Quadrilaterals Chapter Questions

1. What is a polygon?
2. What are the properties of a parallelogram?
3. What are the special parallelograms and their unique properties?
4. Describe the difference of a parallelogram and a trapezoid?
5. Can you explain why a rhombus is a kite?

Quadrilaterals Chapter Problems

Polygons

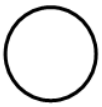
Classwork

1. Describe the polygon…
   - By sides
   - Identify as convex or concave
   - Tell whether the polygon is equilateral, equiangular, or regular.

   a.

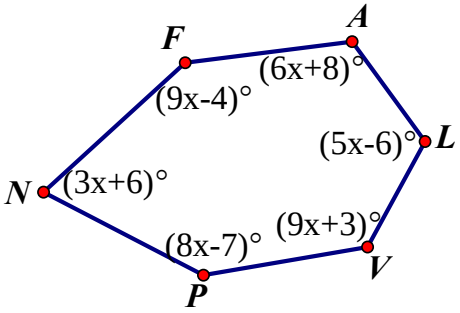
   b. 

   c. 

   d. 

2. What is the sum of the measures of the interior angles of a 14-gon?
3. What is the sum of the measures of the interior angles of a 52-gon?
4. Find the measure of each angle of the polygon.

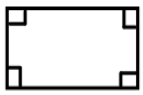


5. What is the measure of each interior angle of a regular 20-gon?
6. What is the measure of each interior angle of a regular 40-gon?
7. What is the measure of each exterior angle of a regular 30-gon?
8. The measure of each angle of a regular convex polygon is 168°. Find the number of the sides of the polygon.

Homework

9. Describe the polygon…
    - By sides
    - Identify as convex or concave
    - Tell whether the polygon is equilateral, equiangular, or regular.

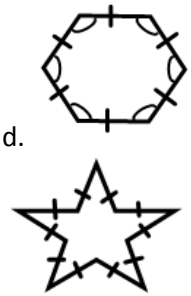
a.



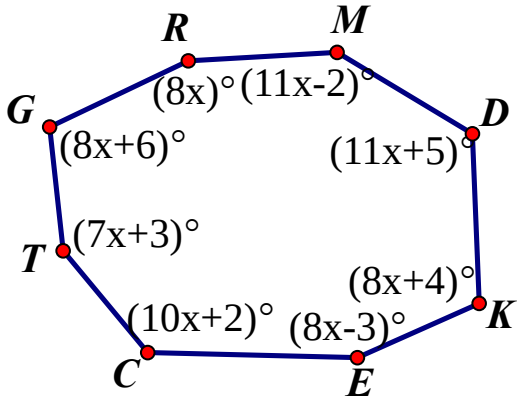
b.

c.

d.



10. What is the sum of the measures of the interior angles of an 18-gon?
11. What is the sum of the measures of the interior angles of a 44-gon?
12. Find the value of each angle of the polygon.



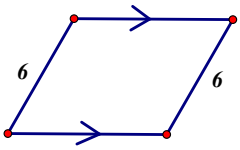
13. What is the measure of each interior angle of a regular 35-gon?
14. What is the measure of each interior angle of a regular 27-gon?
15. What is the measure of each exterior angle of a regular 24-gon?
16. The measure of each angle of a regular convex polygon is 171°. Find the number of the sides of the polygon.

Properties of Parallelograms

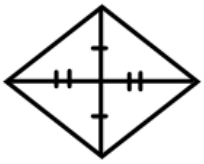
Classwork

Decide whether the figure is a parallelogram. If yes, explain why.

17.

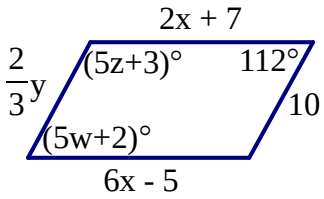


18.

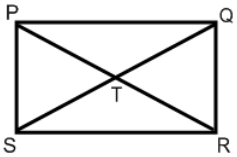


The figure is a parallelogram. Find w, x, y, and z.

19.



PQRS is a parallelogram. Answer the questions below.

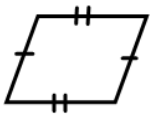


20. If PQ = 17, then SR = ____.
21. If m∠R = 73°, then m∠Q = ____ and the m∠P = _____.
22. If PT = 5, then TR = ____ and PR = ____.
23. If QS = 19, then ST = _____.
24. If PS = $2x^2 + 5x$ and QR = 12, then x = ____.

Homework

Decide whether the figure is a parallelogram. If yes, explain why.

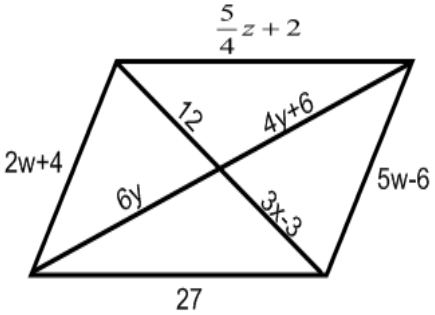
25.



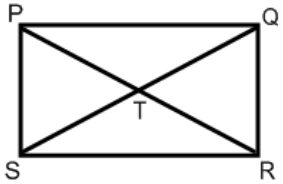
26.

The figure is a parallelogram. Find w, x, y, and z.

27.



PQRS is a parallelogram. Answer the questions below.



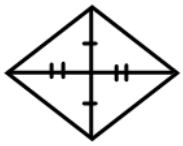
28. If m∠Q = 126°, then m∠R = ____ and the m∠P = _____.
29. If QR = 17, then SP = ____.
30. If SQ = 27, then ST = ____ and TQ = ____.
31. If PT = 11, then PR = _____.
32. If SR = $x^2 - 2x$ and PQ = 15, then x = ____.

Proving Quadrilaterals are Parallelograms

Classwork

Decide whether the quadrilateral is a parallelogram. If yes, state the theorem.

33.



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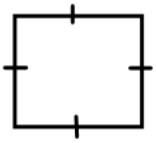

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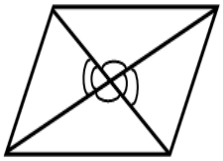

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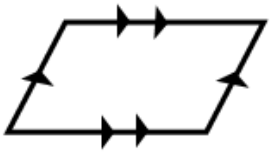

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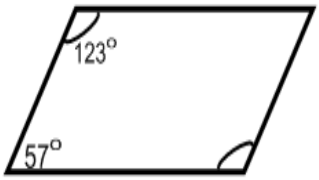
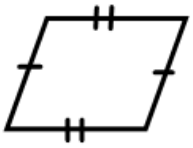


38.

Homework

Decide whether the quadrilateral is a parallelogram. If yes, state the theorem.

39.



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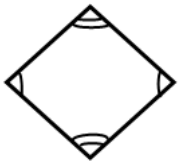

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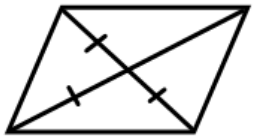
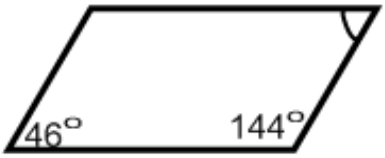


42.

43.



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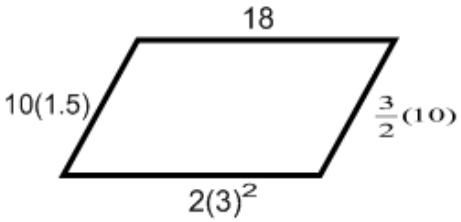
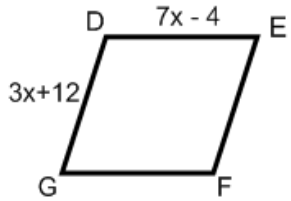


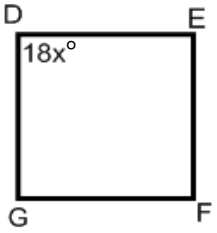
Rhombi, Rectangles, and Squares

Classwork

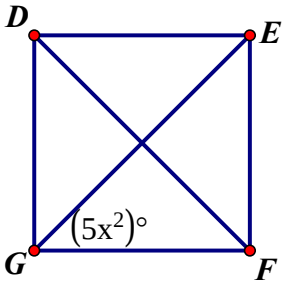
45. DEFG is a rhombus. Find the value of x.



46. DEFG is a square. Find the value of x.

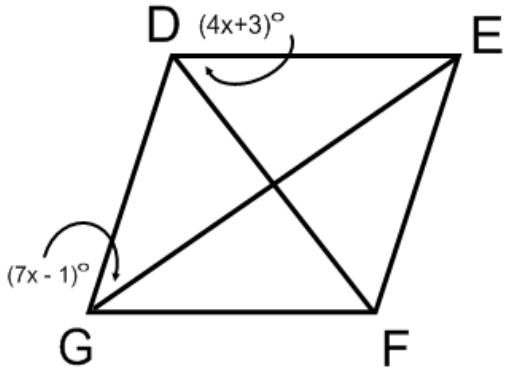


47. DEFG is a square. Find the value of x.

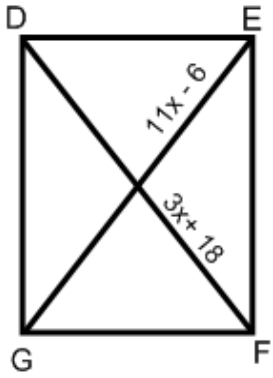


48. DEFG is a rectangle. Find the length of each side.

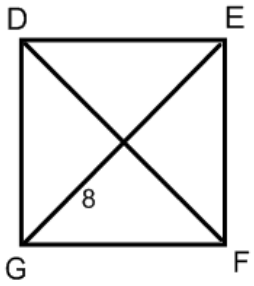
49. DEFG is a rhombus. Find the value of x. $\overline{DF}$.



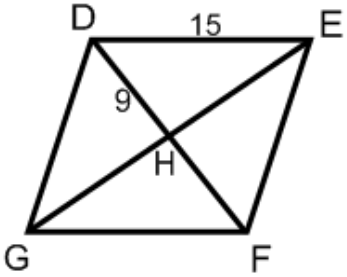
50. DEFG is a rectangle. Find the length of



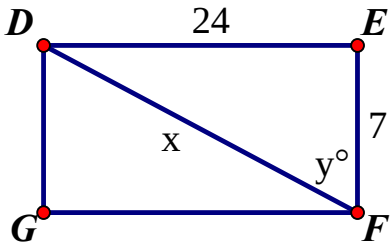
51. DEFG is a square. Find the length of $\overline{DG}$. Round to the nearest hundredth.



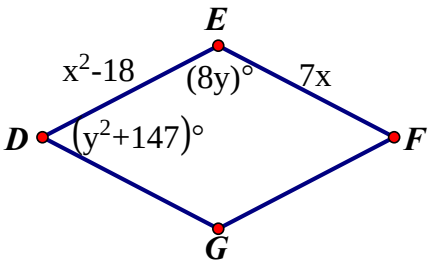
52. DEFG is a rhombus. Find the length of $\overline{EH}$.



53. DEFG is a rectangle. Find the values of x and y. x
Round to the nearest hundredth.

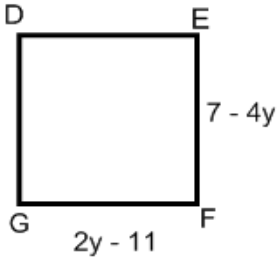


54. DEFG is a rhombus. Find the values of and y.

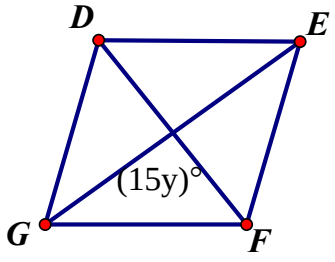


Homework

55. DEFG is a square. Find the length of each side.

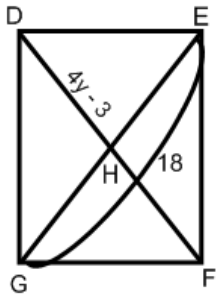


56. DEFG is a rhombus. Find the value of y.

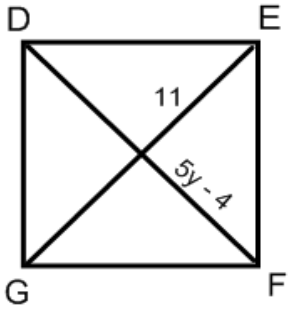


57. DEFG is a rectangle. Find the length of $\overline{DE}$.

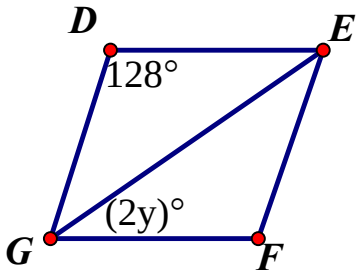
58. PQRS is a rectangle. Find the value of y.



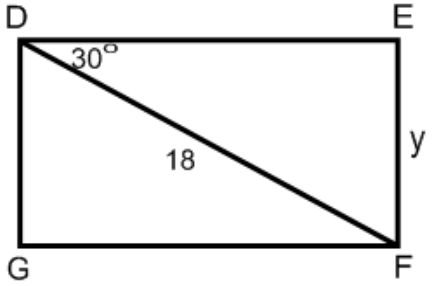
59. DEFG is a square. Find the value of y.



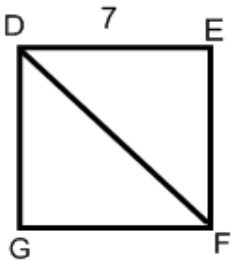
60. DEFG is a rhombus. Find y.



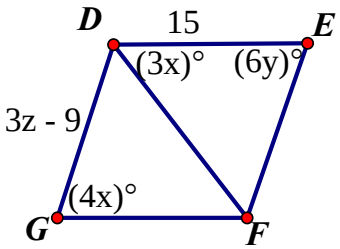
61. DEFG is rectangle. Find y. Round to the nearest hundredth.



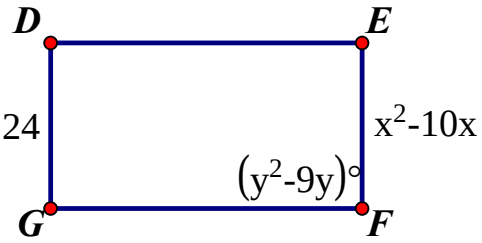
62. DEFG is square. Find the length of $\overline{DF}$. Round to the nearest hundredth



63. DEFG is rhombus. Find the values of x, y, and z.



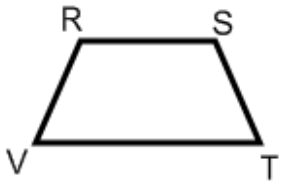
64. DEFG is a rectangle. Find the values of x and y.



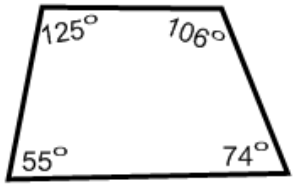
Trapezoids

Classwork

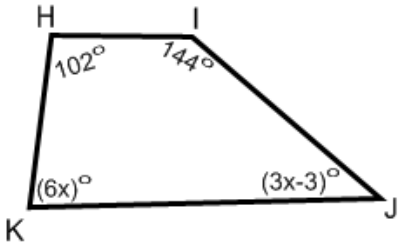
65. RSTV is a trapezoid. Name the bases and legs.



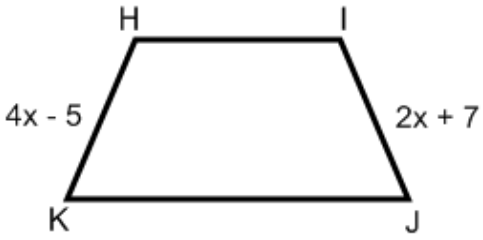
66. Decide whether the quadrilateral is a trapezoid. Justify your answer.



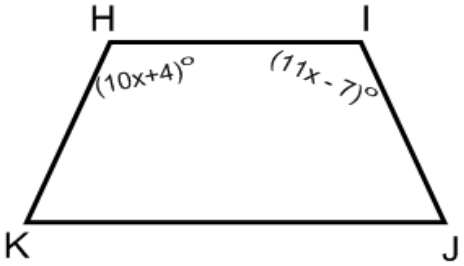
67. HIJK is a trapezoid. Find m∠K and m∠J.



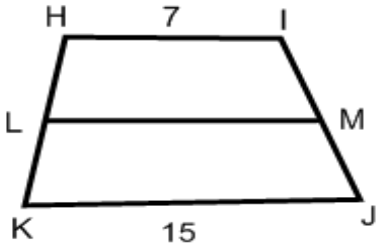
68. HIJK is an isosceles trapezoid. Find the value of x.



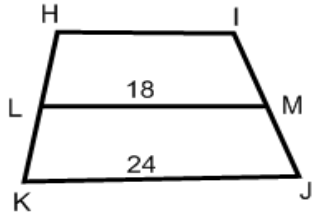
69. HIJK is an isosceles trapezoid. Find m∠H.



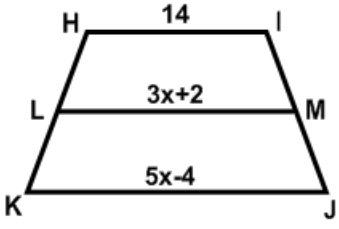
70. $\overline{LM}$ is the midsegment of trapezoid HIJK. Find the length of $\overline{LM}$.



71. $\overline{LM}$ is the midsegment of trapezoid HIJK. Find the length of $\overline{HI}$.

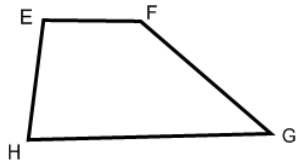


72. $\overline{LM}$ is the midsegment of trapezoid HIJK. Find the value of x.

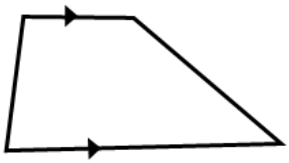


Homework

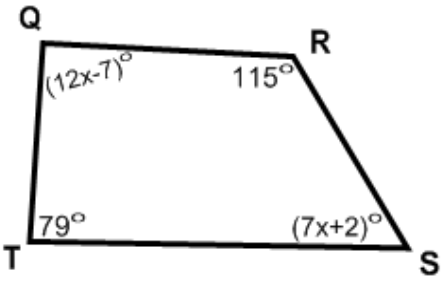
73. EFGH is a trapezoid. Name the bases and legs.



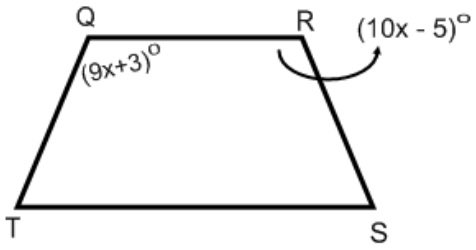
74. Decide whether the quadrilateral is a trapezoid. Justify your answer.



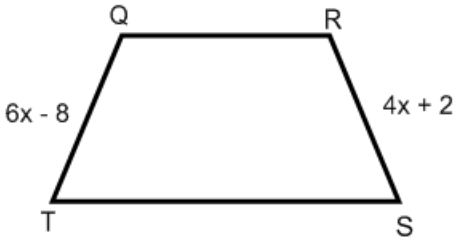
75. QRST is a trapezoid. Find the value of x.



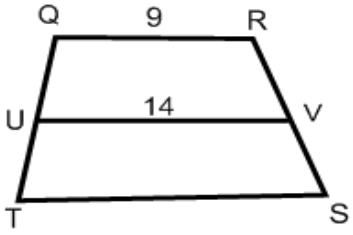
76. QRST is an isosceles trapezoid. Find the value of x.



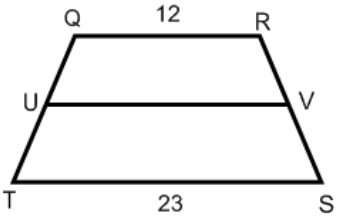
77. QRST is an isosceles trapezoid. Find the length of the legs.



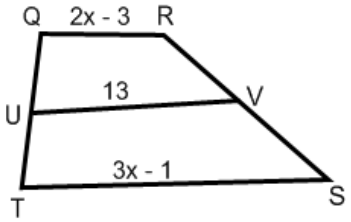
78. $\overline{UV}$ is the midsegment of trapezoid QRST. Find the length of $\overline{TS}$.



79. $\overline{UV}$ is the midsegment of trapezoid QRST Find the length of $\overline{UV}$.



80. $\overline{UV}$ is the midsegment of trapezoid QRST. Find the length of $\overline{QR}$.



Kites

Classwork

Decide whether the quadrilateral is a kite. Justify your answer.

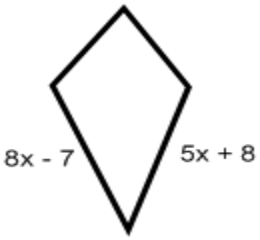
81.

82.

83.

The quadrilateral is a kite. Find the value of x.

84.



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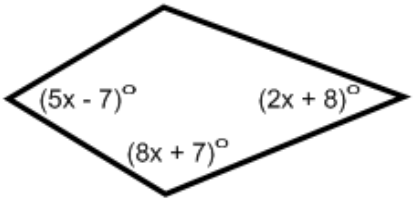
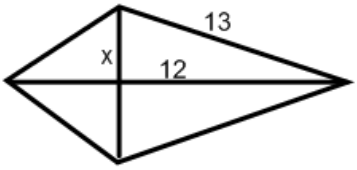
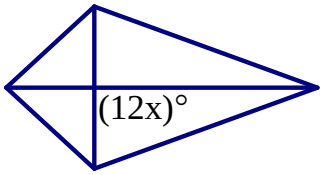


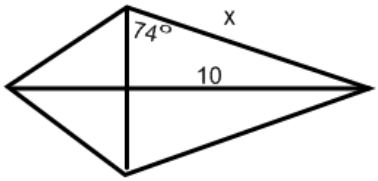
86.



87.



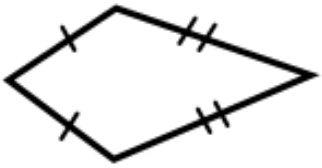
88.



Homework

Decide whether the quadrilateral is a kite. Justify your answer.

89.



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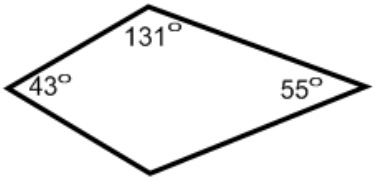
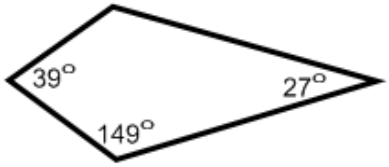
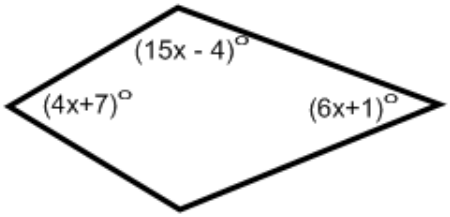


91.

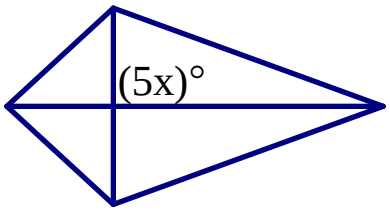


The quadrilateral is a kite. Find the value of x.

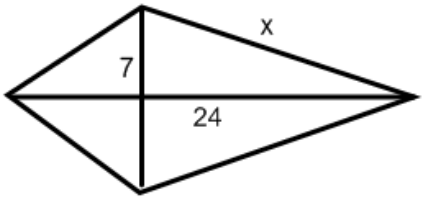
92.



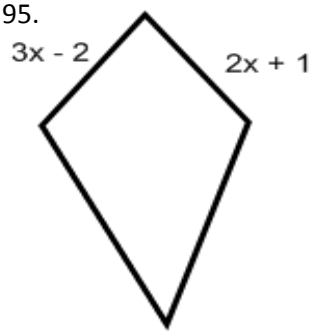
93.



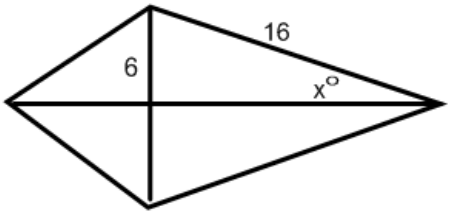
94.



95.



96.



Constructing Quadrilaterals

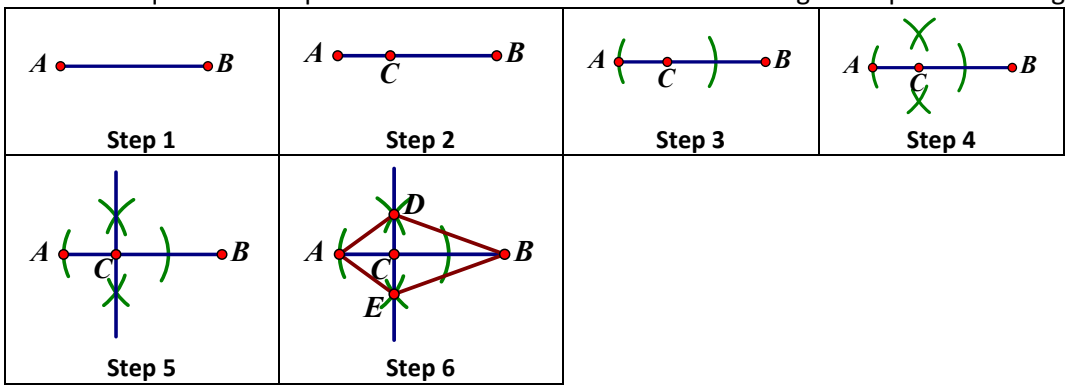
Classwork

97. Construct a parallelogram in the space below. Justify why your construction is a parallelogram.

98. Construct a rhombus in the space below. Justify why your construction is a rhombus.

PARCC-type Question:

99. Below is a sequence of steps that were used to construct a kite using a compass and straightedge.



Part A:

Explain the steps that were used to construct the kite.

Part B:

Explain why the construction shown creates a kite.

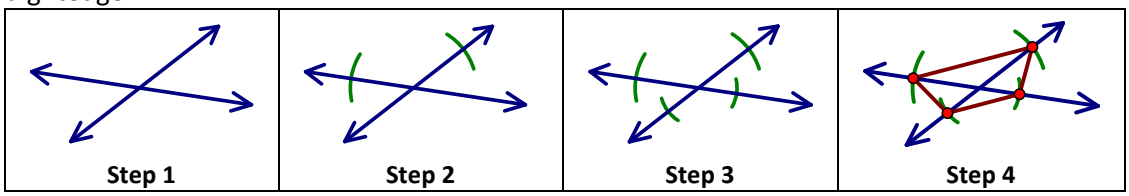
Homework

100. Construct a rectangle in the space below. Justify why your construction is a rectangle.

101. Construct a square in the space below. Justify why your construction is a square.

PARCC-type Question:

102. Below is a sequence of steps that were used to construct an isosceles trapezoid using a compass and straightedge.



Part A:

Explain the steps that were used to construct the isosceles trapezoid.

Part B:

Explain why the construction shown creates an isosceles trapezoid.

Family of Quadrilaterals

Classwork

103. Define quadrilateral.

Name the quadrilateral that always has the given property.

104. What is an equilateral quadrilateral?

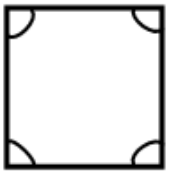
105. Name the quadrilateral with perpendicular diagonals.

106. What quadrilateral has both pairs of opposite sides are congruent.

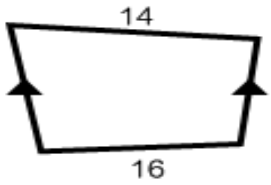
In problems 107-110, identify the quadrilateral. (There may be more than one answer).

107.

108.



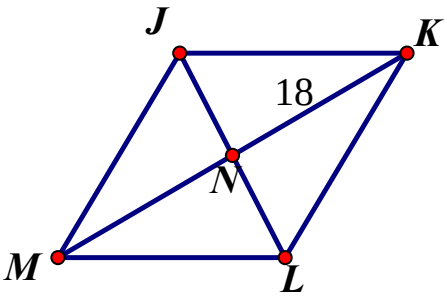
109.



110.

PARCC-type Question:

111. Quadrilateral JKLM is a parallelogram with KN = 18.



Part A

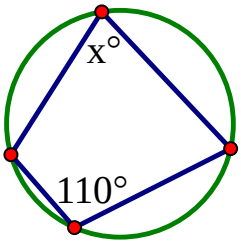
Let $JN = x^2 - 18$ & $LN = 3x$. What are the lengths of $\overline{JN}$ & $\overline{LN}$? Justify your answer.

Part B

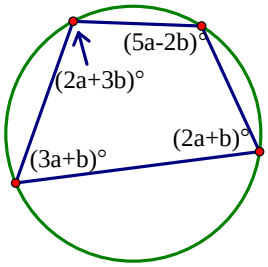
What conclusion can you make regarding the specific classification of parallelogram JKLM? Justify your answer.

#112-113: Find the value of each variable.

112.



113.



Homework

114. Define a parallelogram.

Name the quadrilateral that always has the given property.

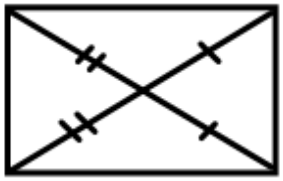
115. The diagonals are congruent.

116. Has two pairs of congruent angles.

117. Exactly one pair of opposite sides are congruent.

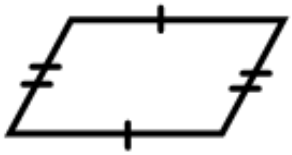
In problems 118-121, identify the quadrilateral. (There may be more than one answer).

118.



119.

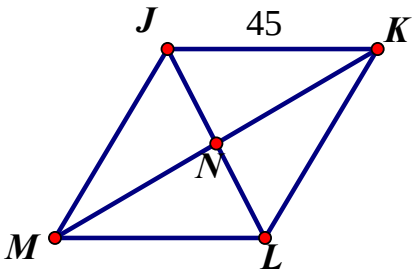
120.



121.

PARCC-type Question:

122. Quadrilateral JKLM is a parallelogram with JK = 45.



Part A

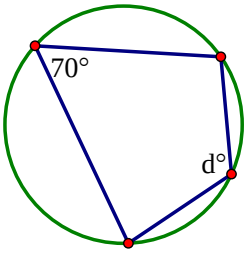
Let $KL = x^2 - 36$ & $JM = 5x$. What are the lengths of $\overline{KL}$ & $\overline{JM}$? Justify your answer.

Part B

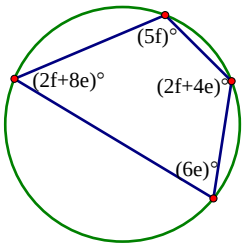
What conclusion can you make regarding the specific classification of parallelogram JKLM? Justify your answer.

#123-124: Find the value of each variable.

123.



124.



Proofs

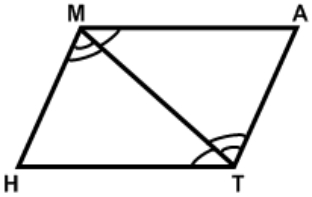
Classwork

PARCC-type questions

Complete the following proof.

125. Given: ∠AMT ≅ ∠HTM, ∠HMT ≅ ∠ATM

Prove: MATH is a parallelogram

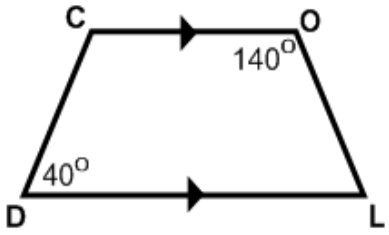


Statements	Reasons
1. ∠AMT ≅ ∠HTM, ∠HMT ≅ ∠ATM	1.
2. $\overline{MA} \parallel \overline{HT}$; $\overline{MH} \parallel \overline{AT}$	2.
3. MATH is a parallelogram	3.

126. Write a proof:

Given: COLD is a quadrilateral, m∠D = 40°, m∠O = 140°, and $\overline{CO} \parallel \overline{DL}$

Prove: COLD is an isosceles trapezoid

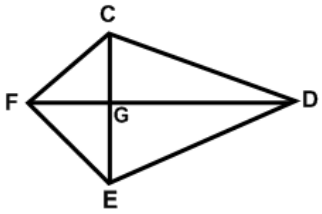


Homework

PARCC-type questions

127. Given: CDEF is a kite

Prove: $\overline{CG} \cong \overline{GE}$

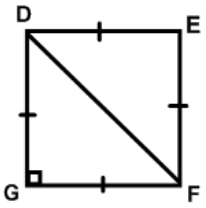


Statements	Reasons
1. CDEF is a kite	1.
2. $\overline{CF} \cong \overline{FE}$	2.
3. $\overline{FG} \cong \overline{FG}$	3.
4. $\overline{CE} \perp \overline{FD}$	4.
5. ∠FGC and ∠FGE are right angles	5.
6. ∠FGC ≅ ∠FGE	6.
7. $\triangle CGF \cong \triangle EGF$	7.
8. $\overline{CG} \cong \overline{GE}$	

128. Write a proof:

Given: DEFG is a rhombus and ∠G is a right angle

Prove: DEFG is a square



Coordinate Proofs

Classwork – Write a coordinate proof.

129. Given: E(-4,7), F(-3,2), G(-1,2), H(0,7)

Prove: EFGH is an isosceles trapezoid

130. Given: P(3,4), Q(-3,4), R(3,-8), S(-3,-8)

Prove: PQRS is a rectangle

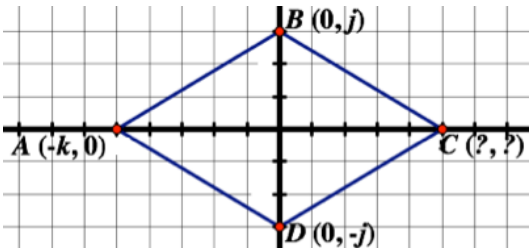
131. Given: A(-1,4), B(1,3) C(3,0), D(-1,2)

Prove: ABCD is a trapezoid but not isosceles

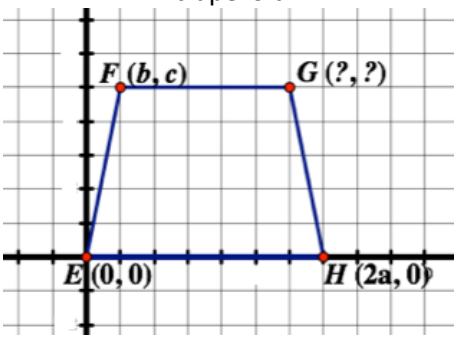
PARCC-type Questions:

#132-133: Using the given information, determine the coordinates of the missing vertex using the variables provided in each question.

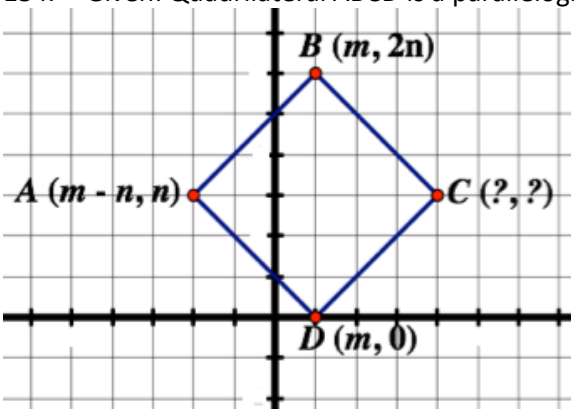
132. Given: Quadrilateral ABCD is a rhombus



133. Given: Quadrilateral EFGH is an isosceles trapezoid



134. Given: Quadrilateral ABCD is a parallelogram



Part A
Find the coordinates of point C in terms of m and n.

Part B
Prove: Quadrilateral ABCD is a square

Homework – Write a coordinate proof.

135. Given: J(-4,8), K(-1,11), L(2,8), M(-1,2)
Prove: JKLM is a kite

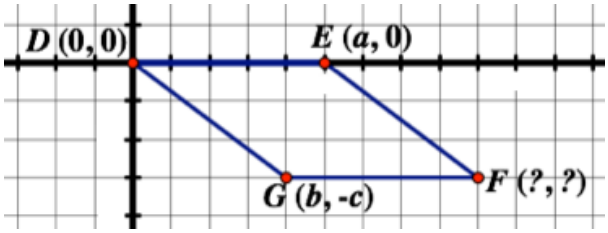
136. Given: D(3,0), E(7,0), F(6,7), G(4,7)
Prove: DEFG is an isosceles trapezoid

137. Given: P(3,5), Q(7,7), R(10,1), S(6,-1)
Prove: PQRS is a parallelogram

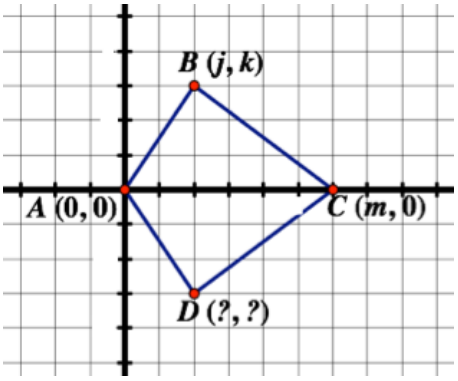
PARCC-type Questions:

#138-139: Using the given information, determine the coordinates of the missing vertex using the variables provided in each question.

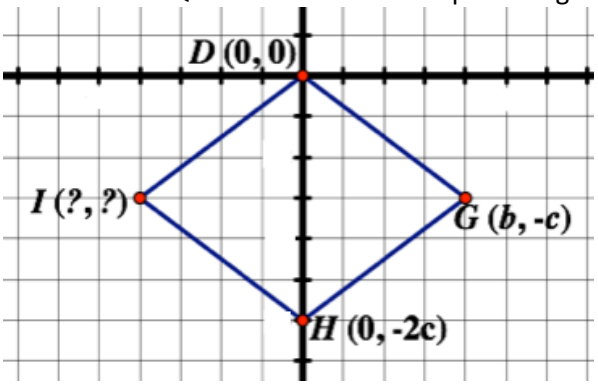
138. Given: Quadrilateral DEFG is a parallelogram



139. Given: Quadrilateral ABCD is a kite



140. Given: Quadrilateral ABCD is a parallelogram



Part A

Find the coordinates of point *I* in terms of b and c.

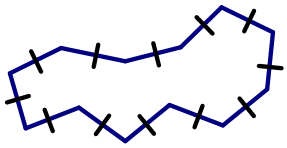
Part B

Prove: Quadrilateral DGHI is a rhombus

Unit Review

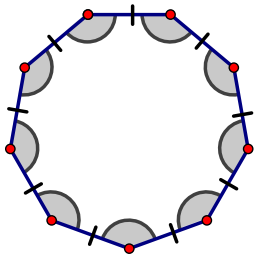
Multiple Choice - Choose the correct answer for each question. No partial credit will be given.

1. Name the polygon below and identify all of its qualities. Circle all that apply.



a. octagon
b. decagon
c. dodecagon
d. equilateral
e. equiangular
f. regular
g. concave
h. convex
i. not a polygon

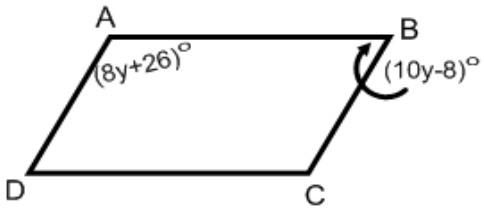
2. Name the polygon below and identify all of its qualities. Circle all that apply.



a. heptagon
b. nonagon
c. decagon
d. equilateral
e. equiangular
f. regular
g. concave
h. convex
i. not a polygon

3. What is the sum of the measures of the interior angles of 24-gon?
a. 4320°
b. 3960°
c. 4680°
d. 7560°

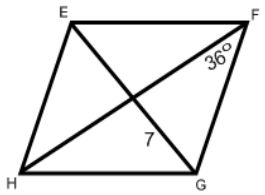
#4-5: Use the parallelogram below to answer the questions.



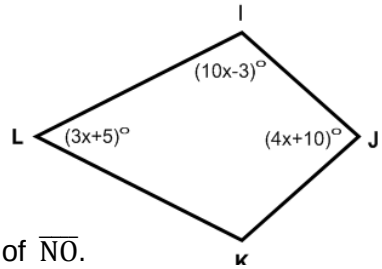
4. Find the value of y.
a. 16
b. 15.44
c. 9
d. 17

5. Find the m∠A.
a. 98°
b. 82°
c. 72°
d. 108°

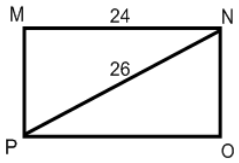
6. EFGH is a rhombus. Find the length of $\overline{FG}$.
   a. 11.91
   b. 8.65
   c. 4.11
   d. 9.63



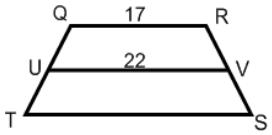
7. IJKL is a kite. Find the m∠K.
   a. 13
   b. 44
   c. 20.5
   d. 127



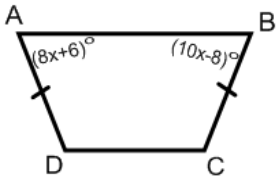
8. MNOP is a rectangle. Find the length of $\overline{NO}$.
   a. 5
   b. 10
   c. 35.38
   d. 100



9. QRST is a trapezoid. If $\overline{UV}$ is the midsegment, find the length of $\overline{TS}$.
   a. 44
   b. 19.5
   c. 27
   d. 5



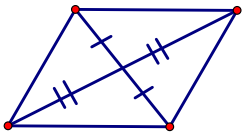
10. ABCD is a trapezoid. Find m∠B.
   a. 62°
   b. 86.89°
   c. 10.11°
   d. 7°



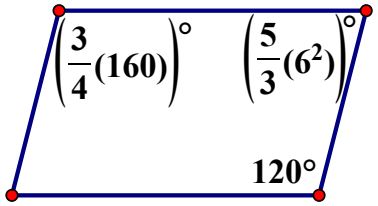
11. Which of the following statements is not true of a parallelogram?
   a. The opposite angles are congruent.
   b. The diagonals bisect each other.
   c. The opposite sides are congruent.
   d. The consecutive angles are congruent.

Short Constructed Response - Write the answer for each question. No partial credit will be given.

12. Tell whether the quadrilateral is a parallelogram. If yes, state the appropriate theorem.



13. Tell whether the quadrilateral is a parallelogram. If yes, state the appropriate theorem.

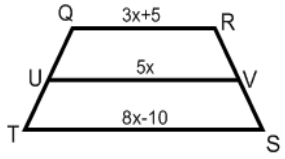


14. What is the measure of each interior angle of a regular 30-gon?

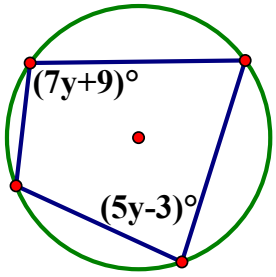
15. What is the measure of each exterior angle of a regular 18-gon?

16. The measure of each angle of a regular convex polygon is 157.5°. Find the number of sides of the polygon.

17. QRST is a trapezoid. If $\overline{UV}$ is the midsegment, find the value of x.

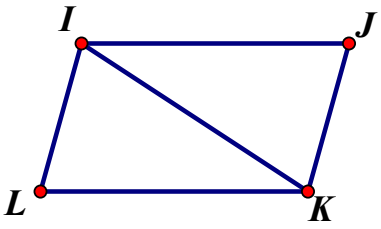


18. Find the value of y in the figure below.



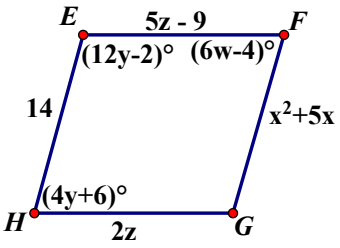
Extended Constructed Response - Solve the problem, showing all work. Partial credit may be given.

19. One method that can be used to prove that both pairs of opposite angles in a parallelogram are congruent is shown in the given partial proof. Complete the proof.
Given: Quadrilateral *IJKL* is a parallelogram
Prove: $\angle J \cong \angle L, \angle JKL \cong \angle LIJ$

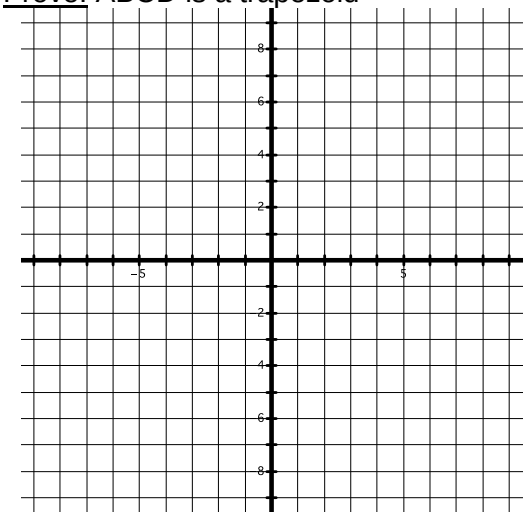


Statements	Reasons
1. _____	1. _____
2. $\overline{IL} \parallel \overline{JK}, \overline{IJ} \parallel \overline{LK}$	2. _____
3. _____ _____	3. If parallel lines are cut by a transversal, then the alternate interior angles are congruent.
4. $\overline{IK} \cong \overline{IK}$	4. _____
5. _____	5. ASA triangle congruence
6. $\angle J \cong \angle L$	6. _____
7. $m\angle JKI = m\angle LIK$ $m\angle JIK = m\angle LKI$	7. _____ _____
8. $m\angle JKI + m\angle LKI = m\angle LIK + m\angle JIK$	8. _____
9. $m\angle LIK + m\angle JIK = m\angle LIJ$ $m\angle JKI + m\angle LKI = m\angle JKL$	9. _____ _____
10. $m\angle JKL = m\angle LIJ$	10. _____
11. _____	11. Definition of congruent angles.

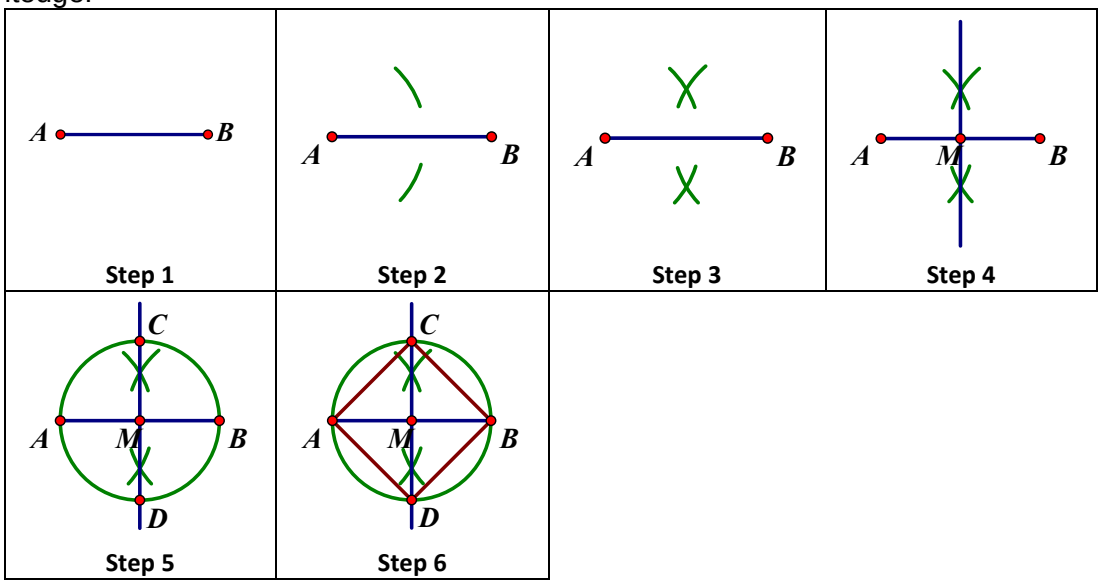
20. EFGH is a parallelogram. Find the value of w, x, y, and z.



21. Given: ABCD is a quadrilateral and A(-2,0), B(0,4), C(5,4), D(8,0)
Prove: ABCD is a trapezoid



22. Below is a sequence of steps that were used to construct a square using a compass and straightedge.



Part A:
Explain the steps that were used to construct the square.

Part B:
Explain why the construction shown creates a square.

Answer Key

1.
   a. pentagon/concave/equilateral
   b. triangle/convex/regular
   c. not a polygon
   d. quadrilateral/convex/equiangular
2. 2160°
3. 9000°
4. m∠N = 60°, m∠F = 158°, m∠A = 116°, m∠L = 84°, m∠V = 165°, m∠P = 137°
5. 162°
6. 171°
7. 12°
8. 30 sides
9.
   a. quadrilateral/convex/equiangular
   b. not a polygon
   c. hexagon/convex/regular
   d. decagon/concave/equilateral
10. 2880°
11. 7560°
12. m∠G = 126°, m∠R = 120°, m∠M = 163°, m∠D = 170°, m∠K = 124°, m∠E = 117°, m∠C = 152°, m∠T = 108°
13. 169.71°
14. 166.67°
15. 15°
16. 40 sides
17. not a parallelogram
18. The figure is a parallelogram, because the diagonals bisect each other.
19. w = 22, x = 3, y = 15, z = 13
20. SR = 17
21. m∠Q = 107°, m∠P = 73°
22. TR = 5, PR = 10
23. ST = 9.5
24. x = -4 or x = 1.5 = $\frac{3}{2}$
25. The figure is a parallelogram, the opposite sides are congruent.
26. not a parallelogram
27. w = 3.33, x = 5, y = 3, and z = 20
28. m∠R = 54°, m∠P = 54°
29. SP = 17
30. ST = TQ = 13.5
31. PR = 22
32. x = 5 or x = -3
33. Yes, the diagonals of the quadrilateral bisect each other.
34. Yes, the opposite sides of the quadrilateral are congruent.
35. not a parallelogram
36. Yes, it is a parallelogram because it has 2 pairs of parallel sides
37. Yes, an angle of the quadrilateral is supplementary to its consecutive angles.
38. not a parallelogram
39. Yes, the opposite sides of the quadrilateral are congruent.
40. Yes, the opposite angles of the quadrilateral are congruent.

41. not a parallelogram
42. Yes, one side of the quadrilateral is congruent and parallel.
43. not a parallelogram
44. Yes, the opposite sides of the quadrilateral are congruent.
45. x = 4
46. x = 5
47. x = 3
48. DE = GF = 27 and EF = DG = 13
49. x = 8
50. x = 3
51. DG = 11.31
52. EH = 12
53. x = 25, y = 73.74°
54. x = 9 & y = 3
55. y = 6
56. y = 3
57. y = 4
58. y = 3
59. y = 3
60. 13
61. y = 9
62. 7
63. x = 18, y = 12, z = 8
64. x = 12, x = -2
    y = 15, y = -6
65. $\overline{RS}$ & $\overline{VT}$ are the bases. $\overline{VR}$ & $\overline{TS}$ are the legs
66. Yes. The consecutive interior angles are supplementary so, the bases are parallel.
67. m∠K = 78°, m∠J = 36°
68. x = 6
69. x = 11
70. LM = 11
71. HI = 12
72. x = 6
73. $\overline{EF}$ & $\overline{HG}$ are the bases. $\overline{EH}$ & $\overline{FG}$ are the legs.
74. Yes. The quadrilateral has one pair of parallel sides
75. x = 9
76. x = 8
77. x = 5
78. TS = 19
79. UV = 17.5
80. QR = 9
81. not a kite
82. not a kite
83. Yes. The diagonals are perpendicular
84. x = 5
85. x = 15
86. x = 5
87. x = 7.5
88. x = 10.40
89. Yes. The consecutive sides are congruent.
90. Yes. There is one pair of congruent opposite angles.

91. not a kite
92. x = 9
93. x = 18
94. x = 25
95. x = 3
96. x = 22
97. sketches will vary; check student constructions
98. sketches will vary; check student constructions
99. **Part A:** Sample Answer
    Step 1: Construct a segment AB.
    Step 2: Construct a point, named C, on $\overline{AB}$
    Step 3: Place the compass tip at point C with a radius of length and construct 2 arcs that intersect $\overline{AB}$, with the radius remaining the same on both sides of point C.
    Step 4: Place the compass tip at one of the intersection points of the arcs from Step #3 with a radius length that is greater than the radius length from the arc to point C & construct 2 arcs, one above and one below $\overline{AB}$. Repeat using the intersection point of the arc from Step #3.
    Step 5: Construct a line through the intersection points of the arcs. This line is perpendicular to $\overline{AB}$.
    Step 6: Connect the intersection points of the arcs with the original endpoints of our segment to make kite ADBE.
    Part B: Sample Answer
    Steps #2-5 create a perpendicular line that intersects $\overline{AB}$ at point C. Because the intersection points of the congruent arcs on the perpendicular line were used, we know that $\overline{CD} \cong \overline{CE}$. Since the diagonals are perpendicular and one of them is bisected, we know that ADBE is a kite.
100. sketches will vary; check student constructions
101. sketches will vary; check student constructions
102. **Part A:** Sample Answer
    Step 1: Construct 2 intersecting lines.
    Step 2: Placing your compass tip at the intersection point of the two lines, extend your compass to any length and construct 2 congruent arcs that intersect the lines on one side (top half).
    Step 3: Placing your compass tip at the intersection point of the two lines, extend your compass to a different length (shorter was used) and construct 2 congruent arcs that intersect the lines on the other side (bottom half).
    Step 4: Connect the intersection points of the arcs and the intersecting lines to create your isosceles trapezoid.
    Part B: Sample Answer
    The distance from the intersection point of the two lines to the upper vertices in found in Step #2 are congruent. Likewise the distance from the intersection point of the two lines to the lower vertices found in Step #3 are congruent. This shows that both of the diagonals are congruent, but do not bisect each other, making the red figure in Step #4 an isosceles trapezoid.
103. A quadrilateral is a polygon with 4 sides.
104. A rhombus or a square.
105. A rhombus, square or a kite
106. A parallelogram, rectangle, rhombus, or a square
107. A parallelogram or rhombus
108. A rectangle or a square
109. A trapezoid

110. A kite
111. Part A: x = 6, JN = 18 & LN = 18
Part B: Parallelogram JLKM is a rectangle because the diagonals are congruent and bisected (JN = LN = KN = MN = 18).
112. x = 70
113. a = 25, b = 20
114. A parallelogram is quadrilateral where both pairs of opposite sides are parallel.
115. A rectangle, square, or isosceles trapezoid
116. A parallelogram, rectangle, square, rhombus, isosceles trapezoid, or kite.
117. A kite or isosceles trapezoid
118. An isosceles trapezoid
119. A rhombus, square, or kite
120. A parallelogram or rectangle
121. An isosceles trapezoid
122. Part A: x = 9, JM = 45, KL = 45
Part B: Parallelogram JKLM is a rhombus because all of the sides are congruent/equal (JK = KL = LM = JM = 45).
123. d = 110
124. e = 5, f = 30

125.

Statements	**Reasons**
1. ∠AMT ≅ ∠HTM, ∠HMT ≅ ∠ATM	1. Given
2. $\overline{MA} \parallel \overline{HT}$; $\overline{MH} \parallel \overline{AT}$	2. Converse of alternate interior angles theorem
3. MATH is a parallelogram	3. Definition of parallelogram

126.

Statements	**Reasons**
1. m∠D = $40°$, m∠O = $140°$, $\overline{CO} \parallel \overline{DL}$	1. Given
2. m∠L = $40°$	2. Consecutive interior angles are supplementary
3. Quad. COLD is an isosceles trapezoid	3. A trapezoid is isosceles if and only if base angles are congruent

127.

Statements	**Reasons**
1. CDEF is a kite	1. Given
2. $\overline{CF} \cong \overline{FE}$	2. Definition of kite
3. $\overline{FG} \cong \overline{FG}$	3. Reflexive property of congruence
4. $\overline{CE} \perp \overline{FD}$	4. Diagonals of a kite are perpendicular
5. ∠FGC and ∠FGE are right angles	5. Definition of perpendicular lines
6. ∠FGC ≅ ∠FGE	6. All right angles are congruent
7. $\triangle CGF \cong \triangle EGF$	7. HL right triangle congruence theorem
8. $\overline{CG} \cong \overline{GE}$	8. CPCTC

128.

Statements	**Reasons**
1. DEFG is a rhombus; ∠G is a right angle	1. Given
2. m∠G = $90°$	2. Definition of right angles
3. m∠D = $90°$	3. Consecutive interior angles are supplementary
4. m∠F = $90°$	4. Consecutive interior angles are supplementary
5. m∠E = $90°$	5. Consecutive interior angles are supplementary

6. DEFG is a square — 6. Definition of square

129. $\overline{EH} \| \overline{FG}$, $\overline{EF} = \overline{HG}$, $\overline{EF}$ is not parallel to $\overline{HG}$
130. QP = RS, QS = PR, $\overline{QP} \| \overline{RS}$, $\overline{QS} \| \overline{PR}$, and $\overline{QS}$ is perpendicular to $\overline{QP}$
131. $\overline{AB} \| \overline{CD}$, $\overline{AD}$ is not congruent to $\overline{BC}$
132. C(k, 0)
133. G(2a – b, c)
134. Part A: C(m + n, n)
Part B: Multiple ways to answer this question. Sample answer given below:
$m_{CD} = \frac{n-0}{m+n-m} = \frac{n}{n} = 1$ & $m_{AD} = \frac{n-0}{m-n-m} = \frac{n}{-n} = -1$
Therefore, $\overline{CD} \perp \overline{AD}$.
$d_{CD} = \sqrt{(m+n-m)^2 + (n-0)^2} = \sqrt{n^2+n^2} = \sqrt{2n^2} = n\sqrt{2}$
$d_{AD} = \sqrt{(m-(m-n))^2 + (0-n)^2} = \sqrt{(m-m+n)^2 + (-n)^2} = \sqrt{n^2+n^2} = \sqrt{2n^2} = n\sqrt{2}$
Since ABCD is a parallelogram, we know that both pairs of opposite sides are parallel and congruent. Since $\overline{CD}$ & $\overline{AD}$ were perpendicular and congruent, the remaining adjacent sides are also perpendicular and congruent. Therefore, parallelogram ABCD is a square.
135. $\overline{JK} = \overline{KL}$, $\overline{JM} = \overline{ML}$
136. $\overline{DE} \| \overline{GF}$, $\overline{DG} = \overline{EF}$, $\overline{DG}$ is not parallel to $\overline{EF}$
137. $\overline{PQ} \| \overline{SR}$, $\overline{QR} \| \overline{PS}$
138. F(a + b, –c)
139. D(j, -k)
140. Part A: $I(-b, -c)$
Part B: Multiple ways to answer this question. Sample answer given below:
$d_{DG} = \sqrt{(b-0)^2 + (-c-0)^2} = \sqrt{b^2 + (-c)^2} = \sqrt{b^2+c^2}$
$d_{GH} = \sqrt{(b-0)^2 + (-c+2c)^2} = \sqrt{b^2+c^2}$
Since *DGHI* is a parallelogram, we know that both pairs of opposite sides are parallel and congruent. Since $\overline{DG}$ & $\overline{GH}$ were congruent, the remaining adjacent sides are also congruent. Therefore, parallelogram *DGHI* is a rhombus.

Unit Review

1. C, G
2. B, D, E, F, H
3. B
4. C
5. A
6. A
7. D
8. B
9. C
10. A
11. D

12. Yes. Theorem Q9: If diagonals of a quadrilateral bisect each other, then the quadrilateral is a parallelogram.
13. Yes. Theorem Q7: If both pairs of opposite angles of a quadrilateral are congruent then the quadrilateral is a parallelogram.
14. 168°
15. 20°
16. 16 sides
17. x = 5
18. y = 14.5

19.

Statements	Reasons
1. Quadrilateral *IJKL* is a parallelogram	1. Given
2. $\overline{IL} \parallel \overline{JK}, \overline{IJ} \parallel \overline{LK}$	2. Definition of a parallelogram
3. $\angle JKI \cong \angle LIK$ $\angle JIK \cong \angle LKI$	3. If parallel lines are cut by a transversal, then the alternate interior angles are congruent.
4. $\overline{IK} \cong \overline{IK}$	4. Reflexive Property of congruence
5. $\Delta JKI \cong \Delta LIK$	5. ASA triangle congruence
6. $\angle J \cong \angle L$	6. CPCTC
7. $m\angle JKI = m\angle LIK$ $m\angle JIK = m\angle LKI$	7. Definition of congruent angles
8. $m\angle JKI + m\angle LKI = m\angle LIK + m\angle JIK$	8. Addition Property of Equality
9. $m\angle LIK + m\angle JIK = m\angle LIJ$ $m\angle JKI + m\angle LKI = m\angle JKL$	9. Angle Addition Postulate
10. $m\angle JKL = m\angle LIJ$	10. Substitution Property of Equality
11. $\angle JKL \cong \angle LIJ$	11. Definition of congruent angles.

20. w = 9, x = -7 or 2, y = 11, z = 3
21. ABCD is a trapezoid, $\overline{\mathrm{AD}}$ || $\overline{\mathrm{BC}}$ and $\overline{\mathrm{AB}}$ is not || to $\overline{\mathrm{CD}}$
22. **Part A:** Sample Answer
    Step 1: Construct segment AB.
    Step 2: Place the compass tip on point A and extend the radius of the compass a little more than half way across the line segment and create 2 arcs w/ the compass.
    Step 3: Repeat Step 2 using the same compass radius with the compass tip on point B.
    Step 4: Construct a line through the intersection points of the sets of arcs. Label the point where our line intersects $\overline{AB}$ as point M.
    Step 5: Place the tip of the compass at point M. Extend the radius of the compass to either point A or point B and construct a circle. Label the intersection points of our new line and the circle as C and D.
    Step 6: Connect points A, C, B, and D to create square ACBD.
    Part B: Sample Answer
    Steps #1-4 help you find the midpoint of $\overline{AB}$, a line perpendicular to $\overline{AB}$, and the center of your circle. By drawing the circle, $\overline{MA} \cong \overline{MC} \cong \overline{MB} \cong \overline{MD}$. Because the diagonals are congruent and perpendicular, ACBD is a square.