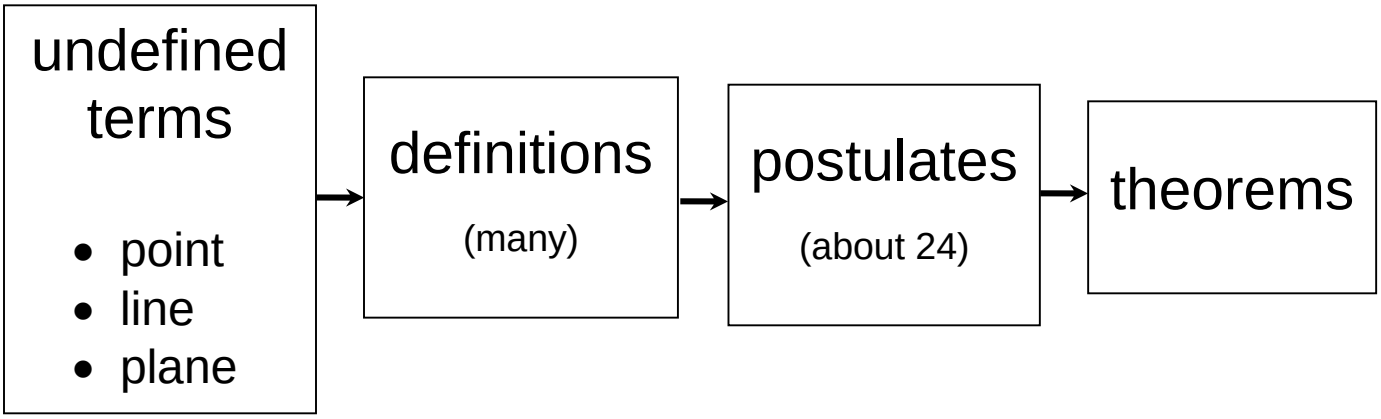
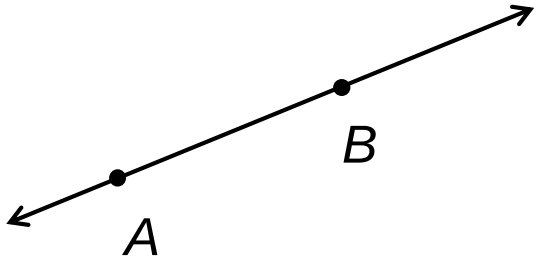
Geometry is the study of points, line, and planes and the figures they form.

Geometry has 3 undefined words: point, line, plane.



- A point shows an exact location in space.
- A line is a set of points that extends infinitely in both directions.
  (2 points determine a line)
- A plane is a flat surface that extends in all directions infinitely
  (3 points not on the same line determine a plane.)

Definitions:



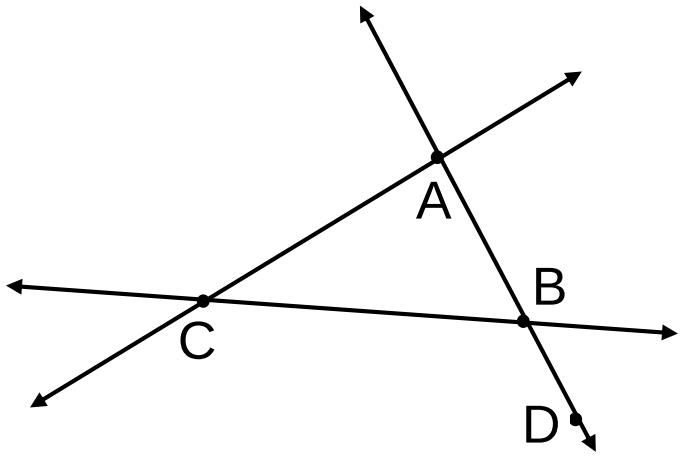
segment – a part of a line consisting of 2 endpoints and the points between them

notation: $\overline{AB}$

ray – a part of a line consisting of one endpoint and extending infinitely in one direction.

notation: $\overrightarrow{AB}$ is the ray having *A* as its endpoint.

$\overrightarrow{BA}$ is the ray having *B* as its endpoint.



Practice Problems:

1. Name a line through A.

$$\overleftrightarrow{AB}\ ,\ \overleftrightarrow{AC}\ ,\ \overleftrightarrow{AD}\ ,or\ \overleftrightarrow{BA}\ ,\ \overleftrightarrow{CA}\ ,\ \overleftrightarrow{DA}$$

2. Name a segment with endpoint B.

$$\overline{BC}\ ,\overline{BA}\ ,\overline{BD}\ \ or\ \overline{CB}\ ,\overline{AB}\ ,\overline{DB}$$

3. Name 2 rays with endpoint C.

$$\overrightarrow{CA}\ \ or\ \ \overrightarrow{CB}$$

4. Name the line that contains point D in 3 ways.

$$\overleftrightarrow{AD}\ ,\overleftrightarrow{AB}\ ,\overleftrightarrow{BD}\ or\ \overleftrightarrow{DA}\ ,\overleftrightarrow{BA}\ ,\overleftrightarrow{DB}$$

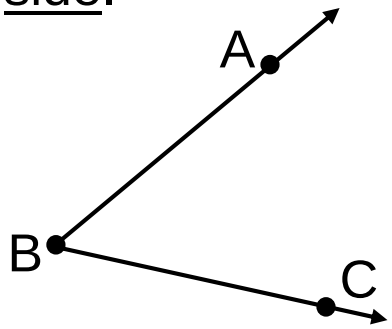
5. Name the plane.

ABC, CBD, etc. but <u>not</u> ABD

Definition:

angle – 2 rays with the same endpoint
The endpoint is called the vertex.
Each ray is called a side.

notation: $\angle ABC$



Measuring angles with Protractors:

protractor – instrument for measuring angles

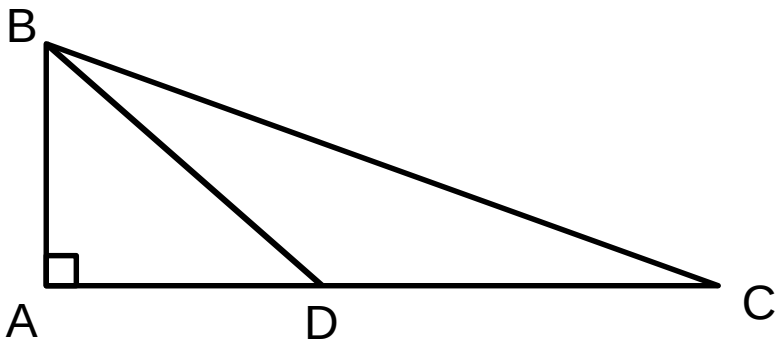
degree – unit of measure (equals 1/180 of a semicircle)

Instead of writing: "the measure of $\angle B = 30°$"
we write: "$m\angle B = 30°$"

Classifying Angles According to their Measure:

Angle name	Angle measure
acute angle	$0 < x < 90^o$
right angle	$x = 90^o$
obtuse angle	$90^o < x < 180^o$
straight angle	$x = 180^o$

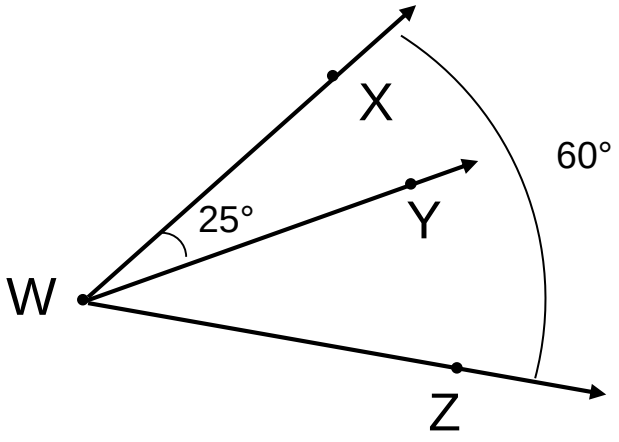
Practice Problems:



Answers

1. Name a right angle. $\angle A$
2. Name an obtuse angle. $\angle BDC$
3. Name an acute angle. $\angle ABD$, $\angle ABC$, $\angle BCD$, $\angle ADB$
4. Name a straight angle. $\angle ADC$

Sample Problem: Find m∠YWZ.

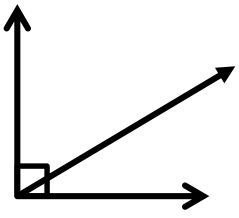


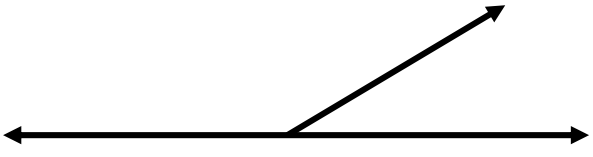
Solution: m∠YWZ = 60° - 25° = 35°

Definitions:

Two angles are complementary if the sum of their angle measures is 90º.

Two angles are supplementary if the sum of their angle measures is 180º.





Sample Problems: Let m∠A = 58º. Find the following measures:

1. The supplement of ∠A.

   answer: 122º

2. The complement of ∠A.

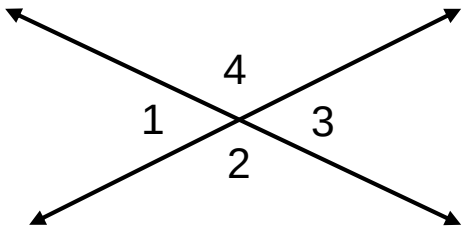
   answer: 32º

Definition:

Intersecting lines – lines that cross at one point

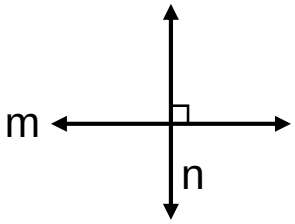
Adjacent angles – angles that share a common side and endpoint.

Vertical angles – angles formed by 2 intersecting lines, such as ∠1 and ∠3 or ∠2 and ∠4.



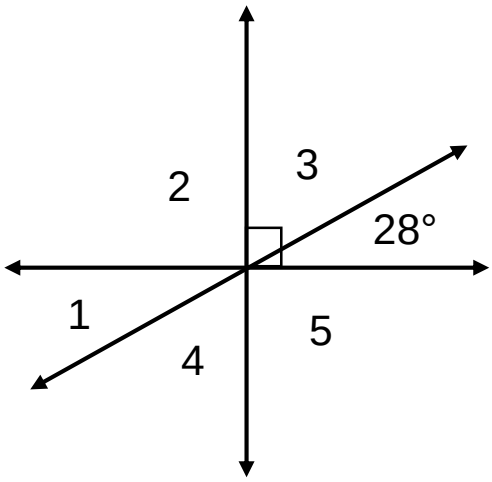
Definition:

<u>perpendicular lines</u> – lines that intersect to form right angles (symbol: ⊥**)**



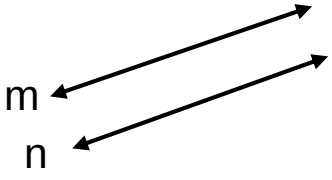
m ⊥ n

Sample Problems: Find the missing measures.



Definition:

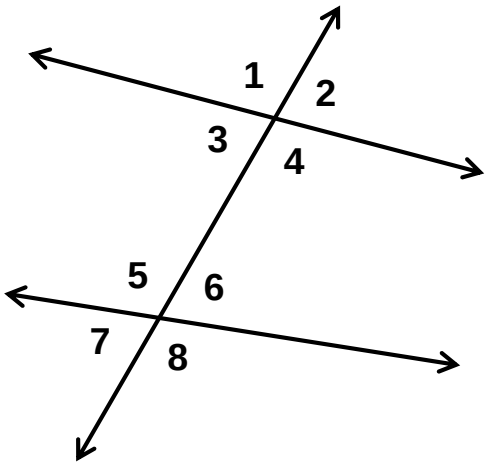
<u>Parallel lines</u> – lines in the same plane that never intersect. (symbol: ***//***)



m ***//*** n

A transversal is a line that intersects two or more lines.

Terms for angles formed when a transversal intersects 2 lines:



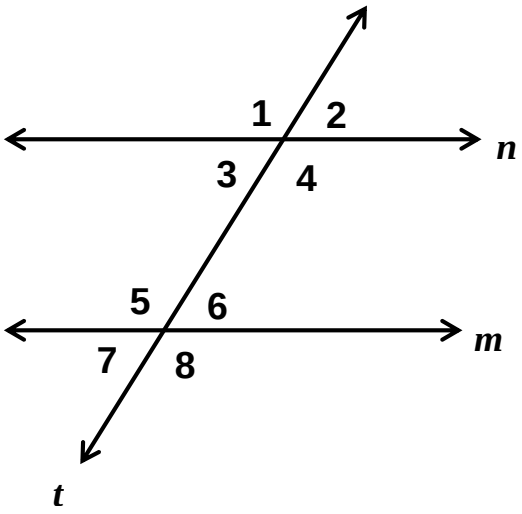
∠3 and ∠6 are alternate interior angles

∠1 and ∠8 are alternate exterior angles

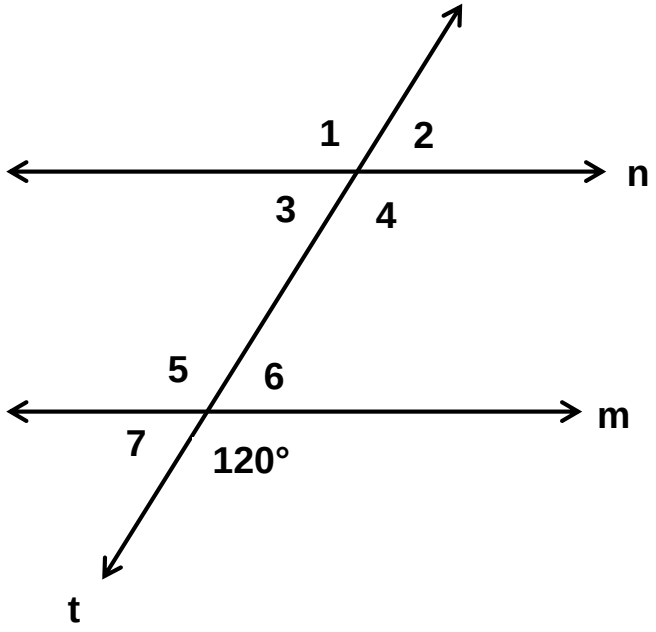
∠2 and ∠6 are corresponding angles

If the lines *n* and *m* are parallel,

- The alternate interior angles are equal.
- The alternate exterior angles are equal.
- The corresponding angles are equal.



Sample Problems: Find the missing measures if lines n and m are parallel.



Definitions

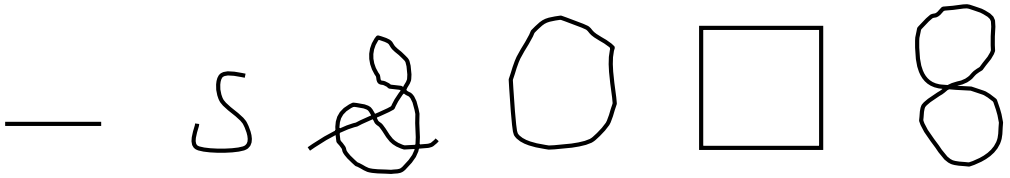
curve – a continuous set of points (can be "straight")

closed curve – begins and ends at the same point

simple curve – doesn't intersect itself (unless starting and ending points coincide)

simple closed curve – a simple curve that is also a closed curve

Examples of curves:



Simple curve | Simple curve | Curve | Simple closed curve | Simple closed curve | Closed curve

Polygons

Definitions:

polygon – a simple closed curve that consists only of segments

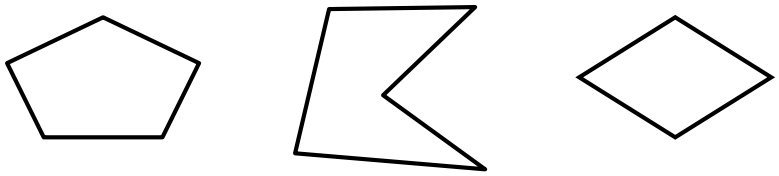
side of a polygon – one of the segments that defines the polygon

vertex – the endpoint of the side of a polygon

Types of Polygons:

convex set – every interior angle is less than 180°

concave set – at least one interior angle is greater than 180° (The "cave in.")



convex concave convex

Definition:

Regular polygon – all sides are the same length and all angles are the same measure.
(Use hash marks to show this.)

Polygon Classification

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

Triangles (polygon with 3 sides)

Classifying triangles by their angles:

An acute triangle has 3 acute angles.

A right triangle has a right angle.

An obtuse triangle has an obtuse angle.

Classifying triangles by the length of their sides:

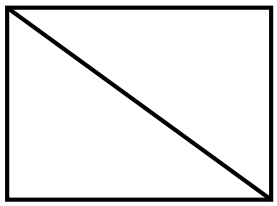
A scalene triangle has no congruent sides.

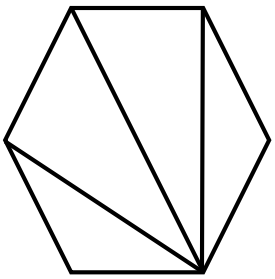
An isosceles triangle has at least 2 congruent sides.

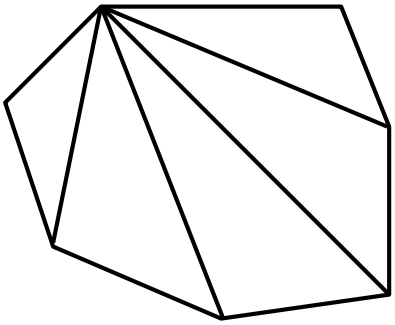
An equilateral triangle has 3 congruent sides.

Important Fact: The sum of the measures of a triangle is 180°.

To find the sum of the measures of any other polygon, we divide the polygon into triangles. Since each triangle equals 180°, multiply the number of triangles times 180° for the total measure of all angles.







4 sides = 2 Δ's 6 sides = 4 Δ's 7 sides = 5 Δ's

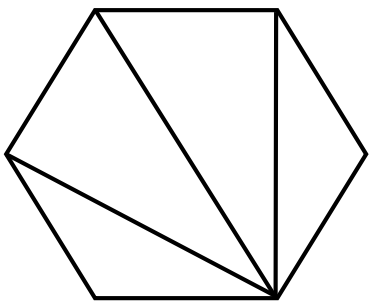
***In general, there are n-2 triangles formed if a figure has n sides.

***The total angle measure of a polygon of n sides is 180(n-2).

Interior Angle Measure:

If the polygon is regular, then to find the measure of each angle, take the total angle measure and divide it by the number of angles: $\frac{180(n-2)}{n}$

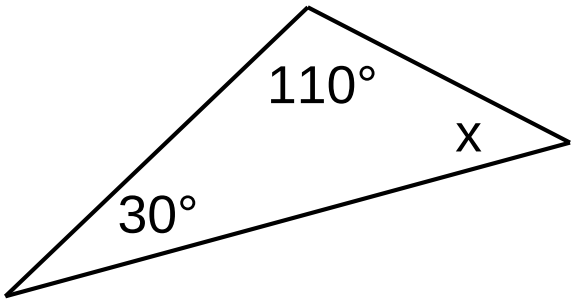
Example:

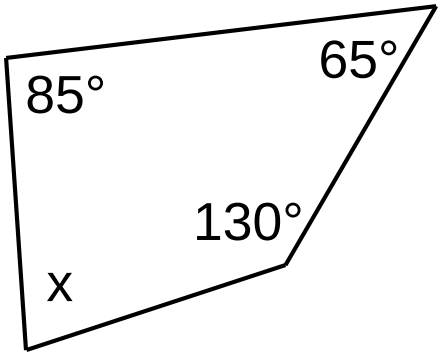


6 sides = 4 triangles
$4 \cdot 180 = 720$

$720° \div 6$ angles $= 120°$

Sample Problems: Find the missing measures.





x = 40°

x = 80°

<u>Quadrilaterals</u> (polygon with 4 sides)

Classifying quadrilaterals:

<u>trapezoid</u> – at least one pair of parallel sides

<u>parallelogram</u> –2 pairs of parallel sides

<u>rectangle</u> – a parallelogram with 4 right angles

<u>rhombus</u> – a parallelogram with 4 congruent sides

<u>square</u> – a rectangle with 4 congruent sides