1. Point, Line, and Plane

2a. always

2b. always

2c. sometimes

2d. always

3. **B**

4. **D**

5. **B**

6. $\overline{AB}$

7. –3 and 13

8. 30

9. 8

10. 20

11. 130

12 12

13. 10

14. 25

15. 25

16a. $\overline{EG} \cong \overline{FH}$

16b. 43

17. 55°

18. 30

19. 110°

20a. 5

20b. 30°

21. $x = 20, y = 80$

22. $F(x, y) = (x, -y)$

23. $F(x, y) = (-x, y)$

24. $F(x, y) = (y, x)$

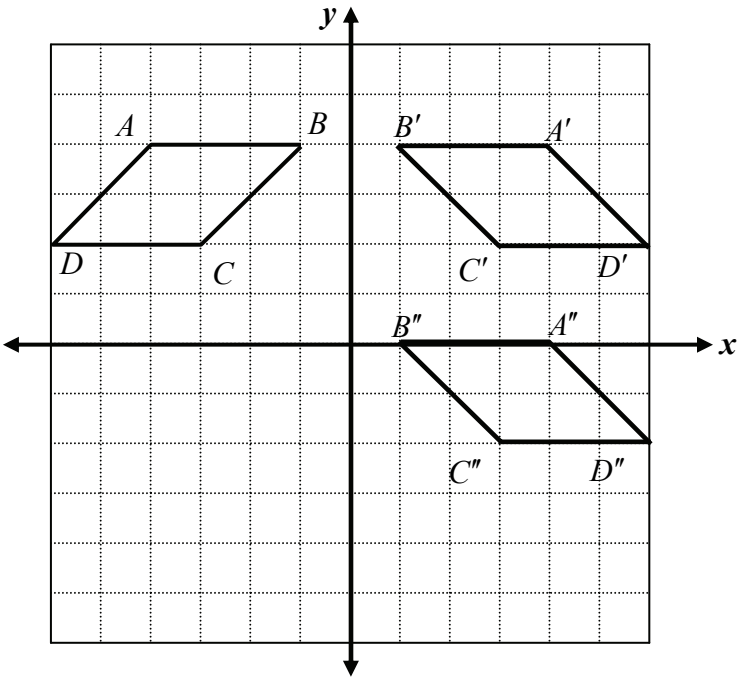
25. $F(x, y) = (-x, -y)$

26. $F(x, y) = (x + 5, y - 3)$

27. $F(x, y) = (6 - x, y)$

28. **C**

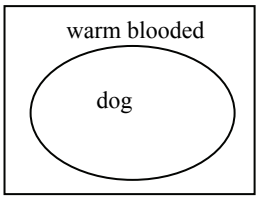
29a.
29b.



29c. $C'(3, 2), C''(3, -2)$

29d. $P''(x, y) = (-x, y - 4)$ The reflection across the *y*-axis makes the *x*-coordinate the opposite, while the translation downward subtracts 4 from the *y*-coordinate.

30a.

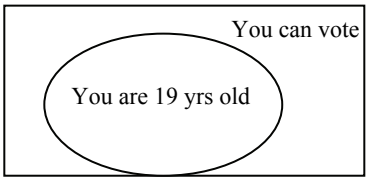


30b. If an animal is warm-blooded, then the animal is a dog.

30c. If an animal is not a dog, then the animal is not warm-blooded.

30d. If an animal is not warm-blooded, then the animal is not a dog.

31a.



31b. If X represents a voter, then the X is inside the box. It may or may not be in the oval, so the statement is not necessarily true.

32a. *q ,r Chris buys gas. Chris drives to Rockville*

32b. *r Chris drives to Rockville*

32c. *no conclusion*

32d. *~ p Chris does not earn $20*

32e. *no conclusion*

33. If Chris earns $10, then he will bring Jane.

34. Triangle *ABC* is equiangular.

35. Sally does not study for the test.

36. The far-right columns have identical truth-values

37.

P	Q	$\sim P$	$P \rightarrow Q$	$P \wedge Q$	$P \vee Q$
T	T	F	T	T	T
T	F	F	F	F	T
F	T	T	T	F	T
F	F	T	T	F	F

38.

P	Q	$\sim Q$	$(P \wedge \sim Q)$	$(P \wedge \sim Q) \vee Q$	$[(P \wedge \sim Q) \vee Q] \rightarrow P$
T	T	F	F	T	T
T	F	T	T	T	T
F	T	F	F	T	F
F	F	T	F	F	T

39. **C**

40. indirect

41. **C**

42. I did not earn $20 this week.

43. Inductive reasoning

44. Inductive reasoning

45. Deductive reasoning

46. Deductive reasoning

47. Inductive reasoning

48. If it is sunny outside today, I will go to the store
If I go to the store, I will buy candy
If I buy candy, I will not eat my dinner.

49a. 4

49b. 8

49c. an infinite number

50. Charlie is correct. The basic rotational symmetry is 360 degrees divided by the number of sides. $360 \div 6 = 60$, so any multiple of 60 degrees will work.

51. **A**

52.

Property	Parallelogram	Rectangle	Square	Rhombus	Trapezoid
Opposite sides congruent	x	x	x	x	
Only one pair of opposite sides parallel					x
Opposite angles congruent	x	x	x	x	
Each diagonal forms 2 congruent triangles	x	x	x	x	
Diagonals bisect each other	x	x	x	x	
Diagonals congruent		x	x		
Diagonals perpendicular			x	x	
A diagonal bisects two angles			x	x	
All angles are right angles		x	x		
All sides are congruent			x	x	

53. 85

54. $x = 20, y = 110$

55a. lines *n* and *p*. Corresponding angles are congruent.

55b. lines *l* and *m*. Alternate interior angles are congruent.

55c. lines *l* and *m*. Adjacent interior angles are supplementary.

56. 5

57. **C**

58. *c, a, b, e, d*

59. 540°

60. 156°

61. 40°

62. 8 sides

63. 6 sides

64. 4,5,6,7,8,9,10,11,12,13,14

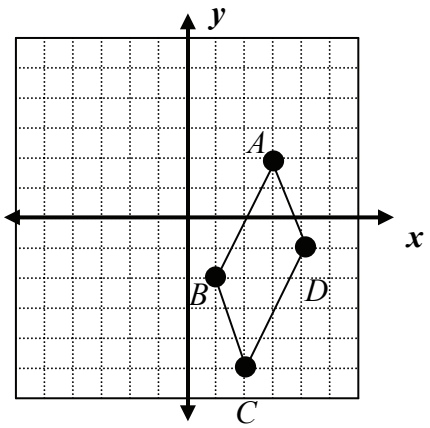
65. $y = 110$

66. 36°

67. $x = 20$

68. $x = 30$

69.



- The quadrilateral is a parallelogram.
  The slopes of $\overline{AB}$ & $\overline{CD}$ equal 2, so $\overline{AB} \parallel \overline{CD}$.
  The slopes of $\overline{AD}$ & $\overline{BC}$ equal –3, so $\overline{AD} \parallel \overline{BC}$.
- The quadrilateral is not a rectangle or a square, since the slopes of $\overline{AD}$ & $\overline{CD}$ are not opposite reciprocals (do not have a product of –1).
- The quadrilateral is not a rhombus since the slopes of the diagonals are not opposite reciprocals. $m\overline{BD} = \frac{1}{3}, m\overline{AC} = 7$.

70a. 3 parallelograms

70b. (–1,–1), (3,3), and (–5,–1)

71. The triangle is a right triangle. $m\overline{AB} = \frac{2}{7}, m\overline{AC} = -\frac{7}{2}$. So $\overline{AB} \perp \overline{AC}$.

72. $(3.5, 13)$

73a. SAS

73b. cannot be proven congruent

73c. ASA

73d. SSS

73e. cannot be proven congruent

73f. AAS

74. Corresponding parts of congruent figures are congruent.

75. A two-column proof is given. A paragraph or flowchart proof is also acceptable.

Statements	Reasons
1. $\overline{BD}$ is the perp. bisector of $\overline{AC}$	1. Given
2. $\angle BEA$ and $\angle BEC$ are right angles	2. Definition of perpendicular
3. $\angle BEA \cong \angle BEC$	3. All right angles are congruent
4. $\overline{AE} \cong \overline{EC}$	4. Definition of bisector
5. $\overline{BE} \cong \overline{BE}$	5. Reflexive Property of Congruence
6. $\triangle BEA \cong \triangle BEC$	6. SAS
7. $\angle BAC \cong \angle BCA$	7. CPCTC

76. A 2-column proof is given. A paragraph or flowchart proof is also acceptable.

Statement	Reasons
1. $\angle EBC \cong \angle ECB$	1. Given
2. $\overline{EB} \cong \overline{EC}$	2. In a triangle, if two angles are congruent, the corresponding sides opposite those angles are also congruent.
3. $\overline{AB} \perp \overline{BE}$	3. Given
4. $\angle ABE$ is a right angle	4. Definition of perpendicular
5. $\overline{DC} \perp \overline{CE}$	5. Given
6. $\angle DCE$ is a right angle	6. Definition of perpendicular
7. $\angle ABE \cong \angle DCE$	7. All right angles are congruent
8. $\angle EAB \cong \angle EDC$	8. Given
9. $\Delta ABE \cong \Delta DCE$	9. AAS
10. $\overline{AE} \cong \overline{DE}$	10. CPCTC

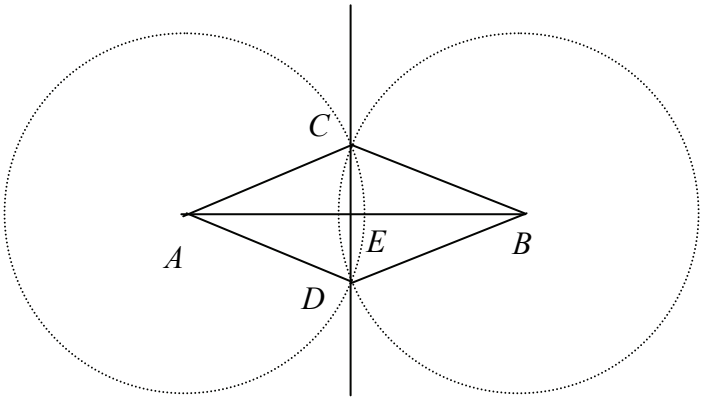
77. A 2-column proof is given. A paragraph or flowchart proof is also acceptable.

Statements	Reasons
1. $\overline{BD} \parallel \overline{EG}$	1. Given
2. $\angle BCF \cong \angle CFG$	2. If 2 $\parallel$ lines are cut by a transversal, alternate interior angles are congruent.
3. $\overline{BC} \cong \overline{FG}$	3. Given
4. $\overline{CF} \cong \overline{CF}$	4. Reflexive property of congruence
5. $\triangle BCF \cong \triangle GFC$	5. SAS
6. $\angle CBF \cong \angle CGF$	6. CPCTC

Alternative proof: Given that $\overline{BD} \parallel \overline{EG}$ and $\overline{BC} \cong \overline{FG}$, then one pair of opposite sides of quadrilateral *BCFG is* parallel and congruent. Therefore *BCFG* is a parallelogram. Since opposite angles of a parallelogram are congruent, then $\angle CBF \cong \angle CGF$.

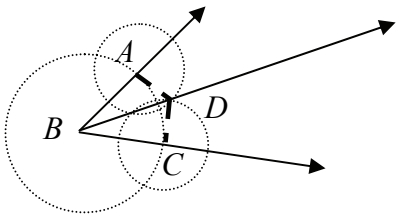
78a. parallelogram
78b. rhombus
78c. rectangle
78d. none of the figures

79a.



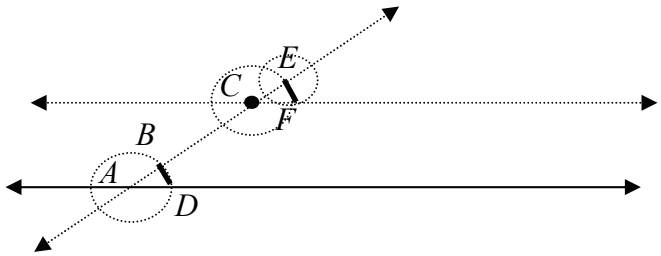
Justification: Congruent circles were constructed with centers at points A and B. Since radii of congruent circles are congruent, $\overline{AC} \cong \overline{BC} \cong \overline{AD} \cong \overline{BD}$; therefore $ACBD$ is a rhombus. In the rhombus, the diagonals are perpendicular, therefore $\overline{AB} \perp \overline{CD}$. Since ACBD is a parallelogram the diagonals bisect each other. Therefore $\overline{AE} \cong \overline{EB}$, so $\overline{CD}$ is the perpendicular bisector of $\overline{AB}$.

79b.



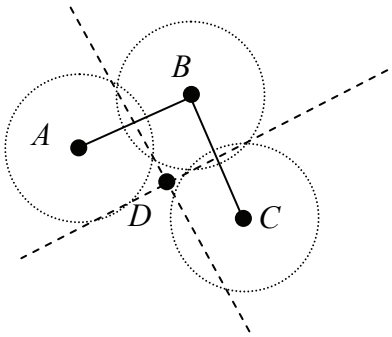
Justification: $\overline{AB} \cong \overline{BC}$ since they are the radii of the same circle. $\overline{AD} \cong \overline{DC}$ since they are constructed using the same compass setting. $\overline{BD} \cong \overline{BD}$ by the reflexive property of congruence. Therefore $\triangle ABD \cong \triangle CBD$ by SSS. $\angle ABD \cong \angle CBD$ by CPCTC, and by the definition of angle bisector $\overrightarrow{BD}$ bisects $\angle$ABC.

79c.



Justification: $\overline{AB} \cong \overline{CE}, \overline{AD} \cong \overline{CF}$ since they were drawn by the same compass setting. $\overline{BD} \cong \overline{EF}$ since they were drawn with the same compass setting. Therefore $\triangle BAD \cong \triangle ECF$ by SSS. Therefore $\angle BAD \cong \angle ECF$ by CPCTC. Finally by the converse of the corresponding angles postulate, $\overleftrightarrow{CF} \,//\, \overleftrightarrow{AD}$.

79d.



Justification. I drew segments between A and B and B and C. I constructed the perpendicular bisector of $\overline{AB}$. Every point on that line is equidistant from points A and B. I constructed the perpendicular bisector of $\overline{BC}$. Every point on that line is equidistant from points B and C. Therefore, point D, the intersection of those two perpendicular bisectors, is equidistant from points A, B, and C.

80. **D**

81. **B**