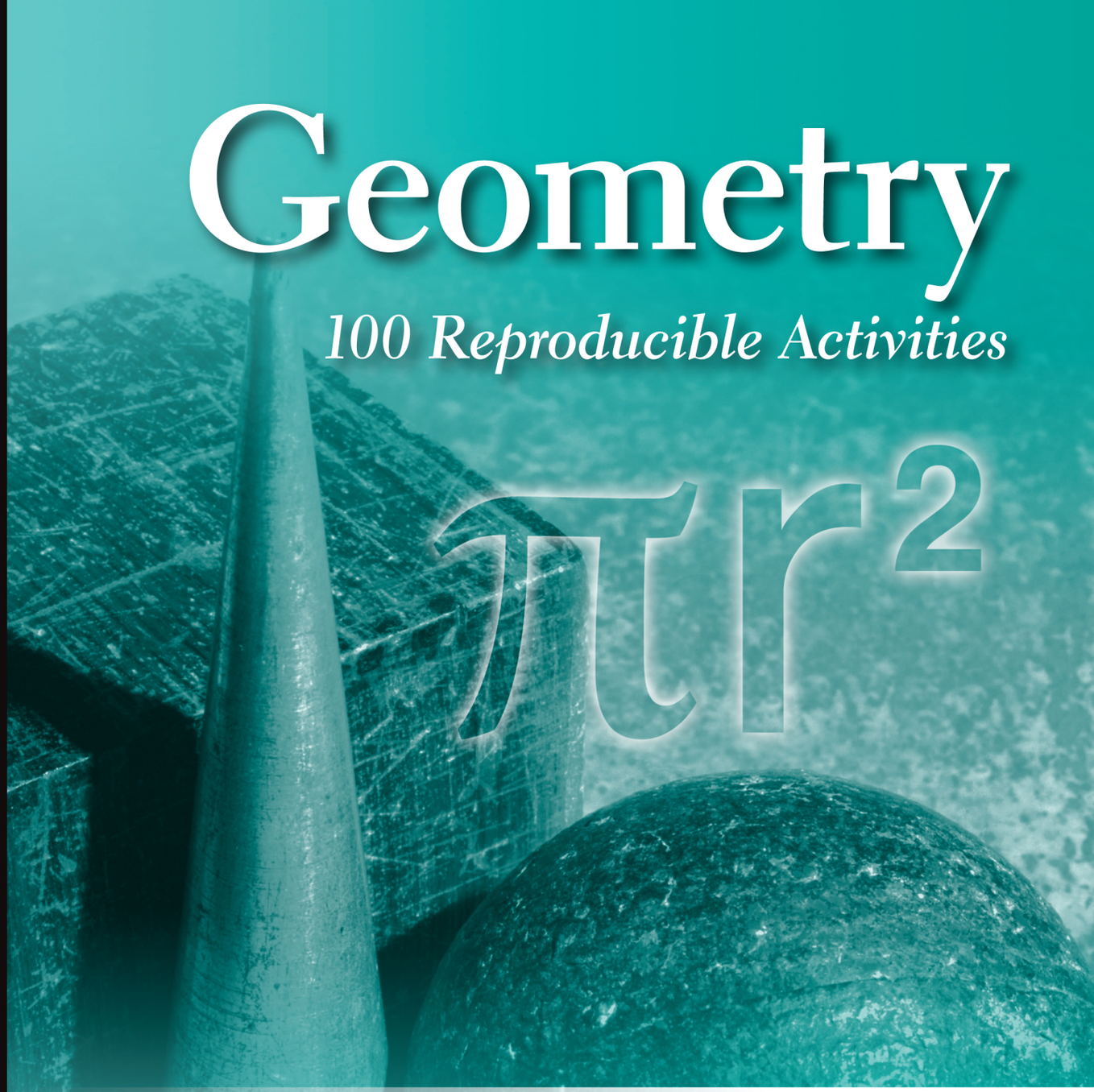
MATHSKILLS

Geometry

100 Reproducible Activities



Topics Include:

Circles and Spheres • Congruent Triangles and Transformations

Exploring Geometry: Points, Lines, and Angles in a Plane

Parallel Lines and Transversals • and more

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EDUCATIONAL PUBLISHING

Table of Contents

Points, Segments, Rays, Lines, and Planes 1
Measuring Segments 2
Using Formulas 3
Types of Angles. 4
Complementary and Supplementary Angles. 5
Pairs of Angles 6
Parallel Lines: Types of Angles 7
Parallel Lines: Angle Relationships. 8
Proving Lines Are Parallel 9
Classifying Triangles 10
Interior and Exterior Angles in Triangles 11
Corresponding Parts of Triangles. 12
Triangle Congruence: Side-Side-Side Congruence 13
Triangle Congruence: Side-Angle-Side Congruence 14
Triangle Congruence: Angle-Side-Angle Congruence 15
Triangle Congruence: Angle-Angle-Side Congruence 16
Choosing the Correct Congruence Postulate 17
Isosceles Triangle Theorem 18
Triangle Mid-segment 19
Hypotenuse-Leg Theorem. 20
Triangle Inequalities: Inequalities for Sides and Angles 21
Triangle Inequality Theorem 22
The Pythagorean Theorem 23
Converse of the Pythagorean Theorem 24
Special Right Triangles: 45°–45°–90° Right Triangles 25
Special Right Triangles: 30°–60°–90° Right Triangles 26
Trigonometric Ratios 27
Inverse of Trigonometric Ratios 28
Angles of Elevation and Depression. 29
Types of Polygons. 30
Sum of Polygon Angle Measures 31
Types of Quadrilaterals 32
Properties of Parallelograms 33
Properties of Trapezoids 34
Diagonals in Parallelograms 35
Exterior Angles of a Polygon. 36
Proportions. 37
Solving Proportions 38

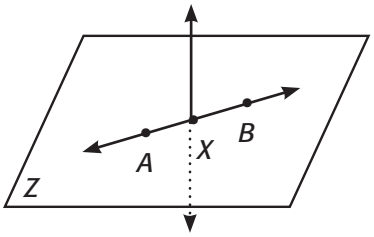
Similar Polygons 39
Triangle Similarity: Angle-Angle Similarity 40
Triangle Similarity: Side-Side-Side Similarity 41
Triangle Similarity: Side-Angle-Side Similarity 42
Finding Lengths in Similar Triangles 43
Proportions in Triangles: Side-Splitter Theorem 44
Triangle-Angle Bisector Theorem 45
Circles and Circumference 46
Exploring π 47
Arc Length 48
Inscribed Angles 49
Angle Measures in Circles 50
Finding Segment Lengths 51
Equation of a Circle 52
Perimeter 53
Perimeter and Similar Figures 54
Area of a Triangle 55
Area of a Parallelogram 56
Area of Similar Figures 57
Area of a Trapezoid 58
Area of a Rhombus or Kite 59
Area of a Circle 60
Area of a Sector of a Circle 61
Area of Regular Polygons 62
Area of an Irregular Shape 63
Comparing Area and Perimeter 64
Using Trigonometry to Find the Area of a Triangle 65
Geometric Probability 66
Types of Solids 67
Solids and Euler's Formula 68
Surface Area: Prisms 69
Surface Area: Cylinders 70
Surface Area: Pyramids 71
Surface Area: Cones 72
Surface Area of Similar Solids 73
Volume: Prisms 74
Volume: Cylinders 75
Volume: Pyramids 76

Volume: Cones 77
Volume of an Irregular Shape 78
Volume of Similar Solids 79
Surface Area: Spheres 80
Volume: Spheres 81
Surface Area and Volume Formulas 82
Plotting Points on a Coordinate Plane 83
Graphing a Linear Equation 84
Distance Formula 85
Midpoint Formula 86
Slope of a Line 87
Slope Intercept Form 88
Parallel Lines 89
Perpendicular Lines 90
Point-Slope Form I 91
Point-Slope Form II 92
Adding Vectors 93
Translations 94
Symmetry 95
Dilations 96
If-Then Statements 97
Inductive Reasoning 98
Deductive Reasoning: Law of Detachment 99
Deductive Reasoning: Law of Syllogism 100
Answer Key 101–108

Name _____ Date _____

Points, Segments, Rays, Lines, and Planes

In geometry, figures are created using points, lines, line segments, rays, and planes. Each item has a unique and specific definition, each a certain way to express it using symbols, and each a certain way the symbols are translated into words.



The figure to the right contains points, segments, lines and planes. Use the figure to complete the chart below.

Type of Figure	Symbol	Words	Drawing
Point	Point *A*	_____	_____
Line	_____	Line *AB*	A B
_____	$\overline{AB}$	_____	A B
Ray	_____	Ray *AB*	_____
_____	▱*Z*	Plane *Z*	_____

Each figure also has a specific definition. Identify each type of figure. Complete each definition using the chart and figures above.

Rules for Naming Basic Figures

Point: A point has _____ size; it is shown by a _____ and named by a capital _____.

Line: A line extends _____ on both sides with _____ thickness or width; a line is shown with an arrow at _____ ends.

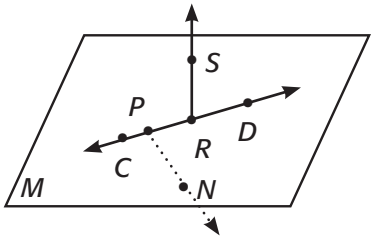
Segment: A part of a line with two points called _____; a segment shows the two points with _____ arrow at either end.

Ray: A ray is a part of a line that extends indefinitely in _____ direction; a ray has one _____.

Plane: A plane is a _____ surface that extends indefinitely in all directions and has _____ thickness.

Practice

Use the figure to the right to complete each statement.



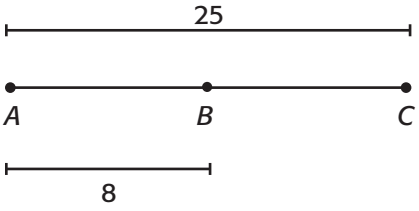
1. The plane shown in the figure is plane _____.
2. The symbol for line *CD* is _____.
3. A ray in the figure can be written using the symbol _____.
4. $\overline{PN}$ is a symbol for _____ *PN*.

Name _____ Date _____

Measuring Segments

Unlike a line, a segment has a beginning point and an ending point, known as **endpoints**. You can measure the distance between the endpoints to find the measure of the segment.

Complete each statement using the figure below.

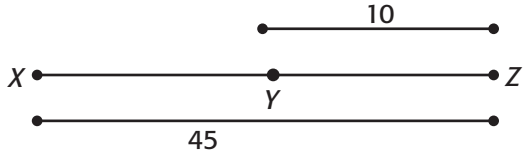


1. The measure of $\overline{AB}$ = _____.
2. The measure of _____ = 25.
3. The measure of $\overline{BC}$ is $\overline{AC}$ – _____ or 25 – _____ = _____.
4. So, $\overline{AB}$ + $\overline{BC}$ = _____.

Complete the rule for segment addition.

If _____ is between A and C, then $\overline{AB} + \overline{BC} = \overline{AC}$.
If $\overline{AB} + \overline{BC} = \overline{AC}$, then _____ is between A and C.

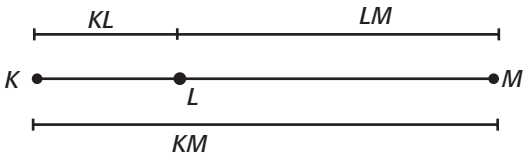
Practice



1. Find XY if Y is between X and Z, if $YZ = 10$ and $XZ = 45$.

Write an equation using what you know about segment addition.	$XY +$ _____ $= XZ$
Plug what you know into the equation.	$XY +$ _____ $= XZ$
	$XY +$ _____ $= 45$
Solve for the unknown segment length.	$XY +$ _____ – _____ $= 45 -$ _____
	$XY =$ _____

Given that *L* is between *K* and *M*, find the missing measure.



2. $KL = 10$, $LM = 17$, $KM =$ _____
3. $KL =$ _____, $LM = 32$, $KM = 47$.
4. $KL = 21$, $LM =$ _____, $KM = 68$
5. $KL = 2x + 1$, $LM = 4x$, $KM =$ _____

Name _____ Date _____

Using Formulas

In geometry you will use many formulas. There are formulas for finding the area, the volume or perimeter of a figure. A **formula** is a statement of a relationship between two or more quantities.

Rules for Using Formulas

1. Identify the formula to use. Determine what each variable stands for.
2. Match what you know and don't know from the problem to the variables in the formula.
3. Plug the numbers you know into the formula.
4. If necessary, use order of operations in reverse to undo operations and solve for the unknown variables.

Example

The formula for the area of a triangle is $A = \frac{1}{2}bh$. A triangle has an area of 36 cm^2 and a height of 12 cm. What is the length of the base?

Step 1	Identify the formula to use. Determine what each variable stands for.	Use the formula given, $A = \frac{1}{2}bh$. A = area, b = base length, h = height
Step 2	Match what you know and don't know from the problem to the variables in the formula.	You know the area and the height. You need to find the base length. $A = 36$ cm^2, $b = ?$, $h = 12$ cm
Step 3	Plug the numbers you know into the formula.	$36 = \frac{1}{2}(b)(12)$
Step 4	Solve.	$6 = b$

Practice

1. The formula for a trapezoid is $A = \frac{1}{2}h(b_1 + b_2)$. What is the area of a trapezoid with base lengths of 6 and 8 and a height of 10?

Identify the formula to use. Determine what each variable stands for.	The formula given is $A = \frac{1}{2}h(b_1 + b_2)$
Match what you know and don't know from the problem to the variables in the formula.	$A =$ _____, $b_1 =$ one base length $b_2 =$ _____, $h =$ _____ $A =$ _____, $b_1 =$ _____, $b_2 =$ _____, $h =$ _____
Plug the numbers you know into the formula.	$A = \frac{1}{2}$ _____ (_____ + _____)
Solve.	= _____ square units

2. The formula for the volume of a sphere is $V = \frac{4}{3}\pi r^3$. A sphere has a volume of 904 cubic units. What is the radius of the sphere? _____

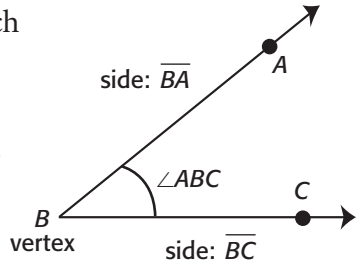
3. The area of a parallelogram is 120 in.^{2}. The base measurement is 6 inches.

What is the length of the height? Use the formula $A = bh$. _____

Name _____ Date _____

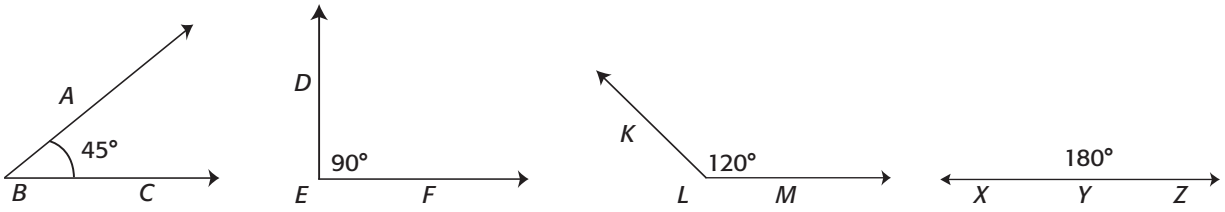
Types of Angles

An angle is made of two rays that have a common endpoint. Each ray forms a side of the angle. The common endpoint forms the vertex of the angle.



Angles are measured in degrees. An angle's measure is written as $m\angle B = 60^\circ$ or $m\angle ABC = 60^\circ$

Angles are classified by their measures. Four types of angles are shown below.



Complete the chart below.

Angle Type	Example	Measure
Acute	$\angle ABC$	_____
Right	_____	90°
_____	$\angle KLM$	120°
Straight	_____	180°

Complete the statements for the rules for classifying angles.

Rules for Classifying Angles

1. An acute angle is an angle whose measure is less than _____.

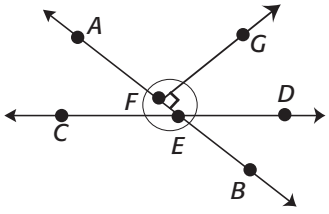
2. A _____ is an angle whose measure is equal to 90°.

3. An obtuse angle is an angle whose measure is _____ 90°.

4. A _____ is an angle whose measure is equal to 180°.

Practice

Refer to the figure to answer the following items.



1. $\angle AFG$ has a measure of 90°; $\angle AFG$ is a _____ angle.

2. $\angle AED$ appears to have a measure greater than 90°; $\angle AED$ is an _____ angle.

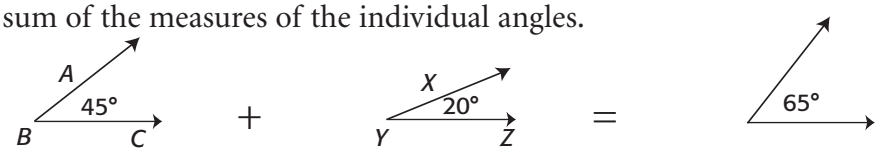
3. _____ measures 180° and is a straight angle.

4. $\angle DEB$ measures _____ 90°; $\angle DEB$ is an acute angle.

Name _____ Date _____

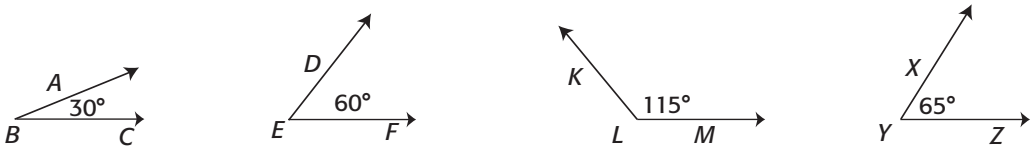
Complementary and Supplementary Angles

Like other measures, you can add angle measures. The result is an angle whose measure is the sum of the measures of the individual angles.



$45^\circ + 20^\circ = 65^\circ$

The figures below are two set of angles. Complete the chart below.



Type	Angle Pair	Measure of One Angle	Measure of the Other Angle	Sum of the Measure
Complementary	$\angle ABC$ and $\angle DEF$	_____ +	_____ =	_____
Supplementary	$\angle KLM$ and $\angle XYZ$	_____ +	_____ =	_____

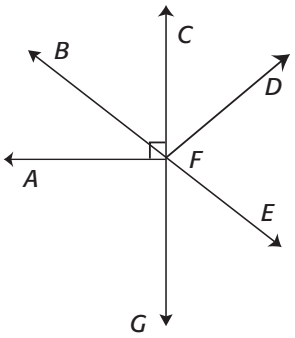
Complete the statement for the rules for complementary and supplementary angles.

Rules for Complementary and Supplementary Angles

1. Two angles are _____ angles if the sum of their measures equals 90°.
2. Two angles are supplementary angles if the sum of their measures equals _____.

Practice

Use the figure to the right to answer the items below.

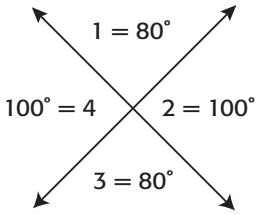


1. $\angle AFB$ is complementary to _____.
2. $m\angle CFE + m\angle EFG =$ _____
3. $\angle BFC = 35^\circ$; $\angle BFC$ and $\angle CFE$ are supplementary. What is the measure of $\angle CFE$? _____
4. $\angle BFC$ and _____ are complementary angles.

Name _____ Date _____

Pairs of Angles

As you know when two lines intersect four angles are created, as you can see in the figure on the right. Certain relationships exist among the angles formed by intersecting lines.



Complete the chart below.

Type	Measure of One Angle	Measure of the Other Angle
Vertical Angles	m∠1 = _____	m∠3 = _____
	m∠2 = _____	m∠4 = _____
Linear Pair	m∠1 = _____	m∠2 = _____
	m∠3 = _____	m∠4 = _____

Complete the statements below.

1. ∠1 and ∠3 are _____, _____ and _____ are also vertical angles.
2. ∠1 and ∠2 form a _____, _____ and _____ also form a linear pair.
3. The sum of the measures of ∠1 and ∠2 is _____; the sum of the measures of _____ and _____ is 180°.
4. Another term for a linear pair is _____ angles.

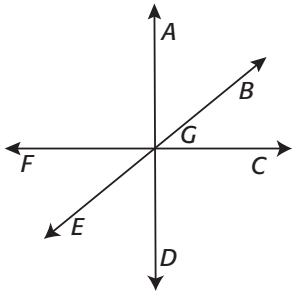
Complete the statements for rules for angle pairs.

Rules for angle pairs

1. When two lines intersect, _____ angles are created opposite one another.
2. Vertical angles have _____ measure; they are _____.
3. The sum of the measures of the angles in a linear pair is _____.

Practice

Use the figure to the right to complete the following statements.

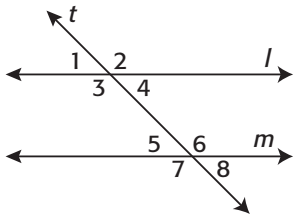


1. ∠*AGB* and _____ are vertical angles.
2. ∠*AGB* and ∠*BGD* are _____.
3. The measure of ∠*FGE* is 45°. The measure of ∠*EGC* is _____.
4. ∠*EGD* is supplementary to ∠_____.
5. An angle congruent to ∠*DGC* is _____.

Name _____ Date _____

Parallel Lines: Types of Angles

In the figure to the right, lines *l* and *m* are parallel lines. Line *t* intersects lines *l* and *m*, line *t* is known as a transversal.



A **transversal** is a line that intersects two or more lines at different points.

As you can see, when a transversal intersects two lines, eight angles are formed. These angles are given special names.

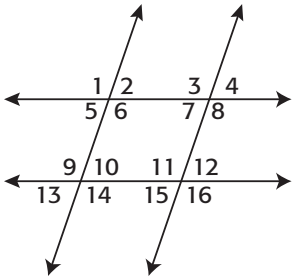
Complete the rules below by using the diagram above.

Rules for Angles Formed by Parallel Lines Intersected by a Transversal

1. Exterior angles are angles on the outside of the lines; angles 1, 2, _____, and _____ are exterior angles.
2. Interior angles are angles on the inside of the lines; angles 3, 4, _____, and _____ are interior angles.
3. Consecutive interior angles are angles that are inside the lines on the same side of the transversal; angles 3 and 5 and angles _____ and _____ are consecutive interior angles.
4. Alternate interior angles are angles that are inside the lines but on the opposite sides of the transversal; angles 3 and 6 and angles _____ and _____ are alternate interior angles.
5. Alternate exterior angles are angles that are outside the lines on opposite sides of the transversal; angles 1 and 8 and angles _____ and _____ are alternate exterior angles.
6. Corresponding angles occupy the same position on each line; angles 1 and 5 and angles 3 and 7 are corresponding angles, as are angles 2 and _____ and angles _____ and 8.

Practice

Classify each pair of angles using the figure to the right.



1. ∠7 and ∠12 _____
2. ∠1 and ∠13 _____
3. ∠11 and ∠14 _____
4. ∠4 and ∠5 _____

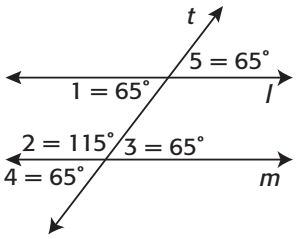
Identify the missing angle in each pair.

5. Corresponding angles: ∠3 and ∠_____ or ∠_____
6. Consecutive interior angles: ∠6 and ∠_____ or ∠_____
7. Interior angles: ∠10 and ∠_____ or ∠_____

Name _____ Date _____

Parallel Lines: Angle Relationships

In the figure to the right lines *l* and *m* are parallel lines. Line *t* intersects line *l* and *m*, line *t* is known as a transversal.



A **transversal** is a line that intersects two or more lines at different points.

As you can see, when a transversal intersects two lines, 8 angles are formed. These angles have special relationships.

Explore the angle relationships that exist when a transversal intersects two parallel lines.

Type	Measure of Angle	Measure of Other Angle
Corresponding angle	m∠1 = 65°	_____
Alternate interior angles	_____	m∠3 = 65°
_____	m∠1 = 65°	m∠2 = 115°
Alternate exterior angles	m∠5 = 65°	_____

Use the chart to complete the statements below.

Rules for the relationships among angles formed when a transversal intersects parallel lines

1. Corresponding angles are _____.

2. Alternate interior angles are _____.

3. _____ angles are supplementary.

4. Alternate exterior angles are _____.

Practice

Use the figure to the right.

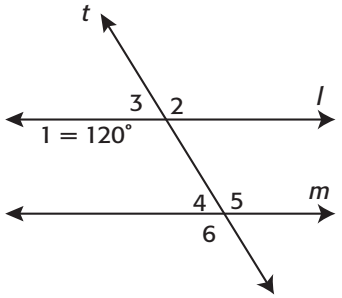
1. m∠4 = _____

2. m∠5 = _____

3. m∠3 = _____

4. m∠2 = _____

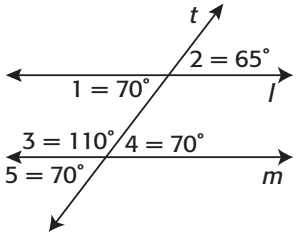
5. m∠6 = _____



Name _____ Date _____

Proving Lines Are Parallel

In the figure to the right, lines *l* and *m* are parallel lines. When a transversal intersects two lines, 8 angles are formed. These angles have special relationships. You can use these relationships to prove lines are parallel.



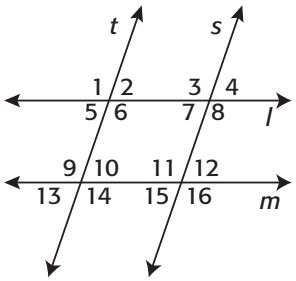
Use the figure above to help complete the following statements.

Rules for Proving Lines are Parallel

1. If two lines are intersected by a transversal and _____ angles, such as ∠1 and ∠5, are _____, then the lines are parallel.
2. If two lines are intersected by a transversal and _____ angles, such as ∠1 and ∠4, are _____, then the lines are parallel.
3. If two lines are intersected by a transversal and _____ angles, such as ∠2 and ∠5, are _____, then the lines are parallel.
4. If two lines are intersected by a transversal and _____ angles, such as ∠1 and ∠3, are _____, then the lines are parallel.

Example

State the rule that says why the lines are parallel, *m*∠5 ≅ ∠10



Step 1 State the relationship between ∠5 and ∠10.
The angles are alternate interior angles.

Step 2 State how the measures of each angle are related.
The angles are congruent.

Step 3 State why the lines *l* and *m* are parallel.
If two lines are intersected by a transversal and alternate interior angles are congruent, then the lines are parallel.

Practice

State the rule that says why the lines are parallel. Use the figure above.

1. m∠5 + m∠9 = 180°

   State the relationship between ∠5 and ∠9: The angles are _____ angles.

   State how the measure of each angle is related: The angles are _____.

   State why lines *l* and *m* are parallel: If two lines are intersected by a transversal and _____ angles are _____, the lines are parallel.

2. m∠4 ≅ m∠5 _____
3. m∠5 ≅ m∠7 _____
4. m∠8 ≅ m∠11 _____
5. m∠10 + m∠11 = 180° _____

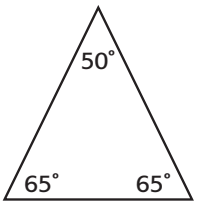
Name _____ Date _____

Classifying Triangles

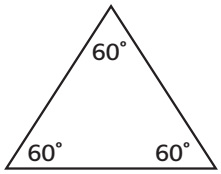
A triangle is a three-sided polygon. A polygon is a closed figure made up of segments, called sides, that intersect at the end points, called vertices.

Triangles are classified by their angles and their sides.

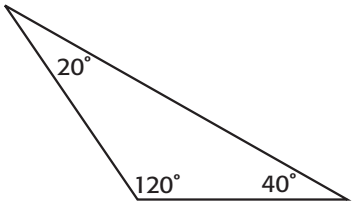
Classifying by angle:



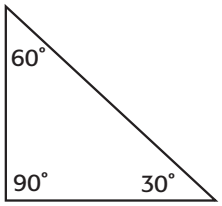
Acute



Equiangular

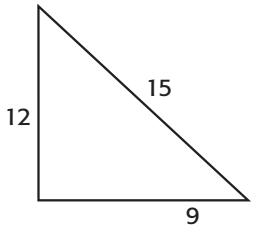


Obtuse

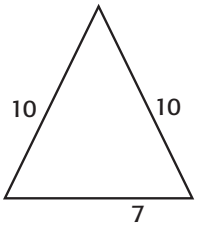


Right

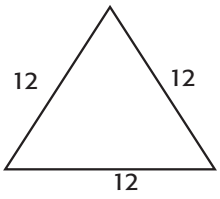
Classifying by side length:



Scalene



Isosceles



Equilateral

Use the figures above to complete the rules for classifying triangles.

Rules for classifying triangles by angle

1. An acute triangle has _____ acute angles.

2. An equiangular triangle has three _____ angles.

3. An obtuse triangle has one _____ angle.

4. A right triangle has one _____ angle.

Rules for classifying triangles by side length

1. A scalene triangle has _____ congruent sides.

2. An isosceles triangle has at least _____ congruent sides.

3. An equilateral triangle has _____ congruent sides.

Practice

Use the figure to the right.

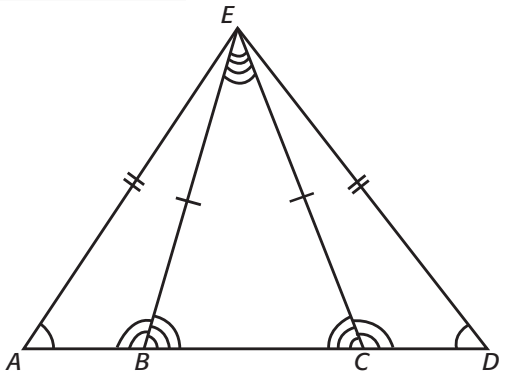
1. Name an equilateral triangle. _____

2. Name a scalene triangle. _____

3. Name an obtuse triangle. _____

4. Name an acute triangle. _____

5. Name an isosceles triangle. _____



Name _____ Date _____

Interior and Exterior Angles in Triangles

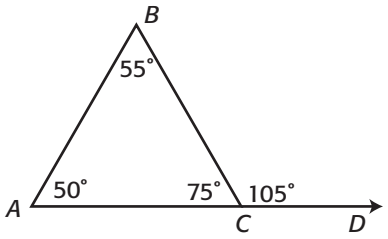
A triangle is a three-sided polygon. A triangle is made of segments, called sides, that intersect only at their endpoints, called vertices.

Sides: $\overline{AB}$, $\overline{BC}$, $\overline{CA}$

Vertices: *A*, *B*, *C*

Interior Angles: $\angle BAC$, $\angle ABC$, $\angle BCA$

Exterior Angle: $\angle BCD$



Complete each statement below.

1. The measure of $\angle BAC$ is _____, the measure of $\angle ABC$ is _____, and the measure of $\angle BCA$ is _____. If you add the measures of the interior angles, the sum is _____.
2. $\angle BCD$ is an exterior angle. The measure of $\angle BCD$ is _____. $\angle BAC$ and $\angle ABC$ are both known as remote interior angles. The measure of $\angle BAC$ is _____ and the measure of $\angle ABC$ is _____. If you add the measures of these remote interior angles, the sum is _____.
3. The measure of $\angle BCA$ is _____. The measure of $\angle BCD$ is _____. If you add the measure of $\angle BCA$ and $\angle BCD$, the sum is _____; the angles are _____.

Use the figure above to complete the rules for angle relationships in triangles.

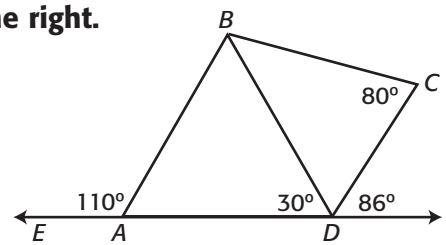
Rules for Angle Relationships in Triangles

1. The sum of the measures of the interior angles of a triangle is _____.
   $m\angle 1 + m\angle 2 + m\angle 3 =$ _____
2. The measure of an _____ angle of a triangle is _____ to the sum of the measures of the two remote interior angles.

Practice

Find the measures of the angles in the figure to the right.

1. m $\angle ABD$ = _____
2. m $\angle BAD$ = _____
3. m $\angle CDB$ = _____
4. m $\angle CBD$ = _____

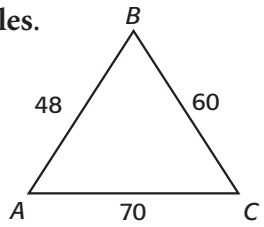


Name _____ Date _____

Corresponding Parts of Triangles

Triangles that are the same size and the same shape are **congruent triangles**.

As you know each triangle has six parts—three sides and three angles.

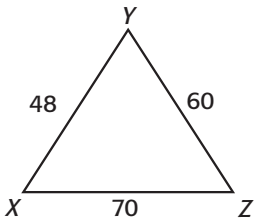


Use the figures to the right to identify corresponding parts.
Use the symbol "$\leftrightarrow$" to mean "corresponds to".

$\angle CAB \leftrightarrow \angle ZXY$ $\quad \overline{AC} \leftrightarrow \overline{XZ}$

$\angle ABC \leftrightarrow$ _____ $\quad \overline{AB} \leftrightarrow$ _____

_____ $\leftrightarrow \angle YZX$ $\quad$ _____ $\leftrightarrow \overline{YZ}$



Complete the chart below.

Angle	Corresponding Angle	Relationship
$\angle CAB = 70°$	$\angle ZXY = 70°$	$\angle CAB \cong \angle ZXY$
$\angle ABC = 57°$	_____	$\angle ABC \cong$ _____
_____	$\angle YZX = 53°$	_____ $\cong \angle YZX$

Side	Corresponding Side	Relationship
$\overline{AC}$	$\overline{XZ}$	$\overline{AC} \cong \overline{XZ}$
$\overline{AB}$	_____	$\overline{AB} \cong$ _____
$\overline{BC}$	$\overline{YZ}$	_____ $\cong \overline{YZ}$

Complete the statement below for the rules for corresponding parts of congruent triangles.

Rules for Corresponding Parts of Corresponding Triangles

Two triangles are congruent if and only if their _____ parts are _____.

Practice

Complete each statement. $\triangle DEF \cong \triangle RST$

1. $\overline{DE} =$ _____

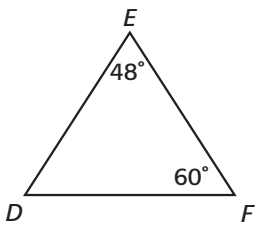
2. $\angle EDF \cong$ _____

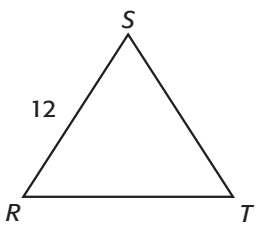
3. $m\angle RST =$ _____

4. $\overline{ST} \cong$ _____

5. $m\angle SRT =$ _____

6. $\overline{DF} =$ _____

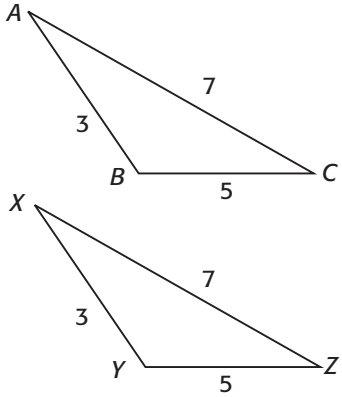




Name _____ Date _____

Triangle Congruence: Side-Side-Side Congruence

If two triangles have three pairs of congruent corresponding angles and three pairs of congruent corresponding sides, then the triangles are congruent. However, you do not need to know that all the sides and angles are congruent in order to conclude that the triangles are congruent. You only need to know certain corresponding parts are congruent. The two triangles to the right are congruent.



Complete the chart by identifying the corresponding sides and their measures.

Side	Measure	Corresponding Side	Measure	Relationship Between Sides
$\overline{AB}$	3	$\overline{XY}$	3	$\overline{AB} \cong \overline{XY}$
$\overline{BC}$	5	_____	_____	$\overline{BC} \cong$ _____
_____	_____	$\overline{XZ}$	7	_____ $\cong \overline{XZ}$

Complete the rule for triangle congruence.

Rule for Side-Side-Side (SSS) Postulate

If three sides of one triangle are _____ to _____ sides of another triangle then the two triangles are congruent.

Practice

For each figure, determine if there is enough information to prove the two triangles congruent.

1. The corresponding side to side AB: _____

Are the sides congruent? _____

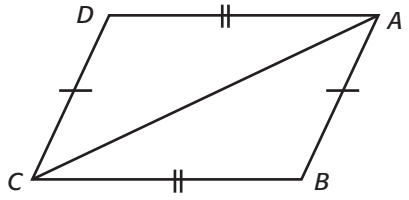
The corresponding side to side AD: _____

Are the sides congruent? _____

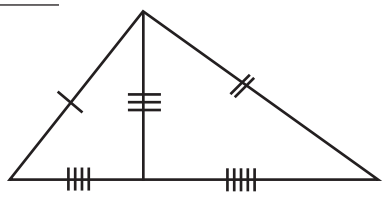
What do you notice about side AC? _____

Does $\overline{AC}$ in $\triangle ABC$ correspond to $\overline{AC}$ in $\triangle ACD$? _____

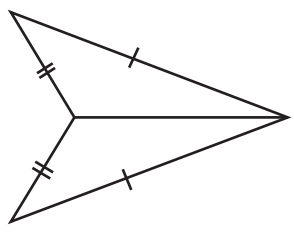
Can you use SSS postulate? _____



2. _____



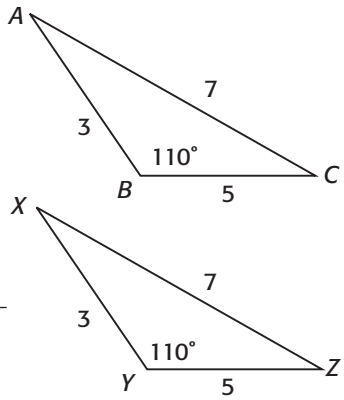
3. _____



Name _____ Date _____

Triangle Congruence: Side-Angle-Side Congruence

You do not need to know that all the sides and angles are congruent in order to conclude that triangles are congruent. You only need to know certain corresponding parts are congruent.



The two triangles to the right are congruent. Use them to answer the following.

1. Which sides in triangle ABC form $\angle B$? $\overline{AB}$ and _____
2. Which angle is formed from (included) $\overline{AB}$ and $\overline{AC}$? _____
3. Which two angles are made using side AB ? _____

The two triangles above are congruent. Complete the chart by identifying the corresponding sides and angles and their measures.

Side	Measure	Corresponding Side	Measure	Relationship Between Sides
$\overline{AB}$	3	_____	3	$\overline{AB} \cong \overline{XY}$
Angle	**Measure**	**Corresponding Angle**	**Measure**	**Relationship Between Angles**
_____	110°	$\angle Y$	110°	_____ $\cong \angle Y$
Side	**Measure**	**Corresponding Side**	**Measure**	**Relationship Between Sides**
_____	5	_____	_____	$\overline{BC} \cong$ _____

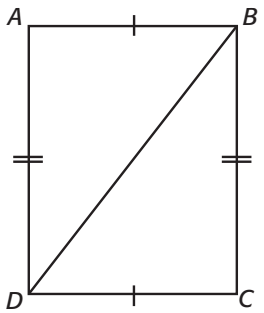
Complete the rule for triangle congruence.

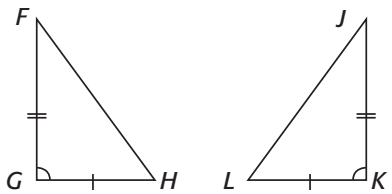
Rule for Side-Angle-Side (SAS) Postulate.

If the two sides and the included angle of one triangle are _____ to two _____ and the _____ angles, then the triangles are congruent.

Practice

Name the included angle between each pair of sides.



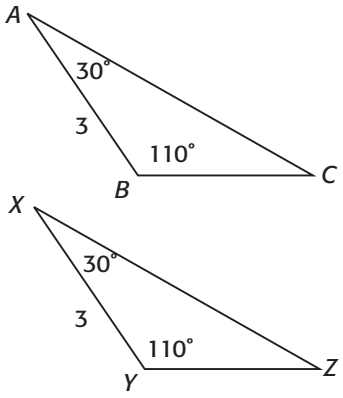
1. $\overline{AD}$ and $\overline{AB}$ _____
2. $\overline{BD}$ and $\overline{BC}$ _____
3. $\overline{BC}$ and $\overline{DC}$ _____
4. 

_____, _____

Name _____ Date _____

Triangle Congruence: Angle-Side-Angle Congruence

You do not need to know that all the sides and angles are congruent in order to conclude that triangles are congruent. You only need to know certain corresponding parts are congruent.



The two triangles to the right are congruent. Use them to answer the following questions.

1. Which side is included by $\angle A$ and $\angle C$? _____
2. Which side is included by $\angle B$ and $\angle C$? _____
3. Which side is included by $\angle A$ and $\angle B$? _____

The two triangles above are congruent. Complete the chart by identifying corresponding sides and angles and their measures.

Angle	Measure	Corresponding Angle	Measure	Relationship Between Angles
$\angle B$	110°	$\angle Y$	110°	$\angle B \cong \angle Y$
Side	**Measure**	**Corresponding Side**	**Measure**	**Relationship Between Sides**
$\overline{AB}$	3	_____	_____	$\overline{AB} \cong$ _____
Angle	**Measure**	**Corresponding Angle**	**Measure**	**Relationship Between Angles**
_____	_____	$\angle X$	30°	_____ $\cong \angle X$

Complete the rule for triangle congruence.

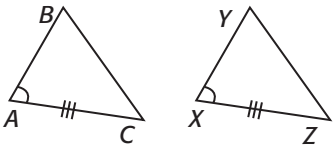
Rule for Angle-Side-Angle (ASA) Postulate.

If the two angles and the included side of one triangle are _____ to two _____ and the _____ side of another triangle, then the two triangles are congruent.

Practice

State the missing congruence that must be given to use the ASA Postulate to prove the triangles are congruent.

1. Which pair of corresponding angles are given? _____

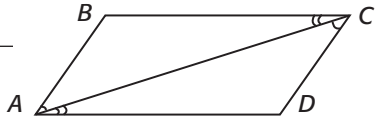
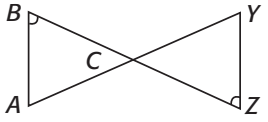


Which set of corresponding sides are given? _____

Which angles are adjacent to $\overline{AC}$? _____

If $\triangle ABC$ and $\triangle XYZ$ are congruent by ASA, which is the other angle in $\triangle ABC$? _____

2. _____



3. _____