Applications

1. Figures a, b, and c are polygons. Figure d is not a polygon because it cannot be traced without visiting several points more than once. Figures e and f are not polygons because they have edges that are not line segments.

2.

Common Polygons

Number of Sides and Angles	Polygon Name	Examples in the Shape Set
3	triangle	A, I, P, T
4	quadrilateral	B, G, H, J, K, L, M, N, O, Q, R, S, U, V
5	pentagon	C
6	hexagon	D
7	heptagon	E
8	octagon	F
9	nonagon	none
10	decagon	none
12	dodecagon	none

3. Regular polygons include: A, B, C, D, E, and F

4. Shapes of signs:

a. pentagon

b. square

c. squares (two of them)

d. equilateral triangles

e. trapezoids

f. rectangles and octagon

g. isosceles triangle

h. rectangle and equilateral triangle

i. square

5. Acute angles are 3 and 5; right angles are 2 and 4; obtuse angles are 1 and 6.

6. Although the sides in the drawing of angle 2 are longer, the drawing of angle 1 indicates a greater turn and thus a larger angle. Mistaking length of sides in a drawing as a measure of angle size is a common misconception.

7. a. Figures B, G, H, and J have only right angle corners.

b. Figures C, D, E, and F have only obtuse angle corners.

c. Figures A and P have only acute angle corners.

d. Figures Q and S have at least one angle of each type.

8. a. two complete rotations

b. one and one-half complete rotations

c. one-half of a complete turn (essentially reversing direction)

9. a. 40° is closest to 45°

b. 140° is closest to 135°

c. 175° is closest to 180°

d. 220° is closest to 225°

e. 250° is closest to 240°

f. 310° is closest to 315°

10. **a.** 180°

b. 90°

c. 150°

d. 60°

e. 270°

f. 360°

g. 120°

h. 30°

i. right angle: b; acute angles: d and h; obtuse angles: c, e, and g

11. finding degree measures by deduction

a. 15° **b.** 67.5°

c. 112.5° **d.** 150°

e. 240° **f.** 540°

12. **a.** $\angle BVA = 45°$ and $\angle AVB = 315°$

b. $\angle LKJ = 80°$ and $\angle JKL = 280°$

c. $\angle RQP = 120°$ and $\angle PQR = 240°$

d. $\angle ZYX = 160°$ and $\angle XYZ = 200°$

13. $x = 150°$

14. $x = 55°$

15. $x = 63°$

16. $x = 325°$

17. **a.** 15 minutes = 90°

b. 30 minutes = 180°

c. 20 minutes = 120°

d. one hour = 360°

e. 5 minutes = 30°

f. one and one-half hours = 540°

18. **a.** 60°

b. 45°

c. 36°

19. $m\angle JVK = 60°$

20. $m\angle JVL = 110°$

21. $m\angle JVM = 150°$

22. $m\angle KVL = 50°$

23. $m\angle KVM = 90°$

24. $m\angle LVM = 40°$

25. the complement of $\angle JVK = 30°$

26. the supplement of $\angle JVK = 150°$

27. the complement of $\angle MVL = 50°$

28. the supplement of $\angle JVL = 70°$

29. **a.** Angle 1 at 60° is larger than angle 2 at 30°.

b. The two angles are the same size at 135°.

c. Angle 1 at 90° is larger than angle 2 at 45°.

30. **a.** The three angles measure 75°, 65°, and 40°.

b. The four angles measure 120°, 120°, 60°, and 60°.

31. **a.** 50°

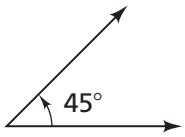
b. 135°

c. 20°

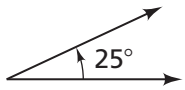
d. 210°

e. 170°

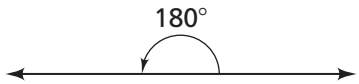
32. **a.**



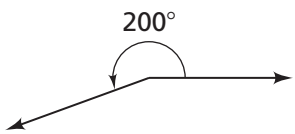
b.



c.

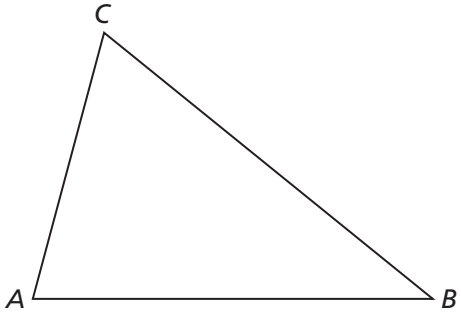


d.

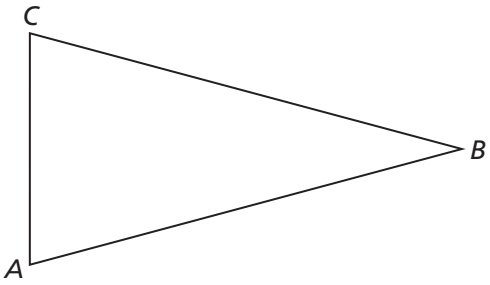


33. A rectangle that has perimeter 24 and one side 8 will look like this:

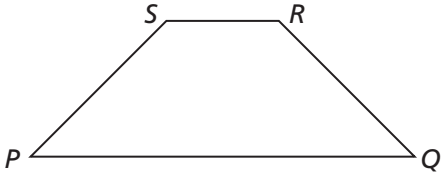
34. A triangle with $\overline{AB} = 2$ in., $\overline{AC} = 1$ in., and $\angle BAC = 75°$ will look like this:



35. There are many triangles that have $\angle BAC = 75°$ and $\angle ACB = 75°$. All are similar to this:



36. A trapezoid $PQRS$ that has $\angle QPS = 45°$, $\angle RQP = 45°$, $\overline{PS} = 1$ in., and $\overline{PQ} = 2$ in. will look like this:



Connections

37. Answers will vary. In some sense nearest of each type would be $\frac{3}{9}$ and $\frac{5}{15}$.

38. Answers will vary. In some sense nearest of each type would be $\frac{6}{10}$ and $\frac{12}{20}$.

39. Answers will vary. In some sense nearest of each type would be $\frac{12}{28}$ and $\frac{18}{42}$.

40. Answers will vary. In some sense nearest of each type would be $\frac{15}{9}$ and $\frac{25}{15}$.

41. $\frac{5}{12} < \frac{9}{12}$

42. $\frac{15}{35} < \frac{12}{20}$

43. $\frac{7}{13} > \frac{20}{41}$

44. $\frac{45}{36} = \frac{35}{28}$

45. **a.** B; (point D)

b. H; (point D)

46. C

47. **a.** 1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30, 36, 40, 45, 60, 72, 90, 120, 360

b. $360 = 2^3 3^2 5$

48. **a.** 30° **b.** 180° **c.** 210°

49. $\frac{1}{2} = \frac{180}{360}$

50. $\frac{1}{10} = \frac{36}{360}$

51. $\frac{1}{9} = \frac{40}{360}$

52. $\frac{1}{3} = \frac{120}{360}$

53. **a.** $\frac{1}{4}$

b. $\frac{3}{4}$

c. 2

d. 25

54. Minute hand rotations

a. 10 minutes

b. 5 minutes

c. $\frac{1}{12}$

d. 30°

55. **a.** Linear rulers use units like inches, feet, yards, centimeters, or meters; angle rulers use degrees (**Note:** in mathematical and scientific reasoning, radians).

b. In some sense the two measurement schemes are similar. Take a small unit of length or angle spread and find how many copies of that unit will fit into the segment or larger angle to be measured.

56. The measure of $\angle AVB$ is 108°. The measure of $\angle BVC$ is 72°

57. Both students have given reasonable answers. However, when no direction of rotation is indicated, it is customary to focus on the angle as a union of two rays with common endpoint and measure between 0 and 180 degrees.

58. **a.** 20 square units

b. 24 square centimeters

c. 20 square units

59. Multiple triangles are possible.

60. Multiple triangles are possible.

61. Multiple triangles are possible.

62. Multiple parallelograms are possible.

63. Multiple parallelograms are possible.

Extensions

64.

Common Quadrilaterals

Sides and Angles	Name	Examples in the Shape Set
All sides are the same length.	rhombus	B, K, V
All sides are the same length and all angles are right angles.	square	B
All angles are right angles.	rectangle	B, G, H, J
Opposite sides are parallel.	parallelogram	B, G, H, J, K, L, M, N, V
Only one pair of opposite sides are parallel.	trapezoid	O, R, S, U

65. **a.** True

b. False

c. True

d. True

e. False

f. True. **Note:** By our chosen definition, a trapezoid is a quadrilateral with one and only one pair of parallel sides.

g. False

66. Variations of the Four in a Row game could take a variety of forms—more concentric circles, different benchmark angle patterns (e.g., multiples of 10°), or others that we haven't imagined.

67. **a.** SSW is 202.5°, NNW is 337.5°

b. The ship is traveling in a direction 30° north of due west.

68. **a.** The runway heading due west is 27; heading due east is 9.

b. Runway 6 implies a compass heading of 60°. Runway 12 implies a compass heading of 120°.

c. Labels for runways in opposite directions differ by 18, related to the 180° difference in their directions.

69. a. She was about 10° off her intended course.

b. Using the scale on the map, points A and D are about 100 miles apart, points B and E are about 175 miles apart, points C and F are about 275 miles apart.

c. If you fly 20° south of the intended course, you might end up in the Samoa Islands.