Name KEY Date ________ Period ________

Lesson 1.6. Notes Two-Dimensional Figures

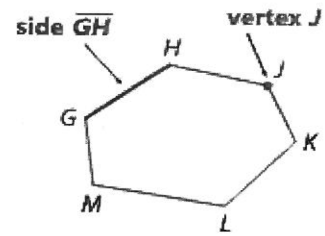
1 Identify Polygons Most of the closed figures shown in the mosaic are polygons. The term *polygon* is derived from a Greek word meaning *many angles*.

KeyConcept Polygons

A **polygon** is a closed figure formed by a finite number of coplanar segments called *sides* such that

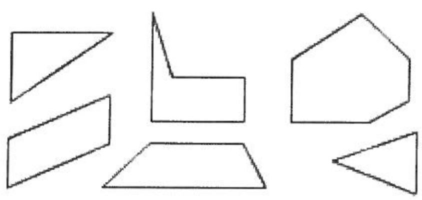
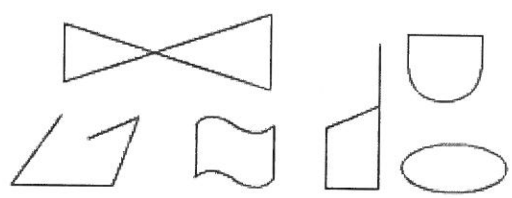
- the sides that have a common endpoint are noncollinear, and
- each side intersects exactly two other sides, but only at their endpoints.

The vertex of each angle is a **vertex of the polygon**. A polygon is named by the letters of its vertices, written in order of consecutive vertices.

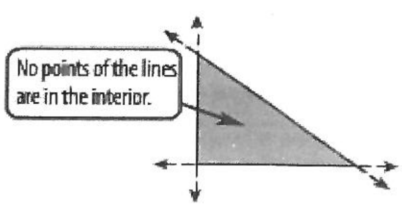


polygon *GHJKLM*

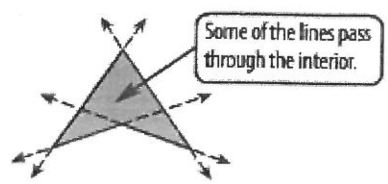
The table below shows some additional examples of polygons and some examples of figures that are not polygons.

Polygons	Not Polygons
	

Polygons can be **concave** or **convex**. Suppose the line containing each side is drawn. If any of the lines contain any point in the interior of the polygon, then it is concave. Otherwise it is convex.



convex polygon

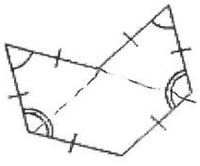


concave polygon

Name and Classify Polygons:

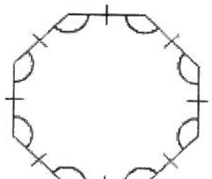
Name each polygon by its number of sides. Then classify it as *convex* or *concave* and *regular* or *irregular*.

a.



6-sides
hexagon
concave
irregular

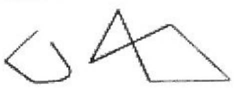
b.



8-sides – octagon
Convex
All sides congruent –
equilateral & equiangular
Regular
octagon

* Only convex polygons can be regular

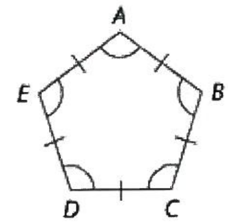
> **StudyTip**
>
> **Naming Polygons** The Greek prefixes used to name polygons are also used to denote number. For example a *bi*cycle has two wheels, and a *tri*pod has three legs.

> **ReadingMath**
>
> **Simple Closed Curves** Polygons and circles are examples of *simple closed curves*. Such a curve begins and ends at the same point without crossing itself. The figures below are *not* simple closed curves.
>
> 

In general, a polygon is classified by its number of sides. The table lists some common names for various categories of polygon. A polygon with n sides is an **n-gon**. For example, a polygon with 15 sides is a 15-gon.

An **equilateral polygon** is a polygon in which all sides are congruent. An **equiangular polygon** is a polygon in which all angles are congruent.

A convex polygon that is both equilateral and equiangular is called a **regular polygon**. An *irregular polygon* is a polygon that is *not* regular.

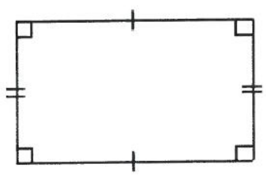


regular pentagon *ABCDE*

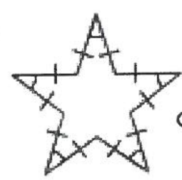
Number of Sides	Polygon
3	triangle
4	quadrilateral
5	pentagon
6	hexagon
7	heptagon
8	octagon
9	nonagon
10	decagon
11	hendecagon
12	dodecagon
n	n-gon

Name and Classify Polygons:

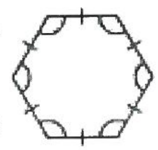
Name each polygon by its number of sides. Then classify it as *convex* or *concave* and *regular* or *irregular*.

1A. 

quadrilateral
convex
irregular

1B. 

decagon
concave
irregular

1C. 

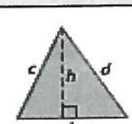
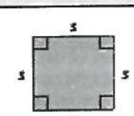
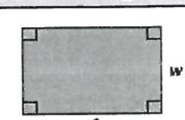
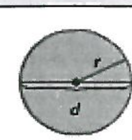
hexagon
convex
regular

2 Perimeter, Circumference, and Area

The **perimeter** of a polygon is the sum of the lengths of the sides of the polygon. Some shapes have special formulas for perimeter, but all are derived from the basic definition of perimeter. You will derive these formulas in Chapter 11. The **circumference** of a circle is the distance around the circle.

The **area** of a figure is the number of square units needed to cover a surface. Review the formulas for the perimeter and area of three common polygons and circle given below.

KeyConcept Perimeter, Circumference, and Area

Triangle	Square	Rectangle	Circle
			
$P = b + c + d$	$P = s + s + s + s$ $= 4s$	$P = \ell + w + \ell + w$ $= 2\ell + 2w$	$C = 2\pi r$ or $C = \pi d$
$A = \frac{1}{2}bh$	$A = s^2$	$A = \ell w$	$A = \pi r^2$

P = perimeter of polygon; b = base, h = height; A = area of figure; ℓ = length, w = width; C = circumference; r = radius, d = diameter

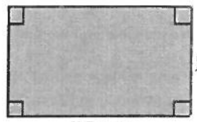
> **ReadingMath**
>
> **Pi** The symbol π is read *pi*. This is not a variable but an irrational number. The most accurate way to perform a calculation with π is to use a calculator. If no calculator is available, 3.14 is a good estimate for π.

Find Perimeter and Area:

> **StudyTip**
> Perimeter vs. Area Since calculating the area of a figure involves multiplying two dimensions (unit × unit), *square units* are used. There is only one dimension used when finding the perimeter (the distance around), thus, it is given simply in *units*.

Find the perimeter or circumference and area of each figure.

a.



$P = 2(l + w)$

$P = 2(2.1 + 3.2)$

$P = 10.6 cm$

$A = lw$

$A = (3.2)(2.1)$

$A \approx 6.72 cm^2$

b.

$P = 2\pi r$

$P = 2\pi \cdot 3$

$P \approx 18.85 in$

$A = \pi r^2$

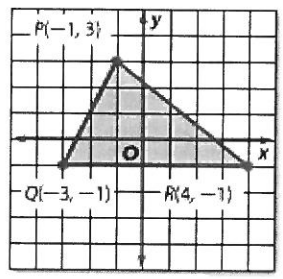
$A = \pi(3 in)^2 \approx 28.3 in^2$

Perimeter and Area on the Coordinate Plane:

COORDINATE GEOMETRY Find the perimeter and area of $\triangle PQR$ with vertices $P(-1, 3)$, $Q(-3, -1)$, and $R(4, -1)$.

Step 1 Find the perimeter of $\triangle PQR$.

Graph $\triangle PQR$.



To find the perimeter of $\triangle PQR$, first find the lengths of each side. Counting the squares on the grid, we find that $QR = 7$ units. Use the Distance Formula to find the lengths of $\overline{PQ}$ and $\overline{PR}$.

$\overline{PQ}$ has endpoints at $P(-1, 3)$ and $Q(-3, -1)$.

$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$	Distance Formula
$= \sqrt{[-1 - (-3)]^2 + [3 - (-1)]^2}$	Substitute.
$= \sqrt{2^2 + 4^2}$	Subtract.
$= \sqrt{20}$ or about 4.5	Simplify.

$\overline{PR}$ has endpoints at $P(-1, 3)$ and $R(4, -1)$.

$PR = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$	Distance Formula
$= \sqrt{(-1 - 4)^2 + [3 - (-1)]^2}$	Substitute.
$= \sqrt{(-5)^2 + 4^2}$	Subtract.
$= \sqrt{41}$ or about 6.4	Simplify.

The perimeter of $\triangle PQR$ is $7 + \sqrt{20} + \sqrt{41}$ or about 17.9 units.

Step 2 Find the area of $\triangle PQR$.

$A = \frac{1}{2}bh$	Area of a triangle
$= \frac{1}{2}(7)(4)$ or 14	Substitute and simplify.

The area of $\triangle PQR$ is 14 square units.

COMPLETE ALL PARTS AND KEEP IT IN YOUR BINDER! IF YOU LOOSE IT = 0 GRADE!!!