Geometry: A Complete Course

(with Trigonometry)

Module E – Solutions Manual

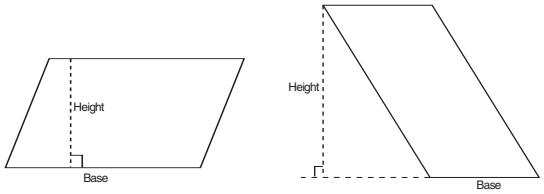
Written by: Larry E. Collins

ERRATA
4/2010

VideoText *Interactive*

p. 507 – Lesson 3 — Parallelogram

1. Theorem 59 - "If you have a parallelogram, then the area inside the parallelogram is the product of the measures of any base and the corresponding altitude."



Area = Base x Height

2. $A = b \cdot h$ AD, BC, CF, and FD are not needed.
$A = 9 \cdot 5$
$A = 45 \text{ units}^2$

3. **a)** $A = b \cdot h$ **b)** Only one - the side parallel to the given side
$54 = 18 \cdot h$
$\frac{54}{18} = h$
$3 \text{ units} = h$

4. $A = b \cdot h$
$126 = (5x) \cdot (4x)$
$126 = 20x^2$
$\frac{126}{20} = \frac{2 \cdot 63}{2 \cdot 10} = x^2$
$\sqrt{\frac{63}{10}} = \frac{\sqrt{63}}{\sqrt{10}} = \frac{\sqrt{9}\sqrt{7}}{\sqrt{10}} = \frac{3\sqrt{7}}{\sqrt{10}} = \frac{3\sqrt{7}\sqrt{10}}{\sqrt{10}\sqrt{10}} = \frac{3\sqrt{70}}{10} = x$

Base is $5x$ or $\frac{5 \cdot 3\sqrt{70}}{10} = \frac{5 \cdot 3\sqrt{70}}{5 \cdot 2} = \frac{3\sqrt{70}}{2}$

Height is $4x$ or $\frac{4 \cdot 3\sqrt{70}}{10} = \frac{2 \cdot 2 \cdot 3\sqrt{70}}{5 \cdot 2} = \frac{6\sqrt{70}}{5}$

5. Altitude of parallelogram is: $10\sqrt{2} = x\sqrt{2}$
$10 = x$

Area of parallelogram is: $b \cdot h$
$15 \cdot 10$
150 units^2

6. Altitude of parallelogram is: $\frac{x\sqrt{3}}{2}$ where $x = 10$
$\frac{10\sqrt{3}}{2}$
$5\sqrt{3}$

Area of parallelogram is: $b \cdot h$
$40 \cdot 5\sqrt{3}$
$200\sqrt{3} \text{ units}^2$

7. Altitude of parallelogram is: $\frac{x}{2}$ where $x = 10$
$\frac{10}{2} = 5$

Area of parallelogram is: $b \cdot h$
$40 \cdot 5$
200 units^2

p. 513 – Lesson 5 — Regular Polygons

1. $A = \frac{1}{2} \cdot s \cdot a \cdot n$

$A = \frac{1}{2} \cdot 4\sqrt{3} \cdot 3 \cdot 3$

$A = \frac{\cancel{2} \cdot 2 \cdot \sqrt{3} \cdot 3 \cdot 3}{\cancel{2}}$

$A = 2 \cdot 3 \cdot 3 \cdot \sqrt{3}$

$A = 18\sqrt{3}$ units^2

2. $A = \frac{1}{2} \cdot s \cdot a \cdot n$

$A = \frac{1}{2} \cdot 16 \cdot 13 \cdot 5$

$A = \frac{\cancel{2} \cdot 8 \cdot 13 \cdot 5}{\cancel{2}}$

$A = 40 \cdot 13$

$A = 520$ units^2

3. $A = \frac{1}{2} \cdot s \cdot a \cdot n$

$A = \frac{1}{2} \cdot 10 \cdot 8.5 \cdot 6$

$A = \frac{\cancel{2} \cdot 5 \cdot 8.5 \cdot 6}{\cancel{2}}$

$A = 30 \cdot 8.5$

$A = 255$ units^2

4. $A = \frac{1}{2} \cdot s \cdot a \cdot n$

$A = \frac{1}{2} \cdot 10\sqrt{2} \cdot 5\sqrt{2} \cdot 4$

$A = \frac{10\sqrt{\cancel{2}} \cdot 5\sqrt{\cancel{2}} \cdot 4}{\cancel{2}}$

$A = 50 \cdot 4$

$A = 200$ units^2

5. $A = \frac{1}{2} \cdot s \cdot a \cdot n$

$A = \frac{1}{2} \cdot 3 \cdot 4.5 \cdot 8$

$A = \frac{3 \cdot 4.5 \cdot \cancel{2} \cdot 4}{\cancel{2}}$

$A = 12 \cdot 4.5$

$A = 54$ units^2

6. $A = \frac{1}{2} \cdot s \cdot a \cdot n$

$A = \frac{1}{2} \cdot 16 \cdot 8\sqrt{3} \cdot 6$

$A = \frac{\cancel{2} \cdot 8 \cdot 8\sqrt{3} \cdot 6}{\cancel{2}}$

$A = 64\sqrt{3} \cdot 6$

$A = 384\sqrt{3}$ units^2

7. $m\angle 2 = \frac{1}{2} \cdot 60$

$m\angle 2 = 30$

$m\angle 1 = 60$

8. $m\angle 2 = \frac{1}{2} \cdot 90$

$m\angle 2 = 45$

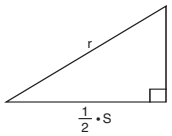
$m\angle 1 = 45$

9. $m\angle 2 = \frac{1}{2} \cdot 108$

$m\angle 2 = 54$

$m\angle 1 = 36$

10.



a) This is a 30-60-90 triangle

r = 12

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

$= \frac{12}{2}$

$= 6$

$\frac{1}{2}s = \frac{x\sqrt{3}}{2}$

$s = x\sqrt{3}$

$s = 12\sqrt{3}$

$p = 3 \cdot s$

$= 3 \cdot 12\sqrt{3}$

$= 36\sqrt{3}$

$A = \frac{1}{2} \cdot a \cdot p$

$= \frac{1}{2} \cdot 6 \cdot 36\sqrt{3}$

$= \frac{\cancel{2} \cdot 3 \cdot 36\sqrt{3}}{\cancel{2}}$

$= 108\sqrt{3}$ units^2

b) This is a 30-60-90 triangle

$s = 10\sqrt{3}$

$\frac{1}{2}s = 5\sqrt{3}$

$\frac{r \cdot \sqrt{3}}{2} = 5\sqrt{3}$

$r \cdot \sqrt{3} = 10\sqrt{3}$

$r = 10$

$p = 3 \cdot s$

$= 3 \cdot 10\sqrt{3}$

$= 30\sqrt{3}$

$a = \frac{1}{2}r$

$= \frac{1}{2} \cdot 10$

$= 5$

$A = \frac{1}{2} \cdot a \cdot p$

$= \frac{1}{2} \cdot 5 \cdot 30\sqrt{3}$

$= \frac{5 \cdot \cancel{2} \cdot 15\sqrt{3}}{\cancel{2}}$

$= 75\sqrt{3}$ units^2

c) This is a 30-60-90 triangle

$p = 24\sqrt{3}$

$\frac{1}{3}p = s$

$\frac{1}{3} \cdot 24\sqrt{3} = s$

$8\sqrt{3} = s$

$4\sqrt{3} = \frac{1}{2}s$

$4\sqrt{3} = \frac{r \cdot \sqrt{3}}{2}$

$8\sqrt{3} = r\sqrt{3}$

$8 = r$

$a = \frac{1}{2}r$

$= \frac{1}{2} \cdot 8$

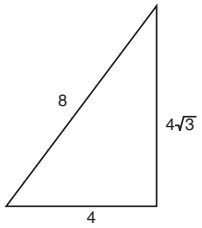
$= 4$

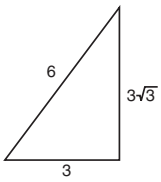
$A = \frac{1}{2} \cdot a \cdot p$

$= \frac{1}{\cancel{2}} \cdot \cancel{2} \cdot 24\sqrt{3}$

$= 24\sqrt{3}$ units^2

13.





Area of outside hexagon

$$A = \frac{1}{2} \cdot a \cdot p$$
$$= \frac{1}{2} \cdot 4\sqrt{3} \cdot (6 \cdot 8)$$
$$= \frac{4\sqrt{3} \cdot 48}{2}$$
$$= \frac{4\sqrt{3} \cdot \cancel{2} \cdot 24}{\cancel{2}}$$
$$= 96\sqrt{3} \text{ units}^2$$

Area of inside hexagon

$$A = \frac{1}{2} \cdot a \cdot p$$
$$= \frac{1}{2} \cdot 3\sqrt{3} \cdot (6 \cdot 6)$$
$$= \frac{3\sqrt{3} \cdot 36}{2}$$
$$= \frac{3\sqrt{3} \cdot \cancel{2} \cdot 18}{\cancel{2}}$$
$$= 54\sqrt{3} \text{ units}^2$$

Area of shaded region $96\sqrt{3} - 54\sqrt{3} = 42\sqrt{3} \text{ units}^2$

14. Area of pentagon

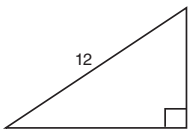
$$A = \frac{1}{2} \cdot a \cdot p$$
$$= \frac{1}{2} \cdot 5.5 \cdot (5 \cdot 8)$$
$$= \frac{5.5 \cdot 40}{2}$$
$$= \frac{5.5 \cdot \cancel{2} \cdot 20}{\cancel{2}}$$
$$= 110 \text{ units}^2$$

Area of white triangle

$$A = \frac{1}{2} \cdot a \cdot p$$
$$= \frac{1}{2} \cdot 8 \cdot 5.5$$
$$= \frac{\cancel{2} \cdot 4 \cdot 5.5}{\cancel{2}}$$
$$= 22 \text{ units}^2$$

Area of shaded region $110 - 22 = 88 \text{ units}^2$

15.



This is a 30-60-90 triangle. The shaded region is made up of 6 identical triangles.

Altitude is $\frac{x}{2}$ where x = 12

$$\frac{12}{2} = 6$$

Base is $\frac{x\sqrt{3}}{2}$ where x = 12

$$\frac{12\sqrt{3}}{2} = 6\sqrt{3}$$

Area of one triangle: $A = \frac{1}{2} \cdot 6\sqrt{3} \cdot 6$

$$= \frac{6\sqrt{3} \cdot \cancel{2} \cdot 3}{\cancel{2}}$$
$$= 18\sqrt{3} \text{ units}^2$$

Area of shaded region: $6 \cdot 18\sqrt{3} = 108\sqrt{3} \text{ units}^2$

6. Corollary 67b - "If a quadrilateral is inscribed in a circle, then its opposite angles are supplementary."

7. **a)** $\overset{\frown}{XZ}$ $180 - 85$ 95 **b)** $\overset{\frown}{NP}$ **c)** $\overset{\frown}{AC}$ $180 - 110$ 70 **d)** $\overset{\frown}{OMQ}$ (or $\overset{\frown}{ONQ}$) **e)** $\overset{\frown}{XZ}$ **f)** $\overset{\frown}{NP}$

8. **a)** $m\angle Y = 70^\circ$ **b)** $m\angle O = 40^\circ$ **c)** $m\angle B = 55^\circ$ **d)** $m\angle MNQ = 40^\circ$ **e)** $m\angle W = 70^\circ$ **f)** $m\angle QPM = 40^\circ$

9. $\angle MNQ$, $\angle MOQ$, $\angle MPQ$

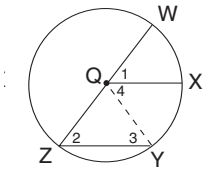
10. The angles are congruent by Corollary 67c: "If two inscribed angles intercept the same arc or congruent arcs, then the angles are congruent."

11. $\angle YXW$, $\angle WZY$

12. The angles are congruent by Corollary 67c: "If two inscribed angles intercept the same arc or congruent arcs, then the angles are congruent."

13. $m\angle U = 15^\circ$, $m\angle V = 30^\circ$, $m\angle UXV = 180 - (15 + 30)$
$180 - 45$
135°

14. Given: $\overline{WZ}$ is a diameter of $\odot Q$; $\overline{QX} \parallel \overline{ZY}$
Prove: $\overset{\frown}{WX} \cong \overset{\frown}{XY}$



STATEMENT	REASONS
1. $\overline{WZ}$ is a diameter of $\odot Q$	1. Given
2. $\overline{QX} \parallel \overline{ZY}$	2. Given
3. Draw $\overline{QY}$	3. Postulate 2 - 1st Assumption - For any two different points, there is exactly one line containing them.
4. $\angle 1 \cong \angle 2$	4. Postulate 11 - If two parallel lines are cut by a transversal, then corresponding angles are congruent.
5. $\overline{QZ} \cong \overline{QY}$	5. Radii of the same circle are congruent.
6. $\angle 2 \cong \angle 3$	6. Theorem 33 - If two sides of a triangle are congruent then the angles opposite them are congruent.
7. $\angle 3 \cong \angle 4$	7. Theorem 16 - If two parallel lines are cut by a transversal, the alternate interior angles are congruent.
8. $\angle 1 \cong \angle 4$	8. Transitive Property of Angle Congruence
9. $\overset{\frown}{WX} \cong \overset{\frown}{XY}$	9. Theorem 65 - If two central angles are congruent, then their intercepted arcs are congruent.

15. $m\overset{\frown}{RS} + m\overset{\frown}{RT} + m\overset{\frown}{ST} = 360$
$(2x + 8) + (4x - 20) + (3x + 12) = 360$

$9x = 360$
$x = 40$

$m\overset{\frown}{RS} = 2x + 8$
$= 2(40) + 8$
$= 80 + 8$
$= 88$

$m\overset{\frown}{RT} = 4x - 20$
$= 4(40) - 20$
$= 160 - 20$
$= 140$

$m\overset{\frown}{ST} = 3x + 12$
$= 3(40) + 12$
$= 120 + 12$
$= 132$

$m\angle R = \frac{1}{2} \cdot m\overset{\frown}{ST}$
$= \frac{1}{2} \cdot 132$
$= 66$

$m\angle S = \frac{1}{2} \cdot m\overset{\frown}{RT}$
$= \frac{1}{2} \cdot 140$
$= 70$

$m\angle T = \frac{1}{2} \cdot m\overset{\frown}{RS}$
$= \frac{1}{2} \cdot 88$
$= 44$

4. A line segment is the perpendicular bisector of chord of a circle if and only if the line segment joins the midpoints of the two arcs determined by the chord.

5. $\overline{PR}$

6. Point P

7. Point Q

8. $\overset{\frown}{RX}$

9. $\overset{\frown}{TY}$

10. $\overline{XY}$

11. $\overline{QU}$

12. $\overline{XY}$

13. No

14. x = 9 Theorem 73

15. x = 34° Corollary 73a

16.
$$(BX)^2 = (BC)^2 + (CX)^2$$
$$(7)^2 = (4)^2 + (CX)^2$$
$$49 = 16 + (CX)^2$$
$$33 = (CX)^2$$
$$\pm\sqrt{33} = CX$$
(CX cannot be negative)
$$\sqrt{33} = CX$$

$$CX + CY = XY$$
$$CX = CY$$
$$\sqrt{33} + \sqrt{33} = XY$$
$$2\sqrt{33} = XY$$

17. Draw radius $\overline{QD}$

QD = QA
QD = 13

$$DM = \frac{1}{2} \cdot DC$$
$$DM = \frac{1}{2} \cdot 24$$
$$DM = 12$$

$$(QD)^2 = (DM)^2 + (QM)^2$$
$$(13)^2 = (12)^2 + (QM)^2$$
$$169 = 144 + (QM)^2$$
$$25 = (QM)^2$$
$$\pm\sqrt{25} = QM \text{ (QM cannot be negative)}$$
$$5 = QM$$

18. Draw radius $\overline{QY}$

$$CY = \frac{1}{2} \cdot XY$$
$$CY = \frac{1}{2} \cdot 18$$
$$CY = 9$$

$$(QY)^2 = (QC)^2 + (CY)^2$$
$$(QY)^2 = (9)^2 + (9)^2$$
$$(QY)^2 = 81 + 81$$
$$(QY)^2 = 162$$
$$QY = \pm\sqrt{162} \text{ (QY cannot be negative)}$$
$$QY = \sqrt{81} \cdot \sqrt{2}$$
$$QY = 9\sqrt{2}$$

19.
$$m\overset{\frown}{UW} = 360 - 288$$
$$= 72$$

$$m\overset{\frown}{VW} = \frac{1}{2} \cdot m\overset{\frown}{UW}$$
$$= \frac{1}{2} \cdot 72$$
$$= \frac{1 \cdot \cancel{2} \cdot 36}{\cancel{2}}$$
$$= 36$$

$$m\angle VQW = m\overset{\frown}{VW}$$
$$m\angle VQW = 36$$

20. BX = 7 Theorem 73
DY = 8 Theorem 73

$$m\overset{\frown}{BE} = 58$$
$$m\overset{\frown}{BE} = m\overset{\frown}{AE}$$
$$m\overset{\frown}{AD} = 180 - \left(m\overset{\frown}{BE} + m\overset{\frown}{AE}\right)$$
$$= 180 - (58 + 58)$$
$$= 180 - 116$$
$$= 64$$

21.
$$m\overset{\frown}{BH} = 180 - m\overset{\frown}{GB}$$
$$= 180 - 140 \quad mAD = 64$$
$$= 40$$

$$m\overset{\frown}{BH} = m\overset{\frown}{AH} \quad \text{Corollary 73a}$$
$$m\overset{\frown}{AB} = m\overset{\frown}{BH} + m\overset{\frown}{AH}$$
$$m\overset{\frown}{AB} = 40 + 40$$
$$m\overset{\frown}{AB} = 80$$

If AB = 18, then HB = 9 (Corollary 73a)
QI = 12 (Given)
Draw $\overline{QB}$

$$(QB)^2 = (HB)^2 + (QI)^2$$
$$(QB)^2 = (9)^2 + (12)^2$$
$$(QB)^2 = 81 + 144$$
$$(QB)^2 = 225$$
$$QB = 15$$

So, QB = 15

$$(QB)^2 = (JC)^2 + (QJ)^2$$
$$(15)^2 = (JC)^2 + (10)^2$$
$$225 = (JC)^2 + 100$$
$$125 = (JC)^2$$
$$\pm\sqrt{125} = JC \text{ (JC cannot be negative)}$$
$$\sqrt{25} \cdot \sqrt{5} = JC$$
$$5\sqrt{5} = JC$$

$$CD = 2 \cdot JC = 2 \cdot 5\sqrt{5} = 10\sqrt{5}$$

15. Given: $\overline{AB}$ is a diameter of $\odot Q$
$\overline{AB}$ bisects $\overline{CD}$; $\overline{AB}$ bisects $\overline{EF}$
Prove: $\overline{CD} \parallel \overline{EF}$

STATEMENT	REASONS
1. $\overline{AB}$ is a diameter of $\odot Q$	1. Given
2. $\overline{AB}$ bisects $\overline{CD}$	2. Given
3. $AB \perp CD$	3. Theorem 74 - If a diameter of a circle bisects a chord that is not a diameter, then that diameter is perpendicular to that chord.
4. $\overline{AB}$ bisects $\overline{EF}$	4. Given
5. $\overline{AB} \perp \overline{EF}$	5. Theorem 74
6. $CD \parallel EF$	6. Theorem 22 - If two lines are perpendicular to a third line, then the two lines are parallel.

16. Two chords of a circle that are not diameters are parallel to each other if and only if a diameter of the circle bisects the two chords.

17. Proof of Theorem 75

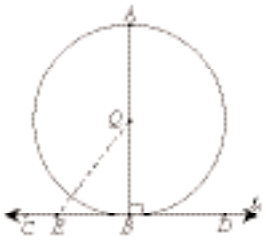
STATEMENT	REASONS
1. Chord $\overline{AB}$ bisects chord $\overline{CD}$ at point E	1. Given
2. Point E is the midpoint of $\overline{CD}$	2. Definition of Line Segment Bisector
3. $\overline{CE} \cong \overline{DE}$ at point E	3. Definition of Midpoint
4. $\overline{AB} \perp \overline{CD}$	4. Given
5. $\angle AEC$ is a right angle	5. Definition of Perpendicular Lines (Segments)
6. $\angle AED$ is a right angle	6. Definition of Perpendicular Lines (Segments)
7. $\angle AEC \cong \angle AED$	7. Theorem 11 - If you have right angles, then those right angles are congruent.
8. $\overline{AE} \cong \overline{AE}$	8. Reflexive Property for Congruent Line Segments
9. Draw $\overline{AC}$	9. Postulate 2 - For any two different points, there is exactly one line (segment) containing them.
10. Draw $\overline{AD}$	10. Postulate 2
11. $\triangle AEC \cong \triangle AED$	11. Postulate 13 - Triangle Congruence - If two sides and the included angle of one triangle are congruent to two sides and the included angle of another triangle then the two triangles are congruent. (SAS Congruence Assumption)
12. $\angle CAB \cong \angle DAB$	12. C.P.C.T.C.
13. $m\angle CAB = \frac{1}{2} m\overset{\frown}{BC}$	13. Theorem 67 - If you have an inscribed angle of a circle, then the measure of the angle is one-half the measure of the intercepted arc.
14. $m\angle DAB = \frac{1}{2} m\overset{\frown}{BD}$	14. Theorem 67
15. $m\angle CAB = m\angle DAB$	15. Definition of Congruent Angles
16. $\frac{1}{2} m\overset{\frown}{BC} = \frac{1}{2} m\overset{\frown}{BD}$	16. Substitution
17. $m\overset{\frown}{BC} = m\overset{\frown}{BD}$	17. Multiplication Property of Equality
18. $\angle ACD \cong \angle ADC$	18. C.P.C.T.C.
19. $m\angle ACD = \frac{1}{2} m\overset{\frown}{DA}$	19. Theorem 67
20. $m\angle ADC = \frac{1}{2} m\overset{\frown}{AC}$	20. Theorem 67
21. $m\angle ACD = m\angle ADC$	21. Definition of Congruent Angles
22. $\frac{1}{2} m\overset{\frown}{DA} = \frac{1}{2} m\overset{\frown}{AC}$	22. Substitution
23. $m\overset{\frown}{DA} = m\overset{\frown}{AC}$	23. Multiplication Property of Equality
24. $m\overset{\frown}{BC} + m\overset{\frown}{BD} + m\overset{\frown}{DA} + m\overset{\frown}{AC} = 360$	24. Postulate 8 - First Assumption - The set of all points on a circle can be put into a one-to-one correspondence with the real numbers from 0 to 360, inclusive, with the exception of any one point which may be paired with 0 and 360.
25. $m\overset{\frown}{BC} + m\overset{\frown}{BC} + m\overset{\frown}{AC} + m\overset{\frown}{AC} = 360$	25. Substitution
26. $2m\overset{\frown}{BC} + 2m\overset{\frown}{AC} = 360$	26. Properties of Algebra - Collect Like Terms
27. $m\overset{\frown}{BC} + m\overset{\frown}{AC} = 180$	27. Multiplication Property of Equality
28. $m\overset{\frown}{BC} + m\overset{\frown}{AC} = m\overset{\frown}{ACB}$	28. Postulate 8 - Fourth Assumption - Arc Addition Assumption
29. $m\overset{\frown}{ACB} = 180$	29. Substitution
30. $\overset{\frown}{ACB}$ is a semicircle	30. Definition of Semicircle - "...a semicircle is the intercepted arc of a central angle of 180°"
31. $\overline{AB}$ is a diameter of the circle	31. Definition of Semicircle - An arc of a circle is a semicircle, if and only if, it is an arc whose endpoints are the endpoints of a diameter of a circle.

Unit VI — Circles

Part C — Line and Segment Relationships

p. 571 – Lesson 5 — Theorem 79

1. Theorem 79 - "If a line is perpendicular to a diameter of a circle at one of its endpoints, then the line is tangent to the circle at that endpoint."



Given: ⊙Q with diameter $\overline{AB}$.
$\overleftrightarrow{CD} \perp \overline{AB}$ at point B
Prove: $\overleftrightarrow{CD}$ is tangent to ⊙Q.

STATEMENT	REASONS
1. ⊙Q with diameter $\overline{AB}$	1. Given
2. $\overleftrightarrow{CD} \perp \overline{AB}$ at point B	2. Given
3. Choose any point E on $\overleftrightarrow{CD}$ and draw $\overline{QE}$.	3. Postulate 2 - For any two different points, there is exactly one line (segment) containing them.
4. QB < QE	4. A segment is the shortest segment from a point to a line if and only it it is the segment perpendicular to the line.
5. Point E lies in the exterior of ⊙Q	5. If a point is in the exterior of a circle, then the measure of the segment joining the point to the center of the circle is greater than the measure of the radius.
6. $\overleftrightarrow{CD}$ is tangent to ⊙Q	6. Definition of Tangent

2. Theorem 79 - "If a line is perpendicular to a diameter of a circle at one of its endpoints, then the line is tangent to the circle at that endpoint."

Given: Line *m* is perpendicular to $\overline{PA}$ at point A.
Prove: Line *m* is tangent to ⊙Q.

Proof: Let point B be any point on line *m* other than point A. SInce $\overline{PA} \perp m$, △QAB is a right triangle with hypotenuse $\overline{QB}$. This means QB > QA and point B must be in the exterior of ⊙Q. Therefore, point B cannot lie on the circle and point A is the only point on line *m* that is on the circle. It follows that line *m* is tangent to the circle.

3. 90 degrees

4. Tangent; Theorem 79 - "If a line is perpendicular to a diameter of a circle at one of its endpoints, then the line is tangent to the circle at that endpoint."

5. 6

6. 42 degrees

7. $3\sqrt{7}$

$$\frac{3}{FG} = \frac{FG}{21}$$
$$(FG)^2 = 63$$
$$FG = \pm\sqrt{63} \text{ (FG cannot be negative)}$$
$$FG = \sqrt{9 \cdot 7}$$
$$FG = 3\sqrt{7}$$

8. 35

$$JP + PI + IF + FH + HQ + QK$$
$$6 + 6 + 2 + 3 + 9 + 9$$
$$12 + 5 + 18$$
$$35$$

10. The inscribed square is a rhombus, so diagonal $\overline{AC}$ bisects $\angle BAC$. $m\angle BAC = 90$, so $m\angle BAC = 45$. $\triangle AEQ$ is therefore a 45-45-90 triangle. Let AE and QE equal x. AQ is then $x\sqrt{2}$.

$$\frac{QE}{QA} = \frac{x}{x\sqrt{2}} = \frac{x \cdot \sqrt{2}}{x\sqrt{2} \cdot \sqrt{2}} = \frac{x\sqrt{2}}{x \cdot 2} = \frac{\sqrt{2}}{2}$$

11. **a)** 120
b) 90
c) 60
d) 45

12.

STATEMENT	REASONS
1. Quadrilateral XYWZ is cyclic.	1. Given
2. $\overline{ZY}$ is a diameter of $\odot Q$.	2. Given
3. $\overline{XY} \parallel \overline{ZW}$	3. Given
4. $\angle XYZ \cong \angle WZY$	4. Theorem 16 - If two parallel lines are cut by a transversal, then alternate interior angles are conruent.
5. $\angle ZXY$ is a right angle.	5. Corollary 67a - If you have an angle inscribed in a semicircle, then that angle must be a right angle.
6. $\triangle ZXY$ is a right triangle.	6. Definition of Right Triangle
7. $\angle YWZ$ is a right angle.	7. Corollary 67a
8. $\triangle YWZ$ is a right triangle.	8. Definition of Right Triangle
9. $\triangle ZXY \cong \triangle YWZ$	9. Postulate Corollary 13e - If the hypotenuse and an acute angle of one right triangle are congruent to the hypotenuse and an acute angle of another right triangle, then the two right triangles are congruent. (HA)
10. $\overline{XZ} \cong \overline{WY}$	10. C.P.C.T.C.
11. $\overset{\frown}{XZ} \cong \overset{\frown}{WY}$	11. Theorem 81 - If two chords of a circle are congruent, then their minor arcs are congruent.
12. $\overline{XY} \cong \overline{WZ}$	12. C.P.C.T.C.
13. $\overset{\frown}{XY} \cong \overset{\frown}{WZ}$	13. Theorem 81 - If two chords of a circle are congruent, then their minor arcs are congruent.

13. **a)** $m\angle AQB = 90$

b)
$$(AQ)^2 + (BQ)^2 = (AB)^2$$
$$(10)^2 + (10)^2 = (AB)^2$$
$$100 + 100 = (AB)^2$$
$$200 = (AB)^2$$
$$\pm\sqrt{200} = AB \quad \text{(AB cannot be negative)}$$
$$\sqrt{200} = AB$$
$$\sqrt{100 \cdot 2} = AB$$
$$10\sqrt{2} = AB$$

c) Distance from point Q to AB
$$= \frac{1}{2} \cdot AB$$
$$= \frac{1}{2} \cdot 10\sqrt{2}$$
$$= 5\sqrt{2}$$