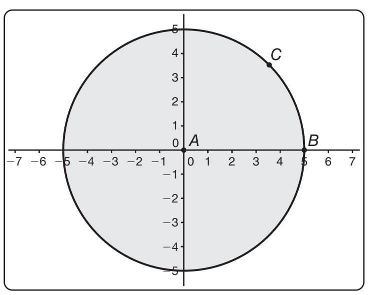
1. a. 36.87°   b. 53.13°
   c. 16.26°   d. 106.26°

2. by their central angles

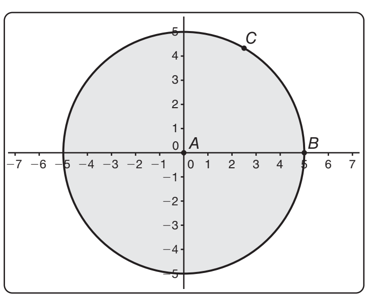
3. a.



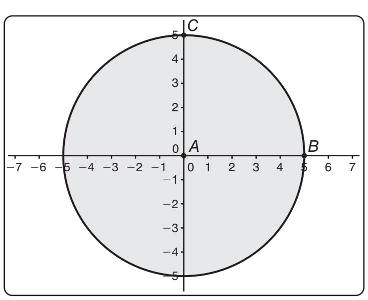
b.



c.



d.



10.2 Extra Practice

1. minor arc; 90°

2. semicircle; 180°

3. major arc; 220°

4. minor arc; 90°

5. major arc; 270°

6. major arc; 230°

7. minor arc; 140°

8. minor arc; 40°

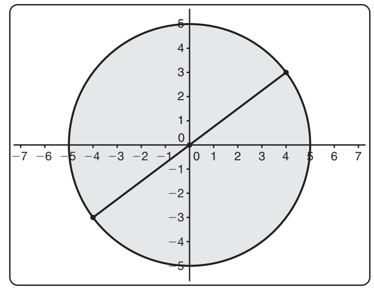
9. yes; $\widehat{ABC} \cong \widehat{ADC}$, because AC is a diameter.

10. 125°

11. $x = 25$; 125°

10.3 Explorations

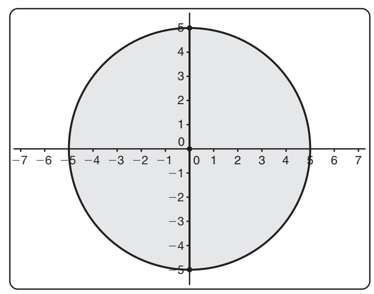
1. a.



;

It passes through the center.

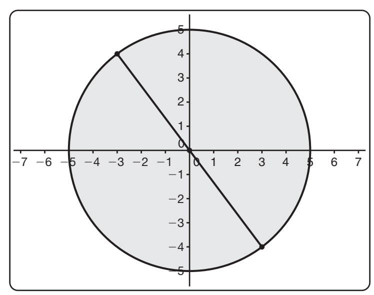
b.



;

It passes through the center.

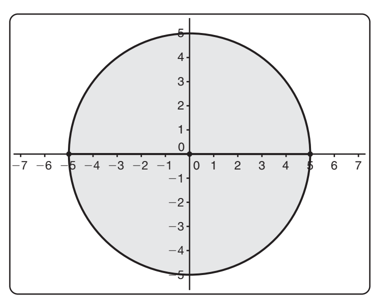
c.



;

It passes through the center.

d.



;

It passes through the center.

2. Check students' work; The perpendicular bisector is a diameter; yes; A perpendicular bisector of a chord is a diameter of the circle.

3. Check students' work; $DF = EF$; yes; If a chord is perpendicular to a diameter of a circle, then the diameter is a perpendicular bisector of the chord.

4. when it is a perpendicular bisector of a chord or passes through the center of the circle

10.3 Extra Practice

1. 42°
2. 3.6
3. 9.2
4. 138°
5. $x = 3.6$
6. $x = 6$
7. 5
8. 12.2

10.4 Explorations

1. **a.** Check students' work.
   b. The inscribed angle is half of the intercepted arc.
   c. Check students' work; The measure of an inscribed angle is equal to half the measure of the intercepted arc.
2. **a.** Check students' work.
   b. *Sample answer:* The angles sum to 360°; Opposite angles sum to 180°.
   c. Check students' work; Opposite angles of an inscribed quadrilateral sum to 180°.
3. Inscribed angles are half of the intercepted arc; Opposite angles of an inscribed quadrilateral are supplementary.
4. 100°; $\angle E$ and $\angle G$ are supplementary.

10.4 Extra Practice

1. 90°
2. 62°
3. 8.3
4. 56°
5. 124°
6. $\angle ABD \cong \angle ACD$, $\angle BAC \cong \angle BDC$
7. $m = 115$, $n = 80$

10.5 Explorations

1. **a.** Check students' work.
   b. *Sample answer:* 50°, 130°
   c. *Sample answer:* 100°, 260°
   d. Check students' work; The measure of each angle between a chord and a tangent is half of its intercepted arc.
2. **a.** Check students' work.
   b. *Sample answer:* 60°
   c. *Sample answer:* 40°, 80°; The angle measure is half of the sum of the measures of the intercepted arcs.
   d. Check students' work; The measure of an angle between two chords is half of the sum of the measure of the arcs intercepted by the angle and its vertical angle.
3. When a chord intersects a tangent line, the angle formed is half of the measure of the intercepted arc. When a chord intersects another chord, the measure of the angle is half of the sum of the measures of the arcs intercepted by the angle and its vertical angle.
4. 74°
5. 110°

10.5 Extra Practice

1. 110°
2. 140°
3. 220°
4. 140°
5. 49°
6. $x = 71$
7. $x = 20$
8. $x = 148$
9. $x = 50$

10.6 Explorations

1. **a.** Check students' work.
   b. *Sample answer:*

BF	***CF***	***BF • CF***
7.5	13.2	99
DF	***EF***	***DF • EF***
6.6	15	99

   The products are equal.
   c. If two chords intersect inside a circle, then the product of the lengths of the segments of one chord is equal to the product of the lengths of the segments of the other chord.
2. **a.** Check students' work.
   b. *Sample answer:*

BE	***BC***	***BE • BC***
17.6	35.9	631.84
BF	***BD***	***BF • BD***
22	28.72	631.84

   The products are equal.
   c. If two secants intersect outside a circle with a common endpoint, then the product of the lengths of the segments of one secant is equal to the product of the lengths of the segments of the other secant.
3. The products of the lengths of the segments of one chord or secant is equal to the product of the lengths of the segments of the other chord or secant.
4. 4

10.6 Extra Practice

1. 5
2. 6
3. 1
4. 5

10.7 Explorations

1. **a.** *Sample answer:*

Radius	**Equation of Circle**
1	$x^2 + y^2 = 1$
2	$x^2 + y^2 = 4$
3	$x^2 + y^2 = 9$
5	$x^2 + y^2 = 25$
6	$x^2 + y^2 = 36$
9	$x^2 + y^2 = 81$

   b. $x^2 + y^2 = r^2$

2. a. *Sample answer:*

Center	Equation of Circle
(0, 0)	$x^2 + y^2 = 4$
(2, 0)	$(x - 2)^2 + y^2 = 4$
(0, 3)	$x^2 + (y - 3)^2 = 4$
(2, −3)	$(x - 2)^2 + (y + 3)^2 = 4$
(−1, 4)	$(x + 1)^2 + (y - 4)^2 = 4$
(−3, −6)	$(x + 3)^2 + (y + 6)^2 = 4$

b. $(x - h)^2 + (y - k)^2 = 4$

c. $(x - h)^2 + (y - k)^2 = r^2$

3. $\sqrt{(x - h)^2 + (y - k)^2} = d$; $(x - h)^2 + (y - k)^2 = d^2$; If $d = r$, then the equations are the same.

4. $(x - h)^2 + (y - k)^2 = r^2$

5. $(x - 4)^2 + (y + 1)^2 = 9$

10.7 Extra Practice

1. $x^2 + y^2 = 64$

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

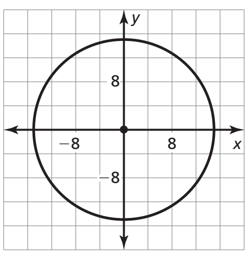
3. $x^2 + y^2 = \frac{1}{9}$

4. $(x + 3)^2 + (y + 5)^2 = 64$

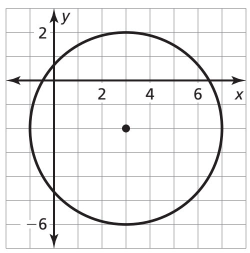
5. $x^2 + y^2 = 25$

6. $(x - 4)^2 + (y - 5)^2 = 25$

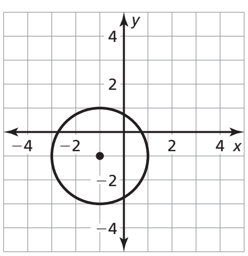
7. center: (0, 0), radius: 15



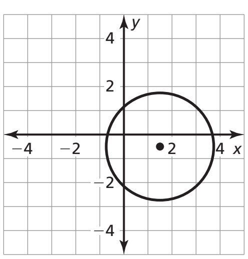
8. center: (3, −2), radius: 4



9. center: (−1, −1), radius: 2



10. center: $\left(\frac{3}{2}, -\frac{1}{2}\right)$, radius: $\sqrt{5}$



11. The radius of the circle is 6. $\sqrt{(-4 - 0)^2 + (4 - 0)^2} = 4\sqrt{2}$, so (−4, 4) does not lie on the circle.

12. The radius of the circle is $3\sqrt{2}$. $\sqrt{(-4 + 1)^2 + (-1 - 2)^2} = 3\sqrt{2}$, so (−1, 2) does lie on the circle.

Chapter 11

Maintaining Mathematical Proficiency

1. 160 in.^{2}

2. 660 cm^2

3. $\frac{5}{2}$ in.

4. 8 cm

11.1 Explorations

1. a. $8\pi \approx 25.13$ units

b. $2\pi \approx 6.28$ units

c. $\frac{10}{3}\pi \approx 10.47$ units

d. $\frac{15}{4}\pi \approx 11.78$ units

2. no; *Sample answer:* One-half revolution of the tire is about 3.27 feet.

3. Multiply the fraction of the circle the arc represents by the circumference of the circle.

4. about 56.55 in.

11.1 Extra Practice

1. about 3.18 in.

2. about 18.85 cm

3. about 1.275 ft

4. about 7.54 m

5. about 3.66 in.

6. $\frac{\pi}{3}$ rad

7. 150°

11.2 Explorations

1. a. about 113.10 square units

b. about 28.27 square units

c. about 11.00 square units

d. about 134.04 square units

2. about 167,552 m^2

3. Multiply the fraction of the circle the sector represents by the area of the circle.

4. about 13,963 m^2

11.2 Extra Practice

1. about 19.63 cm^2

2. about 153.94 m^2

3. about 2.54 in.^{2}

4. about 3.57 ft

5. about 4.55 cm

6. about 116.90 yd^2

7. about 19.55 cm^2; about 30.72 cm^2

8. 59.04 ft^2

9. about 25 people/mi^2

11.3 Explorations

1. a. about 1.15 units; 6.9 square units

b. about 2.75 units; 27.5 square units

c. about 3.46 units; 41.52 square units

d. about 4.83 units; 77.28 square units

Sample answer: Find the center of the regular n-gon by finding the center of its circumscribed circle. Then find the apothem. Use the center to divide the n-gon into n congruent triangles, each with a base that is a side of the n-gon and a height that is the apothem. Find the area of one triangle and multiply by n to find the area of the regular n-gon.

2. $A = \frac{1}{2}aP$, where a is the apothem and P is the perimeter

3. *Sample answer:* Find the perimeter and apothem and substitute the values in the formula $A = \frac{1}{2}aP$.

4. 61.95 m^2

11.3 Extra Practice

1. 140 in.^{2}

2. 16 cm^2

3. 45°

4. 9 sides