Answers for Lesson 12-1, pp. 665–668 Exercises

1. 120 **2.** 47 **3.** 30 **4.** 14.04 in.

5. Extend $\overline{RS}$ and $\overline{QP}$ until they meet at a point, H. By Thm. 11-3, $RH = QH$, or $SH + RS = QP + PH$. By 11-3 again, $SH = PH$. Thus, $RS = QP$.

6. 15.2 cm **7.** 20.0 in.

8. No; $5^2 + 15^2 \neq 16^2$ **9.** Yes; $2.5^2 + 6^2 = 6.5^2$

10. Yes; $6^2 + 8^2 = 10^2$

11. 78 cm **12.** 14.2 in. **13.** 13 **14.** 3.6 cm

15. 8 in.

16. **a.** external

b. external

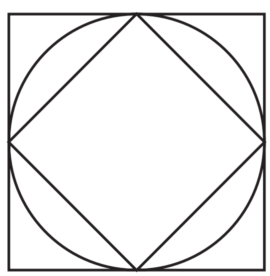
c. internal

d. blue lines; green lines

e. No; explanations may vary.

17. 35.8 km **18.** 80.0 km **19.** 113.1 km **20.** 57.5

21. **a.**

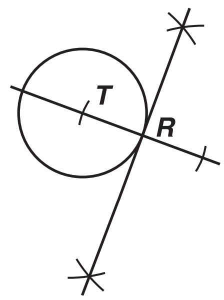


b. Answers may vary. Sample: If you draw diagonals in the small square, 8 ≅ △s are formed in the large square with 4 in the small square.

22. B

23. All four are ≅; the two tangents to each coin from A are ≅, so by the Trans. Prop., all are ≅.

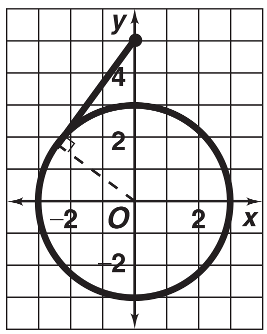
24.



25. 35

26. $90 - \left(\frac{180 - x}{2}\right)$ or $\frac{x}{2}$; $m\angle 4$ is $\frac{1}{2}m\angle 1$.

27.



4 units

28. about 5.2 in.

29. **a.** ⊥

b. LK

c. SAS

d. CPCTC

e. tangent

f. false

30. **1.** $\overline{BA}$ and $\overline{BC}$ are tangent to $\odot O$ at A and C (Given)

2. $\overline{AB} \perp \overline{OA}$ and $\overline{BC} \perp \overline{OC}$ (If a line is tan. to a circle, it is $\perp$ to the radius.)

3. $\triangle BAO$ and $\triangle BCO$ are right $\triangle$s. (Def. of rt. $\triangle$)

4. $\overline{AO} \cong \overline{OC}$ (Radii of a circle are $\cong$.)

5. $\overline{BO} \cong \overline{BO}$ (Refl. Prop. of $\cong$)

6. $\triangle BAO \cong \triangle BCO$ (HL Thm.)

7. $\overline{BA} \cong \overline{BC}$ (CPCTC)

31. **1.** $\overline{BC}$ is tangent to $\odot A$ at D. (Given)

2. $\overline{DB} \cong \overline{DC}$ (Given)

3. $\overline{AD} \perp \overline{BC}$ (If a line is tan. to a circle, it is $\perp$ to the radius.)

4. $\triangle ADB$ and $\triangle ADC$ are rt. $\triangle$s (Def. of rt. $\triangle$)

5. $\overline{AD} \cong \overline{AD}$ (Refl. Prop. of $\cong$)

6. $\triangle ADB \cong ADC$ (SAS)

7. $\overline{AB} \cong \overline{AC}$ (CPCTC)

32. **1.** $\odot A$ and $\odot B$ with common tangents $\overline{DF}$ and $\overline{CE}$ (Given)

2. $GD = GC$ and $GE = GF$ (Two tan. segments from a pt. to a circle are $\cong$.)

3. $\frac{GD}{GC} = 1, \frac{GF}{GE} = 1$ (Div. Prop. of $=$)

4. $\frac{GD}{GC} = \frac{GF}{GE}$ (Trans. Prop. of $=$)

5. $\angle DGC \cong \angle EGF$ (Vert. $\angle$s are $\cong$.)

6. $\triangle GDC \sim \triangle GFE$ (SAS $\sim$ Thm.)

33. Assume $\overleftrightarrow{AB}$ is not tangent to $\odot O$. Then either $\overleftrightarrow{AB}$ does not intersect $\odot O$ or $\overleftrightarrow{AB}$ intersects $\odot O$ at two pts. If $\overleftrightarrow{AB}$ does not intersect $\odot O$, then P is not on $\odot O$, which contradicts $\overline{OP}$ being a radius. If $\overleftrightarrow{AB}$ intersects $\odot O$ at two pts., P and Q, then $\overline{OP} \cong \overline{OQ}$ ($\cong$ radii), $\triangle OPQ$ is isosc., and $\angle OPQ \cong \angle OQP$. But $\angle OPQ$ is a rt. $\angle$, since $\overline{AB} \perp \overline{OP}$, and $\triangle OPQ$ has two rt. $\angle$s. This is a contradiction also, so $\overleftrightarrow{AB}$ is tangent to $\odot O$.

34. At each vertex, let the radius of a circle be the distance from the vertex to either point of tangency of the inscribed circle.

Answers for Lesson 12-2, pp. 673–675 Exercises

1. $\widehat{BC} \cong \widehat{YZ}$; $\overline{BC} \cong \overline{YZ}$

2. $\overline{ET} \cong \overline{GH} \cong \overline{JN} \cong \overline{ML}$
$\widehat{ET} \cong \widehat{GH} \cong \widehat{JN} \cong \widehat{ML}$;
$\angle TFE \cong \angle HFG \cong \angle JKN \cong \angle MKL$

3. 14 **4.** 2 **5.** 7

6. 50 **7.** 8 **8.** 10

9. Answers may vary. Samples are given.
a. $\overline{CE}$
b. $\overline{DE}$
c. $\angle CEB$
d. $\angle DEA$

10. the center of the circle

11. 6 **12.** 5.4 **13.** 8.9

14. 12.5 **15.** 9.9 **16.** 20.8

17. 108 **18.** 90 **19.** about 123.9

20. She can draw 2 chords, and their ⊥ bisectors, of the partial circle. The intersection pt. of the ⊥ bisectors will be the center and she can then measure the radius.

21. 12 cm **22.** 6 in.

23. **a.** $\overline{PL}$
b. $\overline{PM}$
c. All radii of a circle are ≅.
d. $\triangle LPN$
e. SAS
f. CPCTC

24. **a.** All radii of a circle are $\cong$.

b. $\overline{AB} \cong \overline{CD}$

c. Given

d. SSS

e. $\angle AEB \cong \angle CED$

f. $\cong$ central $\measuredangle$s have $\cong$ arcs.

25. $\triangle OAC \cong \triangle OBC$ by HL. $\overline{AC} \cong \overline{BC}$ since CPCTC. Also $\angle AOC \cong \angle BOC$ (CPCTC), so $\widehat{AD} \cong \widehat{BD}$ since $\cong$ central $\measuredangle$s intercept $\cong$ arcs.

26. about 13.9 cm

27. He doesn't know that the chords are equidistant from the center.

28. Check students' work.

29. If the chords, arcs, or central $\measuredangle$s are in different circles and the circles have unequal radii, the theorems do not apply.

30. 5 in. **31.** 10 cm **32.** 10 ft **33.** C

34. 3.5 cm, 15.5 cm

35. **1.** $\odot P$ with $\widehat{QS} \cong \widehat{RT}$ (Given)

2. $m\widehat{QS} = m\angle QPS$ and $m\widehat{RT} = m\angle RPT$ (Arc measure = central $\angle$ measure.)

3. $m\widehat{QS} = m\widehat{RT}$ (Def. of $\cong$)

4. $\angle QPS \cong \angle RPT$ (Subst.)

36. X is equidist. from W and Y, since $\overline{XW}$ and $\overline{XY}$ are radii. So, X is on the $\perp$ bis. of $\overline{WY}$ by the Conv. of the $\perp$ Bis. Thm. But ℓ is the $\perp$ bis. of $\overline{WY}$, so ℓ contains X.

37. C on the bisector of $\angle QPR$ means that C is equidistant from $\overline{PQ}$ and $\overline{PR}$, or $\overline{PQ}$ and $\overline{PR}$ are equidistant from C. Therefore, $PQ = PR$ since chords equidistant from the center of a circle are $\cong$.

38. All radii of $\odot O$ are $\cong$, so $\triangle AOB \cong \triangle COD$ by SSS. $\angle A \cong \angle C$ by CPCTC. Also, $\angle OEA \cong \angle OFC$ since both are rt. $\angle$s. Thus, $\triangle OEA \cong \triangle OFC$ by AAS, and $\overline{OE} \cong \overline{OF}$ by CPCTC.

39. **1.** $\odot A$ with $\overline{CE} \perp \overline{BD}$ (Given)

2. $\overline{CF} \cong \overline{CF}$ (Refl. Prop. of $\cong$)

3. $\overline{BF} \cong \overline{FD}$ (A diameter $\perp$ to a chord bisects the chord.)

4. $\angle CFB$ and $\angle CFD$ are rt. $\angle$s (Def. of $\perp$).

5. $\triangle CFB \cong \triangle CFD$ (SAS)

6. $\overline{BC} \cong \overline{CD}$ (CPCTC)

7. $\widehat{BC} \cong \widehat{DC}$ ($\cong$ chords have $\cong$ arcs.)

40. 1661 gal

41. Let O be the center of the circles, and P be the pt. of tangency of the larger circle's chord to the smaller circle. Then $\overline{OP}$ is $\perp$ to the chord, and therefore bisects it. So P is the mdpt. of the chord.

Answers for Lesson 12-3, pp. 681–684 Exercises

1. $\angle ACB$; $\overparen{AB}$

2. $\angle RQS$; $\overparen{RS}$

3. $\angle MPN$; $\overparen{MN}$

4. **a.** $\angle BAD$ and $\overparen{BCD}$; $\angle ABC$ and $\overparen{ADC}$; $\angle DCB$ and $\overparen{DAB}$; $\angle ADC$ and $\overparen{ABC}$

b. $\angle ABC$ and $\angle BCD$; obtuse

5. 58

6. 180

7. $a = 218$; $b = 109$

8. $a = 54$; $b = 30$; $c = 96$

9. $a = 112$; $b = 120$; $c = 38$

10. $a = 101$; $b = 67$; $c = 84$; $d = 80$

11. $x = 36$; $y = 36$

12. $a = 85$; $b = 47.5$; $c = 90$

13. $a = 50$; $b = 90$; $c = 90$

14. $p = 90$; $q = 122$

15. $w = 123$

16. $x = 65$; $y = 130$

17. $e = 65$; $f = 130$

18. $a = 26$; $b = 64$; $c = 42$

19. $a = 22$; $b = 78$; $c = 156$

20. $a = 30$; $b = 60$; $c = 62$; $d = 124$; $e = 60$

21. **a.** 96
b. 55
c. 77
d. 154

22. **a.** 40
b. 50
c. 40
d. 40
e. 65

23. B

24. **a.** 78
b. 95
c. 105
d. 85

25. $\angle PQR \cong \angle QRS$ since they are alt. int. ∠s. Since $\cong$ inscribed ∠s intercept $\cong$ arcs, $m\overset{\frown}{PR} = m\overset{\frown}{QS}$.

26. **a.** Check students' work.
b. isosc. trapezoid; justifications may vary. Sample: arcs between two ∥ chords are $\cong$.

27. **a.** $77\frac{1}{7}$
b. 36

28. Rectangle; opp. ∠s are $\cong$ (because figure is ▱) and suppl. (because opp. ∠s intercept arcs whose measures sum to 360). Congruent suppl. ∠s are rt ∠s, so inscribed ▱ must be a rectangle.

29. about 7.1 cm by 7.1 cm

30. about 8.7 cm for each side

31. about 7.1 cm legs, and a 10 cm base

32. Answers may vary. Sample:

a. If the cameras' lenses open at = ≜s, then in the positions shown they share the same arc of the scene.

b. No; the distances from each position of the scene to each camera affect the look of the scene.

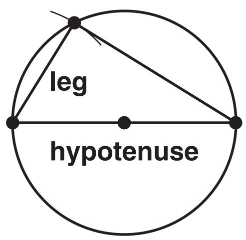
33. $\angle ACB$ is a rt. $\angle$ because it is inscribed in semicircle $\widehat{ACB}$, and if a line is $\perp$ to a radius at its endpoint, it is tangent to the circle.

34. **a.** $\angle CEF$, $\angle FEG$, $\angle GED$, $\angle CED$, $\angle CEG$, and $\angle FED$

b. $\angle CED$

c. $\angle EFG$ and $\angle EDG$; $\angle FED$, and $\angle FGD$

35.



36. **1.** $\odot O$ with inscribed $\angle ABC$ (Given)

2. $m\angle ABO = \frac{1}{2}m\widehat{AP}$; $m\angle OBC = \frac{1}{2}m\widehat{PC}$ (Inscribed $\angle$ Thm., Case I)

3. $m\angle ABO + m\angle OBC = m\angle ABC$ ($\angle$ Add. Post.)

4. $\frac{1}{2}m\widehat{AP} + \frac{1}{2}m\widehat{PC} = m\angle ABC$ (Subst.)

5. $\frac{1}{2}(m\widehat{AP} + m\widehat{PC}) = m\angle ABC$ (Distr. Prop.)

6. $\frac{1}{2}m\widehat{AC} = m\angle ABC$ (Arc Add. Post.)

37. **1.** $\odot S$ with inscribed $\angle PQR$ (Given)

2. $m\angle PQT = \frac{1}{2}m\overset{\frown}{PT}$ (Inscribed $\angle$ Thm., Case I)

3. $m\angle RQT = \frac{1}{2}m\overset{\frown}{RT}$ (Inscr. $\angle$ Thm., Case I)

4. $m\overset{\frown}{PR} = m\overset{\frown}{PT} - m\overset{\frown}{RT}$ (Arc Add. Post.)

5. $m\angle PQR = m\angle PQT - m\angle RQT$ ($\angle$ Add. Post.)

6. $m\angle PQR = \frac{1}{2}m\overset{\frown}{PT} - \frac{1}{2}m\overset{\frown}{RT}$ (Subst.)

7. $m\angle PQR = \frac{1}{2}m\overset{\frown}{PR}$ (Subst.)

38. **1.** $\odot O$, $\angle A$ intercepts $\overset{\frown}{BC}$, and $\angle D$ intercepts $\overset{\frown}{BC}$ (Given)

2. $m\angle A = \frac{1}{2}m\overset{\frown}{BC}$ and $m\angle D = \frac{1}{2}m\overset{\frown}{BC}$ (Inscr. $\angle$ Thm.)

3. $m\angle A = m\angle D$ (Subst.)

4. $\angle A \cong \angle D$ (Def. of $\cong$)

39. **1.** $\odot O$ with inscribed $\angle CAB$ in a semicircle (Given)

2. $m\angle CAB = \frac{1}{2}m\overset{\frown}{BDC}$ (Inscr. $\angle$ Thm.)

3. $m\overset{\frown}{BDC} = 180$ (Meas. of semicircle $= 180$.)

4. $m\angle CAB = 90$ (Subst.)

5. $\angle CAB$ is a rt. $\angle$. (Def. of rt. $\angle$)

40. **1.** quadrilateral $ABCD$ inscribed in $\odot O$ (Given)

2. $m\angle A = \frac{1}{2}m\overset{\frown}{BCD}$ and $m\angle C = \frac{1}{2}m\overset{\frown}{BAD}$ (Inscr. ∠ Thm.)

3. $m\angle A + m\angle C = \frac{1}{2}m\overset{\frown}{BCD} + \frac{1}{2}m\overset{\frown}{BAD}$ (Add. Prop.)

4. $m\overset{\frown}{BCD} + m\overset{\frown}{BAD} = 360$ (Entire circle = 360°.)

5. $m\angle A + m\angle C = 180$ (Subst. & Mult. Prop.)

6. $\angle A$ and $\angle C$ are suppl. (Def. of suppl.)

7. $m\angle B = \frac{1}{2}m\overset{\frown}{ADC}$ and $m\angle D = \frac{1}{2}m\overset{\frown}{ABC}$ (Inscr. ∠ Thm.)

8. $m\angle B + m\angle D = \frac{1}{2}m\overset{\frown}{ADC} + \frac{1}{2}m\overset{\frown}{ABC}$ (Add. Prop.)

9. $m\overset{\frown}{ADC} + m\overset{\frown}{ABC} = 360$ (Entire circle = 360.)

10. $m\angle B + m\angle D = 180$ (Subst. and Mult. Prop.)

11. $\angle B$ and $\angle D$ are suppl. (Def. of suppl.)

41. **1.** $\overline{GH}$ and tangent ℓ intersecting at H on $\odot E$ (Given)

2. Construct diameter $\overline{HD}$ intersecting circle E at D. (Constr.)

3. $\angle DHI$ is a rt. ∠. (Tangent and radius are ⊥.)

4. $\overset{\frown}{DGH}$ is a semicircle of measure 180. (Def. of semicircle)

5. $m\angle DHG + m\angle GHI = m\angle DHI$ (∠ Add. Post.)

6. $m\overset{\frown}{DG} + m\overset{\frown}{GFH} = m\overset{\frown}{DGH}$ (Arc Add. Post.)

7. $90 = m\angle DHG + m\angle GHI$ (Subst.)

8. $180 = m\overset{\frown}{DG} + m\overset{\frown}{GFH}$ (Subst.)

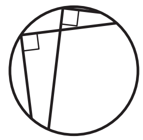
9. $90 = \frac{1}{2}(m\overset{\frown}{DG} + m\overset{\frown}{GFH})$ (Div. Prop.)

10. $m\angle DHG + m\angle GHI = \frac{1}{2}m\overset{\frown}{DG} + \frac{1}{2}m\overset{\frown}{GFH}$ (Subst. and Distr. Prop.)

11. $m\angle DHG = \frac{1}{2}m\overset{\frown}{DG}$ (Inscr. ∠ Thm.)

12. $m\angle GHI = \frac{1}{2}m\overset{\frown}{GFH}$ (Subtr. Prop.)

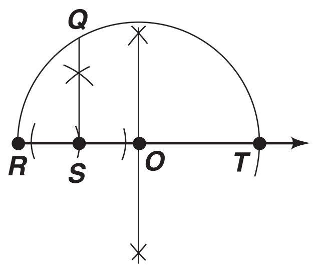
42. false



43. True; the angle's intercepted arc has measure 180, so the angle is inscribed in a semicircle.

44. True; opposite angles in an inscribed quadrilateral intercept non-overlapping arcs totaling 360, and inscribed angles equal half the measure of the arcs they intercept.

45. In the construction below, $RS = x$, $ST = y$, O is the mdpt. of $\overline{RT}$, and $\overline{QS} \perp \overline{RT}$.



1. 46

2. 50

3. $x = 60; y = 70$

4. 60

5. $x = 115; y = 74$

6. $x = 108; y = 72$

7. 160°

8. 125

9. 15

10. 11.5

11. 13.2

12. 3.5

13. $x = 25.8; y = 12.4$

14. $x = 5.3; y = 2.9$

15. about 270.8 ft

16. It could range from 256.9 ft to 285.2 ft.

17. $360 - x$

18. $180 - x$

19. $180 - y$

20. 26.7

21. 16.7

22. 14.1

23. $x = 10.7; y = 10$

24. $x = 8.9; y = 2$

25. $x = 10.9; y = 2.3$

26. You must use (7.5 + 6)6 or the entire segment length.

27. 95, 104, 86, 75

28. **a.** 30; $30 < m\angle Y < 180$; $0 < m\angle Z < 30$

b. If the ∠ measure is ≤ 30, the ship is safe.

29. Answers may vary. Sample: Since they are inscribed ∠s: $m\angle BED = \frac{1}{2}m\widehat{BD}$ and $m\angle ABE = \frac{1}{2}m\widehat{AE}$. Apply the Ext. ∠ Thm. to $\triangle BCE$ to prove that $m\angle C = \frac{1}{2}(m\widehat{AE} - m\widehat{BD})$.

30. Given: $\overline{AB}$ tangent to $\odot O$ at A, $\overline{BC}$ tangent to $\odot O$ at C; Prove: $m\angle B = \frac{1}{2}(360 - 2m\widehat{AC})$.

1. Construct $\overline{AC}$.

2. $m\angle A = \frac{1}{2}m\widehat{AC}$ (The measure of an $\angle$ formed by a tangent and a chord is half the measure of the intercepted arc.)

3. $m\angle C = \frac{1}{2}m\widehat{AC}$ (The measure of an $\angle$ formed by a tangent and a chord is half the measure of the intercepted arc.)

4. $m\angle B = 180 - m\angle A - m\angle C$ ($\triangle$ $\angle$ Sum Thm.)

5. $m\angle B = 180 - \frac{1}{2}m\widehat{AC} - \frac{1}{2}m\widehat{AC}$ (Subst.)

6. $m\angle B = 180 - m\widehat{AC}$

7. $m\angle B = \frac{1}{2}(360 - 2m\widehat{AC})$ (Distr. Prop.)

Given: $\overline{BC}$ secant and $\overline{AB}$ tangent to $\odot O$. $\overline{AB}$, $\overline{BC}$ intersect at B and $\overline{AB}$ tangent to $\odot O$ at A. $\overline{BC}$ intersects $\odot O$ at D; Prove: $m\angle B = \frac{1}{2}(m\widehat{AC} - m\widehat{DA})$.

1. Construct $\overline{AD}$.

2. $m\angle A = \frac{1}{2}m\widehat{AD}$ (The measure of an $\angle$ formed by a tangent and a chord is half the measure of the intercepted arc.)

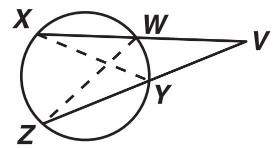
3. $m\angle ADC = \frac{1}{2}m\widehat{AC}$ (The measure of an inscribed $\angle$ is half the measure of its intercepted arc.)

4. $m\angle B = m\angle ADC - m\angle BAD$ (Subtr. and Ext. $\angle$ Thm.)

5. $m\angle B = \frac{1}{2}m\widehat{AC} - \frac{1}{2}m\widehat{AD}$ (Subst.)

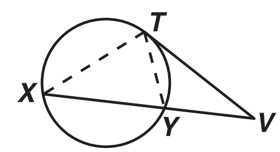
6. $m\angle B = \frac{1}{2}(m\widehat{AC} - m\widehat{AD})$ (Distr. Prop.)

31. Given: A circle with secant segments $\overline{XV}$ and $\overline{ZV}$; Prove: $XV \cdot WV = ZV \cdot YV$.



1. Construct $\overline{XY}$ and $\overline{ZW}$.
2. $\angle XVY \cong \angle ZVW$ (Reflexive Prop. of $\cong$)
3. $\angle VXY \cong \angle WZV$ (2 inscribed ∡s that intercept the same arc are $\cong$.)
4. $\triangle XVY \sim \triangle ZVW$ (AA$\sim$)
5. $\frac{XV}{ZV} = \frac{YV}{WV}$ (In similar figures, corr. sides are proport.)
6. $XV \cdot WV = YV \cdot ZV$ (Mult. Prop.)

32. Given: A circle with tangent $\overline{TV}$ and secant $\overline{XV}$; Prove: $XV \cdot YV = (TV)^2$.



1. Construct $\overline{TX}$ and $\overline{TY}$.
2. $m\angle TXV = \frac{1}{2}m\widehat{TY}$ (The measure of an inscribed $\angle$ is half the measure of the intercepted arc.)
3. $m\angle VTY = \frac{1}{2}m\widehat{TY}$ (The measure of an $\angle$ formed by a chord and a tangent is half the measure of the intercepted arc.)
4. $m\angle TXV = m\angle VTY$ (Trans. Prop. of $=$)
5. $\angle TVY \cong \angle TVX$ (Reflexive Prop. of $\cong$)
6. $\triangle TVY \sim \triangle XVT$ (AA$\sim$)
7. $\frac{YV}{TV} = \frac{TV}{XV}$ (In similar figures, corr. sides are proport.)
8. $XV \cdot YV = TV^2$ (Mult. Prop.)

33. Answers may vary. Sample: If the given pt. is on the circle, then a line through the given pt. can only intersect the circle tangentially or one other place. It follows that one segment has length zero, so the product of the segments is always zero.

34. **1.** $m\angle 1 = \frac{1}{2}m\widehat{QRP} - \frac{1}{2}m\widehat{PQ}$ ($\frac{1}{2}$ diff. of intercepted arcs)

2. $m\angle 1 + m\widehat{PQ} = \frac{1}{2}m\widehat{QRP} + \frac{1}{2}m\widehat{PQ}$ (Add. Prop. of = and Distr. Prop.)

3. $m\angle 1 + m\widehat{PQ} = \frac{1}{2}(m\widehat{QRP} + m\widehat{PQ})$ (Distr. Prop.)

4. $m\angle 1 + m\widehat{PQ} = \frac{1}{2}(360)$ (circle has 360°)

5. $m\angle 1 + m\widehat{PQ} = 180$ (Subst.)

35. **1.** $m\angle 1 = \frac{1}{2}m\widehat{QRP} - \frac{1}{2}m\widehat{PQ}$ $\left(\frac{1}{2}\text{ diff. of intercepted arcs}\right)$

2. $m\angle 2 = \frac{1}{2}m\widehat{RQP} - \frac{1}{2}m\widehat{RP}$ $\left(\frac{1}{2}\text{ diff. of intercepted arcs}\right)$

3. $m\angle 1 + m\angle 2 = \frac{1}{2}m\widehat{QRP} + \frac{1}{2}m\widehat{RQP} - \frac{1}{2}m\widehat{PQ} - \frac{1}{2}m\widehat{RP}$ (Subst.)

4. $m\angle 1 + m\angle 2 = \frac{1}{2}m\widehat{QR} + \frac{1}{2}m\widehat{RP} + \frac{1}{2}m\widehat{QR} + \frac{1}{2}m\widehat{PQ} - \frac{1}{2}m\widehat{PQ} - \frac{1}{2}m\widehat{RP}$ (Arc. Add. Post. and Distr. Prop.)

5. $m\angle 1 + m\angle 2 = m\widehat{QR}$ (Distr. Prop.)

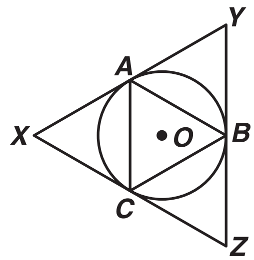
36. **1.** $(PQ)^2 = (QS)(QR)$ (Prod. of segments is const.)

2. $b^2 = (c + a)(c - a)$ (Subst.)

3. $b^2 = c^2 - a^2$ (Distr. Prop.)

4. $b^2 + a^2 = c^2$ (Add. Prop. of =)

37.



$m\widehat{AB} = m\widehat{BC} = m\widehat{AC} = 120$, since chords $\overline{AB}$, $\overline{BC}$, and $\overline{CA}$ are all $\cong$. So the measures of $\angle X$, $\angle Y$, and $\angle Z$ are $\frac{1}{2}(240 - 120) = 60$, and $\triangle XYZ$ is equilateral.

Answers for Lesson 12-5, pp. 697–699 Exercises

1. $(x - 2)^2 + (y + 8)^2 = 81$

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

3. $(x - 0.2)^2 + (y - 1.1)^2 = 0.16$

4. $(x - 5)^2 + (y + 1)^2 = 144$

5. $(x + 6)^2 + (y - 3)^2 = 64$

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

7. $x^2 + y^2 = 16$

8. $(x + 4)^2 + y^2 = 9$

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

10. $(x + 2)^2 + (y - 6)^2 = 16$

11. $(x - 1)^2 + (y - 2)^2 = 17$

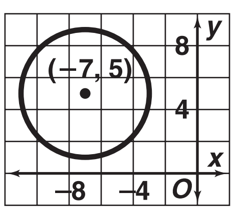
12. $(x - 7)^2 + (y + 2)^2 = 52$

13. $(x + 10)^2 + (y + 5)^2 = 125$

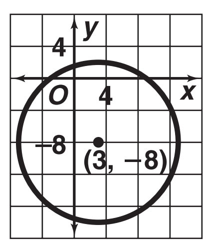
14. $(x - 6)^2 + (y - 5)^2 = 61$

15. $(x + 1)^2 + (y + 4)^2 = 25$

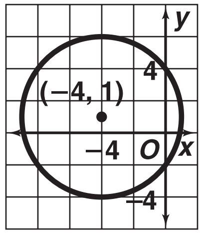
16. center: $(-7, 5)$; radius: 4



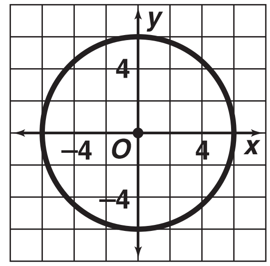
17. center: $(3, -8)$; radius: 10



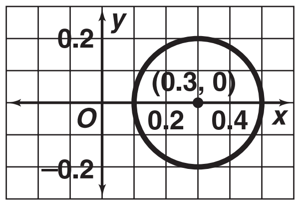
18. center: $(-4, 1)$; radius: 5



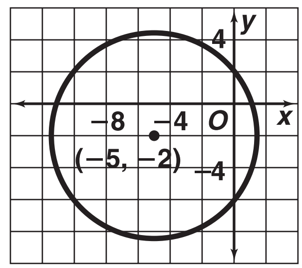
19. center: $(0, 0)$; radius: 6



20. center: $(0.3, 0)$; radius: 0.2



21. center: $(-5, -2)$; radius: $4\sqrt{3}$



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

23. $(x - 4)^2 + (y + 4)^2 = 4$

24. $(x + 3)^2 + (y - 2)^2 = 25$

25. position: $(5, 7)$; range: 9 units

26. position: $(-4, 9)$; range: 12 units

27. $x^2 + y^2 = 4$

28. $x^2 + y^2 = 9$

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

30. $(x - 2)^2 + y^2 = 9$

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

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

33. $(x - 4)^2 + (y - 3)^2 = 25$

34. $(x - 5)^2 + (y - 3)^2 = 13$

35. $(x - 3)^2 + (y - 3)^2 = 8$

36. $(x + 3)^2 + (y + 1.5)^2 = 6.25$

37. $(x + 1.5)^2 + (y - 5)^2 = 18.25$

38. $(x - 2)^2 + (y + 2)^2 = 41$

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

40. The graph is the point (0, 0).

41. Check students' work.

42. yes

43. No; the x and y terms are not squared.

44. No; the x term is not squared.

45. circumference: 16π; area: 64π

46. $(x - 4)^2 + (y - 7)^2 = 36$

47. x-int. = 13, y-int. = $\frac{39}{4}$

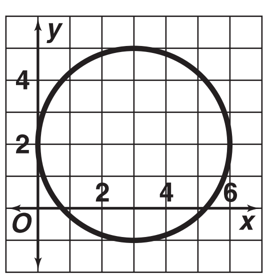
48. $(x - h)^2 + (y - k)^2 = r^2$

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

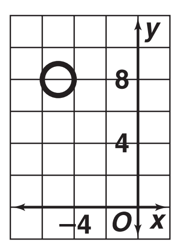
$y - k = \pm\sqrt{r^2 - (x - h)^2}$

$y = \pm\sqrt{r^2 - (x - h)^2} + k$

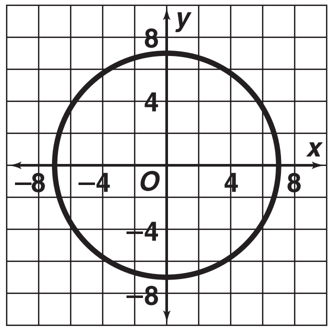
49.



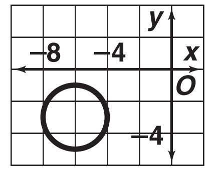
50.



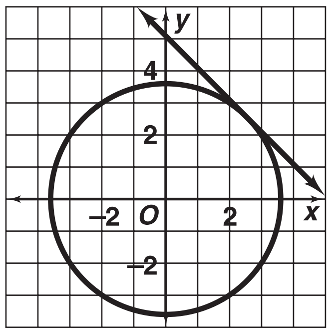
51.



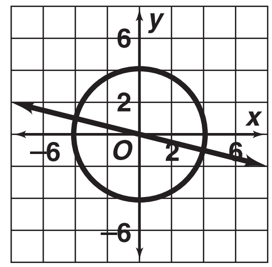
52.



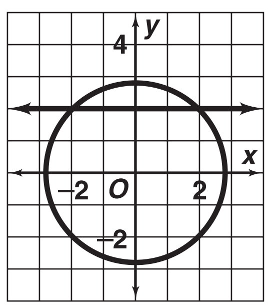
53. (3, 2); (2, 3)



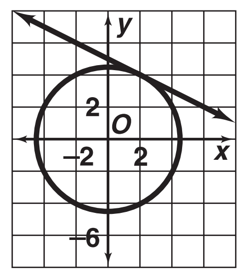
54. (4, −1); (−4, 1)



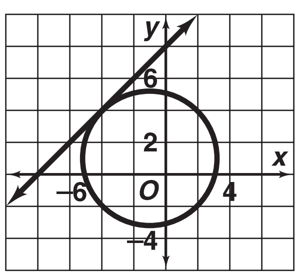
55. (2, 2); (−2, 2)



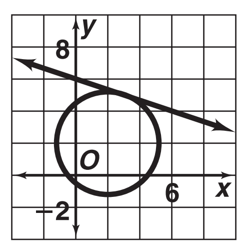
56. (2, 4)



57. (−4, 4)



58. (3, 5)



59–60. Explanations may vary. Sample: Solve the circle and line eqs. for *y*, enter in the calc., and use the zooming feature.

61. Answers may vary. Sample: Lines can appear tangent on a graph, but may not be.

62. about 11.5, 11.5, 49.8, 49.8

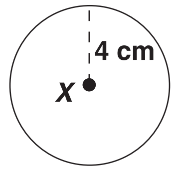
63. **a.** $x^2 + y^2 = 15{,}681{,}600$ **b.** 69.1 mi

c. 1.2 mi **d.** about 32 days

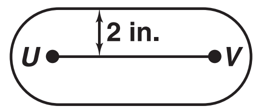
64. **a.** $\sqrt{6}$

b. $(x + 1)^2 + (y - 3)^2 + (z - 2)^2 = 6$

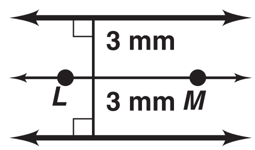
1. a circle of radius 4 cm with center X



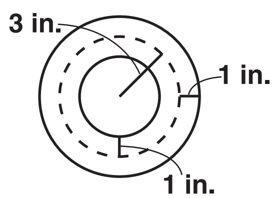
2. two distinct segments $\parallel$ to and 2 in. from $\overline{UV}$, connected by two semi-circles with 2-in. radii centered at U and V



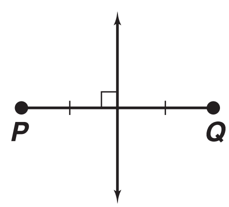
3. two distinct lines $\parallel$ to $\overleftrightarrow{LM}$ and 3 mm from $\overleftrightarrow{LM}$



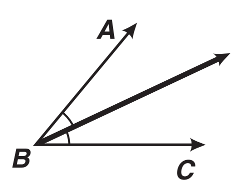
4. two circles, concentric with the original circle, of radius 2 in. and 4 in.



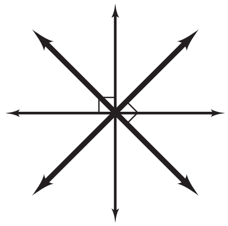
5. a line $\perp$ $\overline{PQ}$ and through the midpoint of $\overline{PQ}$



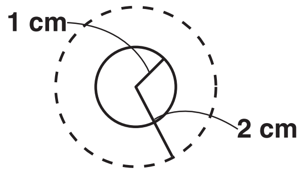
6. the $\angle$ bisector of $\angle ABC$



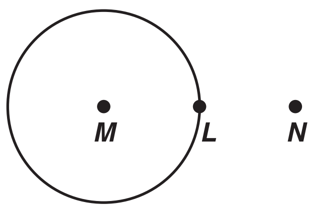
7. two ⊥ lines, meeting at the intersection of the orig. lines, making 45° ∠s with orig. lines



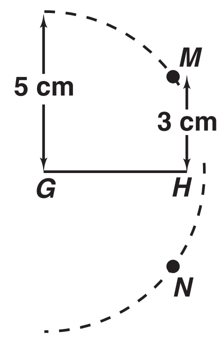
8. a circle of radius 1 cm with same center as original circle



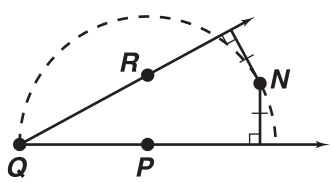
9. the single pt. *L*



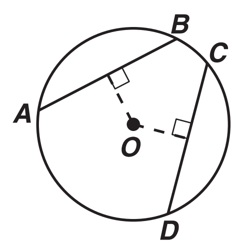
10. the pts. *M* and *N*



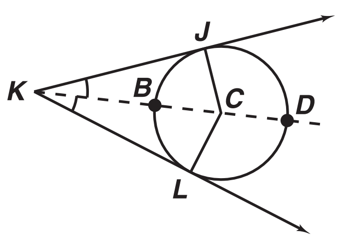
11. the single pt. *N*



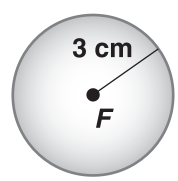
12. the center *O*



13. the pts. *B* and *D*

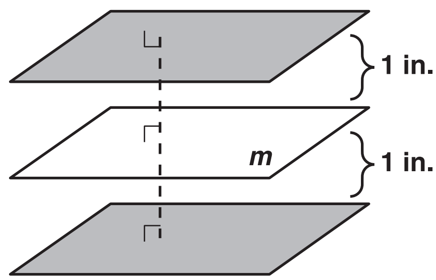


14. a sphere of radius 3 cm, centered at *F*

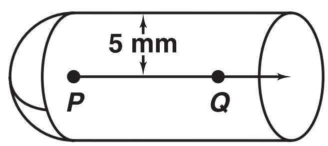


15. an endless cylinder with radius 4 cm and center-line $\overleftrightarrow{DE}$

16. two planes ∥ to plane *M*, each 1 in. from *M*



17. an endless cylinder with radius 5 mm and center-ray $\overrightarrow{PQ}$ and a hemisphere of radius 5 mm centered at *P*



18. the set of all points equidistant from the sides of $\angle A$

19. the set of all points 2 units from the origin

20. the set of all points *a* units from planes *M* and *N*

21. Check students' work.

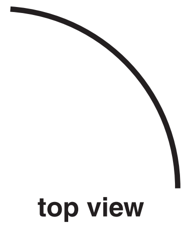
22. Yes; if the collinear pts. are *A*, *B*, and *C*, then the locus of pts. equidist. from *A* and *B* is a plane *M*, ⊥ to *AB* at its midpt. Similarly, pts. equidist. from *B* and *C* are on plane *N*, ⊥ at the midpt. of *BC*. But *M* ∥ *N*.

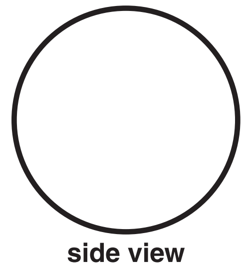
23. $y = x$

24. $y = 2x - 4$

25. $y = -x + 3$

26. origin; *x*

27. 

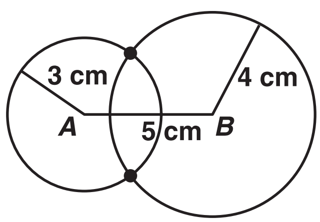
28. 

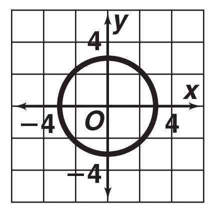
29. 

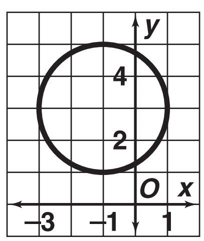
30. 

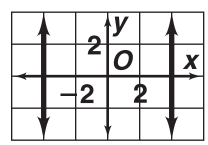
31. Draw a circle with radius 3 mi and center at downtown area. Connect their offices with a segment and construct the ⊥ bis. Locations will lie on the ⊥ bis. and on or inside the circle.

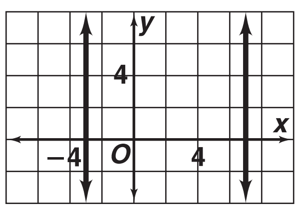
32. yes; 2 points

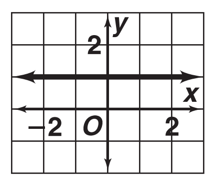


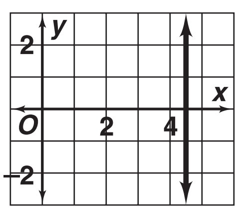
33. 

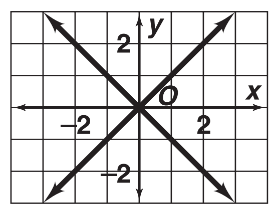
34. 

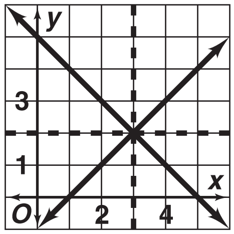
35. 

36. 

37. 

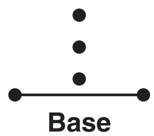
38. 

39. 

40. 

41. a circle

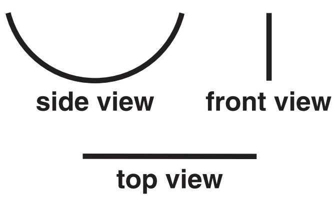
42. $x^2 + y^2 = 4$

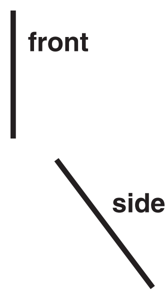
43. a. 

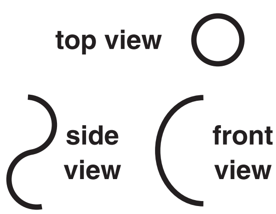
b. $\perp$ bis. of the base, except the pt. on the base

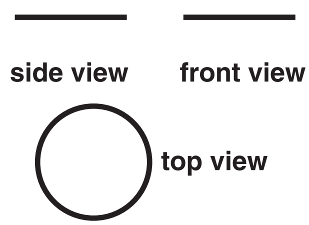
c. The vertex must be equidist. from the endpoints of the base. These points lie only on the $\perp$ bis.

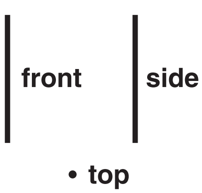
44. a line through the center of the circle, $\perp$ to the plane of the circle

45. 

46. 

47. 

48. 

49. 

50.