

# Chapter 7

## Geometric Relationships

### Intro

#### Part 1: Classifying Triangles

##### **Classifying Using Side Lengths**

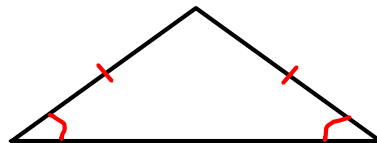
##### **Scalene Triangle**

- no equal sides or angles



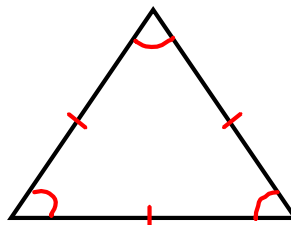
##### **Isosceles Triangle**

- 2 equal sides
- 2 equal angles



##### **Equilateral Triangle**

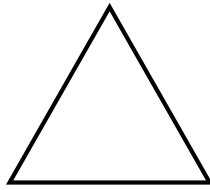
- 3 equal sides
- 3 equal angles



## Classifying Using Angle Measures

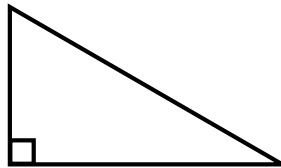
### Acute Triangle

- 3 acute angles  
(less than 90 degrees)



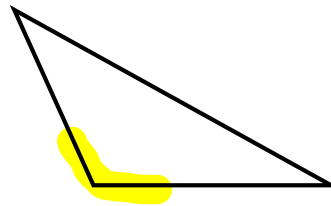
### Right Triangle

- one right angle  
(90 degrees)



### Obtuse Triangle

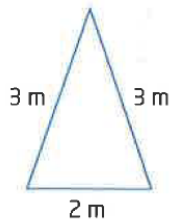
- one obtuse angle  
(between 90 and 180 degrees)



## Example 1

Classify Each Triangle Using its Side Lengths

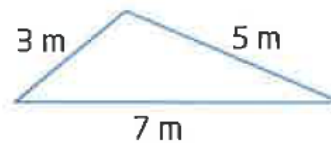
a)



Isosceles

2 equal sides

b)



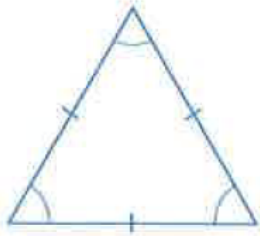
Scalene

No equal sides

## Example 2

Classify Each Triangle in Two ways Using its Angle Measures

a)



**Equilateral** (3 equal angles)

**Acute** (all angles  $< 90$ )

b)



**Isosceles** (2 equal angles)

**Obtuse** (1 angle  $> 90$ )

## Part 2: Classifying Polygons

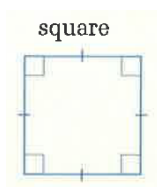
A **polygon** is a closed figure formed by three or more line segments.

A **regular polygon** has all sides equal and all angles equal.

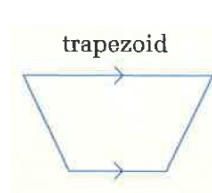
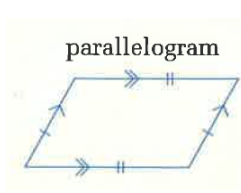
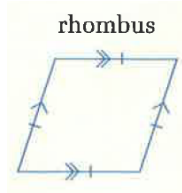
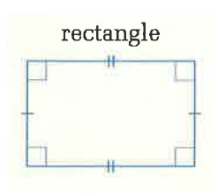
Number of Sides	Name
3	triangle
4	quadrilateral
5	pentagon
6	hexagon

Some **quadrilaterals** have special names.

A **regular** quadrilateral is a square.

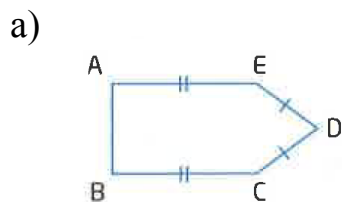


An **irregular** quadrilateral may be a *rectangle*, *rhombus*, *parallelogram*, or *trapezoid*

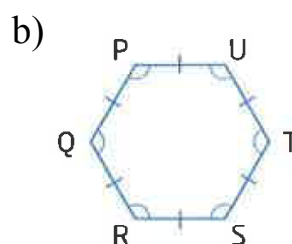


### Example 3

Classify each polygon according to its number of sides and whether it is regular or irregular.



Irregular Pentagon

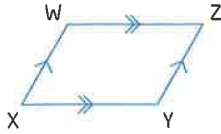


Regular Hexagon

## Example 4

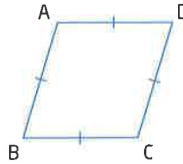
Classify each quadrilateral.

a)



**Parallelogram**

b)

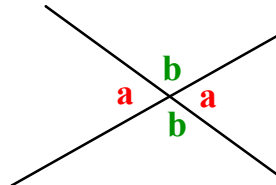


**Rhombus**

### Part 3: Angle Properties

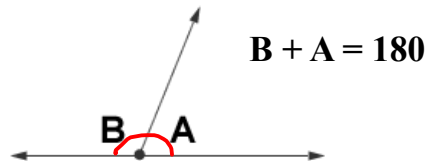
#### Opposite Angles:

- When 2 lines intersect, the opposite angles are equal.



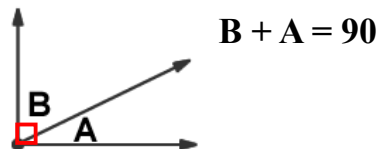
#### Supplementary Angles:

- angles that add to 180 degrees
- angles on a straight line are supplementary



#### Complementary Angles:

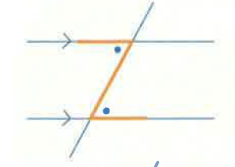
- angles that add to 90 degrees



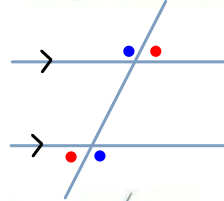
### Part 4: Parallel Line Theorems

When a transversal crosses parallel lines, many pairs of angles are related...

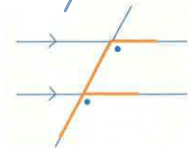
**Alternate Interior Angles** are equal  
- Z pattern



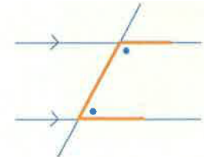
**Alternate Exterior Angles** are equal



**Corresponding Angles** are equal  
- F pattern

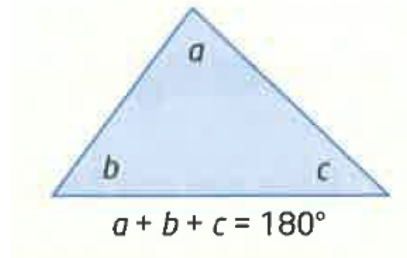


**Co-Interior Angles** add to 180  
- C pattern

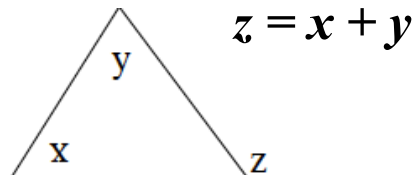


### Part 6: Triangle Theorems

The sum of the **interior angles** of a triangle is **180** degrees.

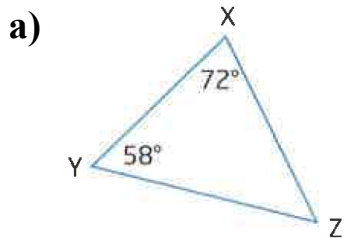


The **exterior angle** is equal to the sum of the 2 opposite interior angles.

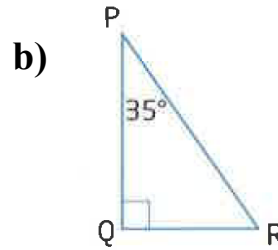


## Example 5

Find the measure of the third angle in each triangle...



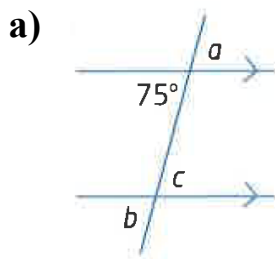
$$\begin{aligned}\angle Z &= 180 - 58 - 72 \\ &= 50^\circ\end{aligned}$$



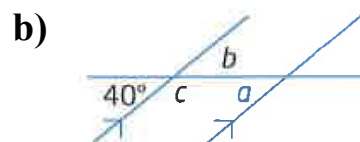
$$\begin{aligned}\angle R &= 180 - 90 - 35 \\ &= 55\end{aligned}$$

## Example 6

Find the measure of the angles  $a$ ,  $b$ , and  $c$ . Give reasons for your answers...



$$\begin{aligned}\angle a &= 75^\circ \text{ (opposite angle)} \\ \angle c &= 75^\circ \text{ (alternate interior)} \\ \angle b &= 75^\circ \text{ (corresponding angle)}\end{aligned}$$



$$\begin{aligned}\angle c &= 180 - 40 = 140^\circ \text{ (supplementary)} \\ \angle b &= 40^\circ \text{ (opposite angle)} \\ \angle a &= 180 - \angle c = 40^\circ \text{ (co-interior)}\end{aligned}$$