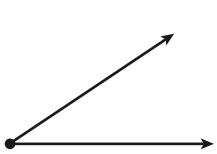
Classifying Geometric Figures

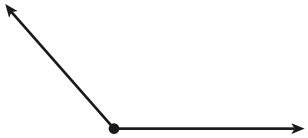
Angles are all around us. Your upper arm and forearm form an angle. Buildings and bridges contain many angles.

An angle consists of two rays with a common endpoint called a vertex. There are four basic classifications of angles. They are listed below. Angles are usually measured in degrees (°). A square symbol at the vertex of an angle indicates that the angle is a right angle.



Acute Angle
(less than 90°)

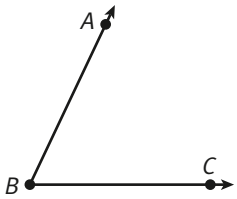
Right Angle
(exactly 90°)



Obtuse Angle
(greater than 90°,
but less than 180°)

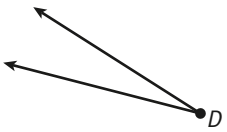
Straight Angle
(exactly 180°)

An angle can be named using just the vertex point or using 3 points: a point on one of the sides, followed by the vertex point, followed by a point on the other side. For example, the angle at the right can be named $\angle B$, $\angle ABC$, or $\angle CBA$. The symbol $\angle$ means angle.



EXAMPLE A

Classify $\angle D$.



Step 1: *Compare $\angle D$ to a right angle.*

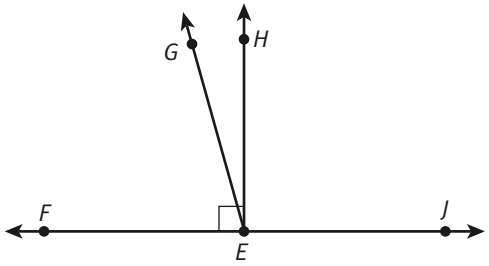
The measure of $\angle D$ is less than that of a right angle.

Solution: $\angle D$ is an acute angle.

Some pairs of angles can be classified as complementary or supplementary. If the sum of the measures of two angles is equal to 90°, the angles are ***complementary***. If the sum of the measures of two angles is equal to 180°, the angles are ***supplementary***.

EXAMPLE B

If $\angle GEH$ has a measure of 25°, what is the measure of $\angle FEG$?



Step 1: *Determine if $\angle GEH$ and $\angle FEG$ are either complementary or supplementary.*

Because $\angle FEH$ is a right angle, $\angle GEH$ and $\angle FEG$ are complementary. Their measures have a sum of 90°.

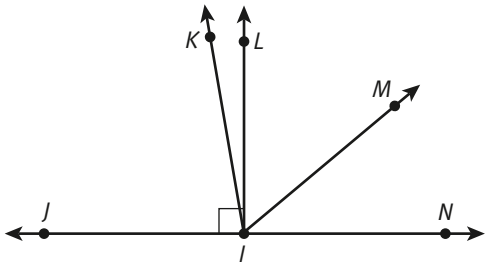
Step 2: *Subtract the measure of $\angle GEH$ from 90° to find the measure of $\angle FEG$.*

$90° - 25° = 65°$

Solution: The measure of $\angle FEG$ is 65°.

EXAMPLE C

If $\angle JIK$ has a measure of 75°, what is the measure of $\angle KIN$?



Step 1: *Determine if $\angle JIK$ and $\angle KIN$ are either complementary or supplementary.*

Because $\angle JIN$ is a straight angle, $\angle JIK$ and $\angle KIN$ are supplementary. Their measures have a sum of 180°.

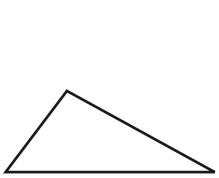
Step 2: *Subtract the measure of $\angle JIK$ from 180° to find the measure of $\angle KIN$.*

$180° - 75° = 105°$

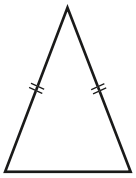
Solution: The measure of $\angle KIN$ is 105°.

Classifying Geometric Figures (continued)

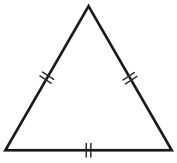
Triangles can be classified by the number of equal sides they have. A triangle can have 0 equal sides, 2 equal sides, or 3 equal sides.



Scalene Triangle
(0 equal sides)

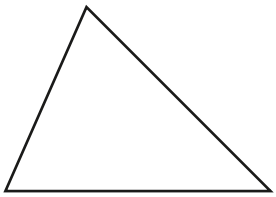


Isosceles Triangle
(at least 2 equal sides)

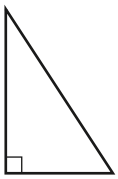


Equilateral Triangle
(3 equal sides)

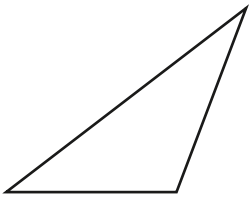
Triangles can also be classified by the greatest type of angle they contain.



Acute Triangle
(3 acute angles)



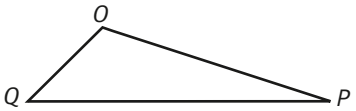
Right Triangle
(1 right angle)



Obtuse Triangle
(1 obtuse angle)

EXAMPLE D

Classify triangle *OPQ* by the number of equal sides and by the greatest type of angle it contains.



Step 1: *Identify the number of equal sides.*

None of the sides have equal lengths. The triangle is scalene.

Step 2: *Identify and classify the greatest angle.*

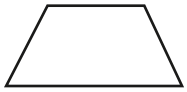
The triangle has 1 obtuse and 2 acute angles. The greatest angle is $\angle O$, which is obtuse. The triangle is an obtuse triangle.

Solution: Triangle *OPQ* is a scalene, obtuse triangle.

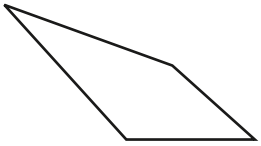
Classifying Geometric Figures (continued)

Quadrilaterals are classified by the number of pairs of parallel sides that they have. Parallel sides never meet and remain the same distance apart.

Parallelogram
(2 pairs of parallel sides)

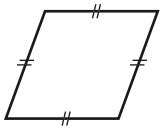


Trapezoid
(1 pair of parallel sides)



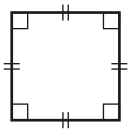
Neither a parallelogram nor a trapezoid
(0 pairs of parallel sides)

Parallelograms can further be classified by the number of equal sides and by the number of right angles that they have.



Rhombus
(4 equal sides)

Rectangle
(4 right angles)



Square
(4 equal sides and 4 right angles)

EXAMPLE E

Classify the quadrilateral at right.

Step 1: *Identify the number of parallel sides.*

There are two pairs of parallel sides. The quadrilateral is a parallelogram.

Step 2: *Count the number of right angles.*

The parallelogram does not have any right angles. It is not a rectangle or square.

Step 3: *Determine if the figure has 4 equal sides.*

The parallelogram does not have 4 equal sides. It is not a rhombus.

Solution: The quadrilateral is a parallelogram.

PRACTICE

Classify each angle by its measure.

1. 145°

2. 90°

3. 57°

Find the measure of each angle.

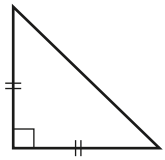
4. angle complementary to 36°

5. angle complementary to 64°

6. angle complementary to 19°

Classify each triangle or quadrilateral in as many ways as you can.

7.



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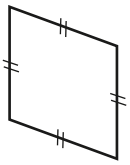

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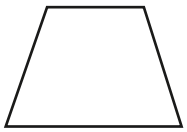

10. What is the least number of acute angles a triangle can have?

11. Can a triangle have a right angle and an obtuse angle? Explain your answer.

12. Kaya said that a rectangle can be a rhombus. Explain whether Kaya's statement is correct.

13. Andy said that a quadrilateral can have exactly 3 right angles. Explain whether Andy's statement is correct.