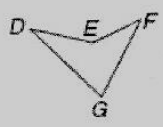
1-6 Two-Dimensional Figures (Polygons)

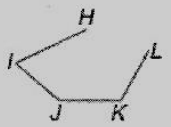
Objective #1: Identify and name polygons. Define the difference between a convex and concave polygon.

- A polygon is a closed figure formed by a finite number of coplanar segments called sides.
- The sides have a common endpoint, are noncollinear and intersect at their endpoints.
- A polygon is named by the letters of its vertices and written in order of consecutive vertices.
- Polygons can be either convex or concave.
- To determine whether a polygon is convex or concave, draw a line extending each side. If any of the lines contain any point in the interior of the polygon, then the polygon is concave. Otherwise it is convex.
- In general, a polygon is classified by its number of sides.
- An equilateral polygon is a polygon in which all its sides are congruent.
- An equiangular polygon is a polygon in which all angles are congruent.
- A convex polygon that has $\cong$ sides and $\cong$ angles is called a regular polygon.
- A polygon that does not have congruent sides and angles is called an irregular polygon.

Example **Name each polygon by its number of sides. Then classify it as *concave* or *convex* and *regular* or *irregular*.**

a. 

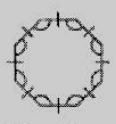
The polygon has 4 sides, so it is a quadrilateral. It is concave because part of $\overline{DE}$ or $\overline{EF}$ lies in the interior of the figure. Because it is concave, it cannot have all its angles congruent and so it is irregular.

b. 

The figure is not closed, so it is not a polygon.

c. 

The polygon has 5 sides, so it is a pentagon. It is convex. All sides are congruent and all angles are congruent, so it is a regular pentagon.

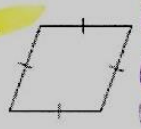
d. 

The figure has 8 congruent sides and 8 congruent angles. It is convex and is a regular octagon.

Exercises

Name each polygon by its number of sides. Then classify it as *concave* or *convex* and *regular* or *irregular*.

1.  hexagon convex regular

2.  quad. convex irregular (equilateral only)

3.  pentagon concave irregular

4.  triangle convex irregular

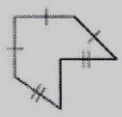
5.  pentagon concave irregular

6.  octagon concave irregular

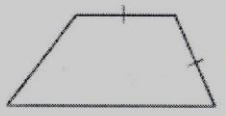
Objective #2: Find the perimeters and areas of polygons.

- The perimeter of a polygon is the sum of the lengths of the sides of the polygon.
- The area of a polygon is the number of square units needed to cover a surface.

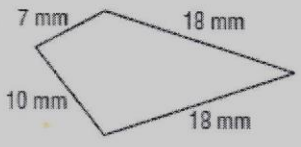
Name each polygon by its number of sides and then classify it as *convex* or *concave* and *regular* or *irregular*.

1.  hexagon concave irregular

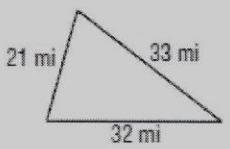
2.  nonagon convex regular

3.  quad. convex irregular

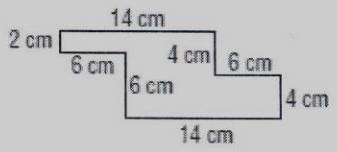
Find the perimeter of each figure.

4. 

53mm

5. 

86 mi

6. 

56 cm

COORDINATE GEOMETRY Find the perimeter of each polygon.

7. quadrilateral $OPQR$ with vertices $O(-3, 2)$, $P(1, 5)$, $Q(6, 4)$, and $R(5, -2)$

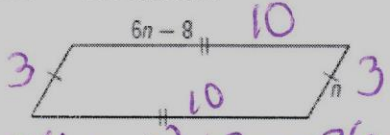
≈ 25.1

8. pentagon $STUVW$ with vertices $S(0, 0)$, $T(3, -2)$, $U(2, -5)$, $V(-2, -5)$, and $W(-3, -2)$

≈ 17.6

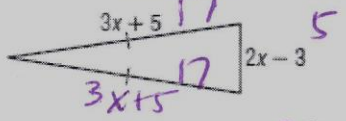
ALGEBRA Find the length of each side of the polygon for the given perimeter.

9. $P = 26$ inches



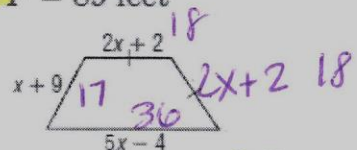
$2(6n-8)+2n=26$
$12n-16+2n=26$
$14n=42$
$n=3$

10. $P = 39$ centimeters



$8x+7=39$
$8x=32$
$x=4$

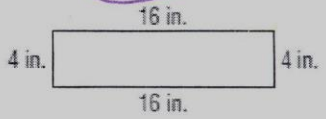
11. $P = 89$ feet



$10x+9=89$
$10x=80$
$x=8$

SEWING For Exercises 12–13, use the following information.

Jasmine plans to sew fringe around the scarf shown in the diagram.



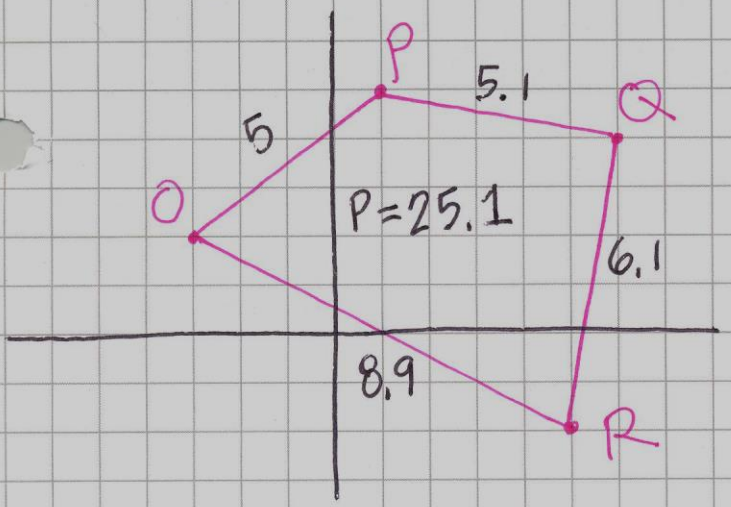
12. How many inches of fringe does she need to purchase?

$2 \cdot 4 + 2 \cdot 16 = 8 + 32 = 40$ in.

13. If Jasmine doubles the width of the scarf, how many inches of fringe will she need?

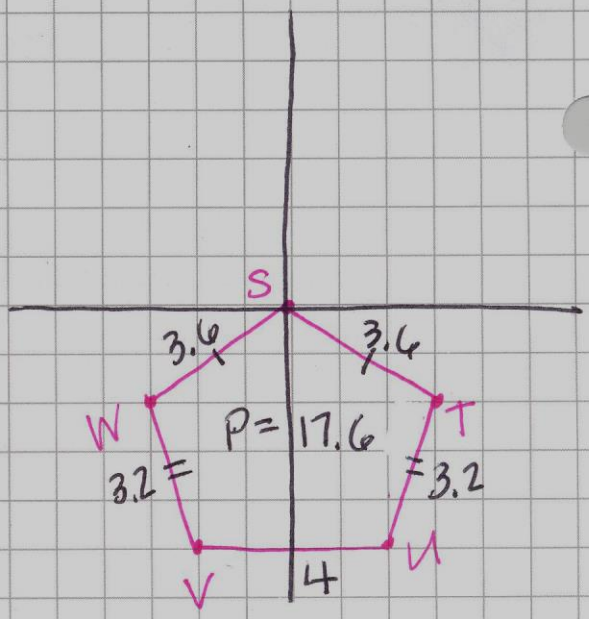
$2 \cdot 8 + 2 \cdot 16 = 16 + 32 = 48$ in.

7.



$OP = \sqrt{3^2+4^2} = \sqrt{25} = 5$
$PQ = \sqrt{5^2+1^2} = \sqrt{26} = 5.1$
$QR = \sqrt{1^2+6^2} = \sqrt{37} = 6.1$
$OR = \sqrt{8^2+4^2} = \sqrt{80} = 8.9$

8.



$SW = \sqrt{3^2+2^2} = \sqrt{13} = 3.6$
$ST = \sqrt{3^2+2^2} = \sqrt{13} = 3.6$
$TU = \sqrt{1^2+3^2} = \sqrt{10} = 3.2$