I. Course Proficiency Purpose:

The purpose of this study guide is to aid the students who wish to take the proficiency assessment for the credit flex option. Items that the student will be required to know for proficiency will be administered in two portions. The first part of the assessment is a two hour written exam. The second part is a two hour hands-on lab.

II. Description of the Assessment Format:

a. The Written Assessment consists of
    i. 80 multiple choice questions – 1 point each
    ii. Three extended response questions – total of 40 points
b. The 2 Hour Hands-on lab is worth 50 points. The lab will be a hands-on exercise using an accumulation of geometric concepts including, but not limited to, surface area and volume. It will have teacher check points during the time given.

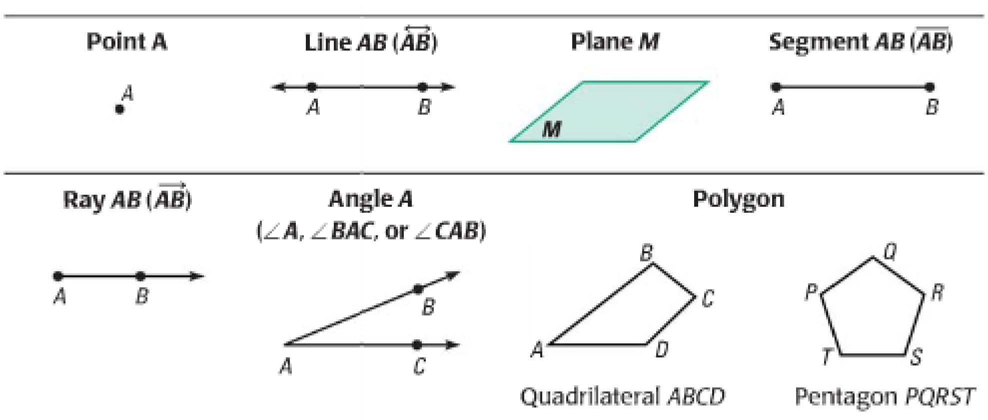
III. Proficiency Content:

The student will demonstrate both applied and conceptual knowledge of:

- All terms listed on page 60 in textbook.
- Describing Geometric Figures

Learn to identify and classify geometric figures

Examples



- Measuring Geometric Figures

Measuring segments in the coordinate plane

Formulas

Distance Formula

Distance between $A(x_1, y_1)$ and $B(x_2, y_2)$:

$$AB = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

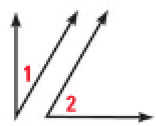
Midpoint Formula

Coordinates of midpoint M of $\overline{AB}$, with endpoints $A(x_1, y_1)$ and $B(x_2, y_2)$:

$$M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

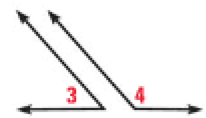
Classify angles and find their measures

Examples



Complementary angles

$m\angle 1 + m\angle 2 = 90°$

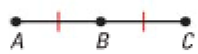


Supplementary angles

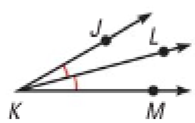
$m\angle 3 + m\angle 4 = 180°$

- Understanding Equality and Congruence

Examples



$\overline{AB} \cong \overline{BC}$ and $AB = BC$



$\angle JKL \cong \angle LKM$ and $m\angle JKL = m\angle LKM$

The student will demonstrate both applied and conceptual knowledge of:

- All terms listed on page 134 in textbook.
- Using Inductive and Deductive reasoning
- Understanding Geometric Relationships in Diagrams

Examples

The following can be assumed from the diagram:

A, B, and C are coplanar.

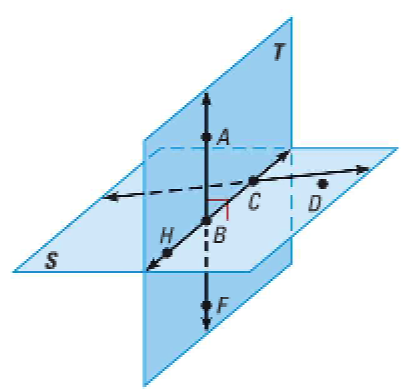
$\angle ABH$ and $\angle HBF$ are a linear pair.

Plane T and plane S intersect in $\overleftrightarrow{BC}$.

$\overleftrightarrow{CD}$ lies in plane S.

$\angle ABC$ and $\angle HBF$ are vertical angles.

$\overleftrightarrow{AB} \perp$ plane S.



- Writing proofs of Geometric Relationships

Example

Writing Proofs of Geometric Relationships

You can write a logical argument to show a geometric relationship is true. In a two-column proof, you use deductive reasoning to work from GIVEN information to reach a conjecture you want to PROVE.

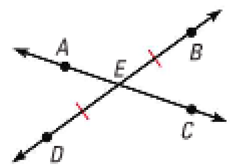


Diagram of geometric relationship with given information labeled to help you write the proof

GIVEN ▶ The hypothesis of an if-then statement

PROVE ▶ The conclusion of an if-then statement

STATEMENTS	REASONS
1. Hypothesis	1. Given
______________	______________
n. Conclusion	*n.* ______________

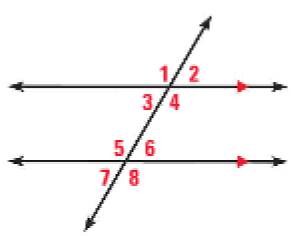
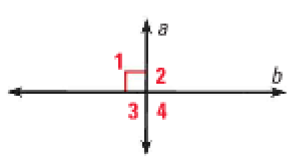
Statements based on facts that you know or conclusions from deductive reasoning

Use postulates, proven theorems, definitions, and properties of numbers and congruence as reasons.

<u>The student will demonstrate both applied and conceptual knowledge of:</u>

- All terms listed on page 202 in textbook.
- Using Properties of Parallel and Perpendicular Lines

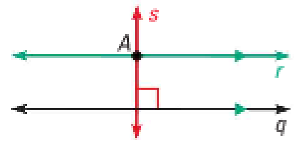
  When parallel lines are cut by a transversal, angle pairs are formed. Perpendicular lines form congruent right angles.

	∠2 and ∠6 are corresponding angles, and they are congruent. ∠3 and ∠6 are alternate interior angles, and they are congruent. ∠1 and ∠8 are alternate exterior angles, and they are congruent. ∠3 and ∠5 are consecutive interior angles, and they are supplementary.
	If $a \perp b$, then ∠1, ∠2, ∠3, and ∠4 are all right angles.

- Proving Relationships using Angle Measures

You can use the angle pairs formed by lines and a transversal to show that the lines are parallel. Also, if lines intersect to form a right angle, you know that the lines are perpendicular.

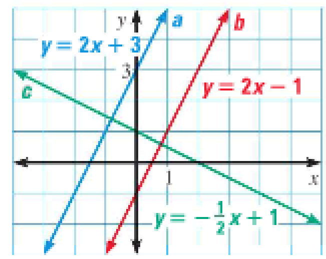
Through point A not on line q, there is only one line r parallel to q and one line s perpendicular to q.



- Making Connections to Lines in Algebra

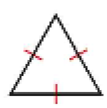
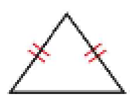
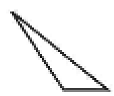
In Algebra 1, you studied slope as a rate of change and linear equations as a way of modeling situations.

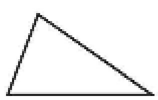
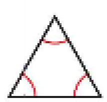
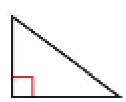
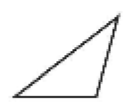
Slope and equations of lines are also a useful way to represent the lines and segments that you study in Geometry. For example, the slopes of parallel lines are the same ($a \parallel b$), and the product of the slopes of perpendicular lines is -1 ($a \perp c$, and $b \perp c$).



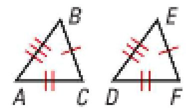
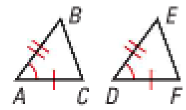
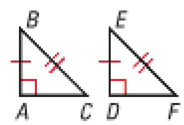
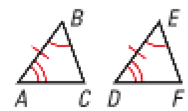
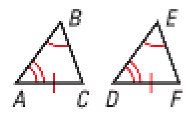
<u>The student will demonstrate both applied and conceptual knowledge of:</u>

- All terms listed on page 282 in textbook.
- Classifying Triangles by Sides and Angles

	Equilateral	Isosceles	Scalene
Sides			
	3 congruent sides	2 or 3 congruent sides	No congruent sides

	Acute	Equiangular	Right	Obtuse
Angles				
	3 angles < 90°	3 angles = 60°	1 angle = 90°	1 angle > 90°

- Proving that Triangles are Congruent

SSS	All three sides are congruent.	$\triangle ABC \cong \triangle DEF$	
SAS	Two sides and the included angle are congruent.	$\triangle ABC \cong \triangle DEF$	
HL	The hypotenuse and one of the legs are congruent. (Right triangles only)	$\triangle ABC \cong \triangle DEF$	
ASA	Two angles and the included side are congruent.	$\triangle ABC \cong \triangle DEF$	
AAS	Two angles and a (non-included) side are congruent.	$\triangle ABC \cong \triangle DEF$	

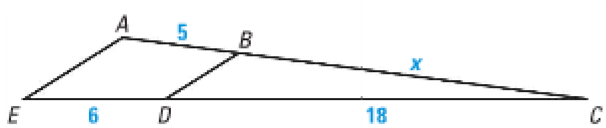
- Using Coordinate Geometry to Investigate Triangle Relationships

  You can use the Distance and Midpoint Formulas to apply postulates and theorems to triangles in the coordinate plane.

<u>The student will demonstrate both applied and conceptual knowledge of:</u>

- All terms listed on page 418 in textbook.
- Using Ratios and Proportions to Solve Geometry Problems

  You can use properties of proportions to solve a variety of algebraic and geometric problems.

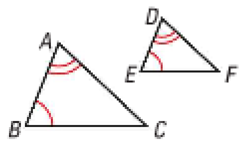


For example, in the diagram above, suppose you know that $\frac{AB}{BC} = \frac{ED}{DC}$. Then you can write any of the following relationships.

$\frac{5}{x} = \frac{6}{18}$ $\quad$ $5 \cdot 18 = 6x$ $\quad$ $\frac{x}{5} = \frac{18}{6}$ $\quad$ $\frac{5}{6} = \frac{x}{18}$ $\quad$ $\frac{5+x}{x} = \frac{6+18}{18}$

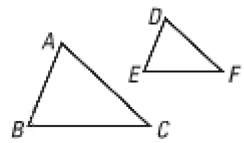
- Showing that Triangles are Similar

AA Similarity Postulate



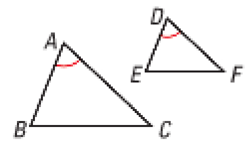
If $\angle A \cong \angle D$ and $\angle B \cong \angle E$, then $\triangle ABC \sim \triangle DEF$.

SSS Similarity Theorem



If $\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$, then $\triangle ABC \sim \triangle DEF$.

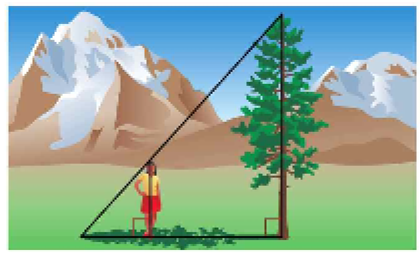
SAS Similarity Theorem



If $\angle A \cong \angle D$ and $\frac{AB}{DE} = \frac{AC}{DF}$, then $\triangle ABC \sim \triangle DEF$.

- Using Indirect Measurement and Similarity

You can use triangle similarity theorems to apply indirect measurement in order to find lengths that would be inconvenient or impossible to measure directly.



Consider the diagram shown. Because the two triangles formed by the person and the tree are similar by the AA Similarity Postulate, you can write the following proportion to find the height of the tree.

$$\frac{\text{height of person}}{\text{length of person's shadow}} = \frac{\text{height of tree}}{\text{length of tree's shadow}}$$

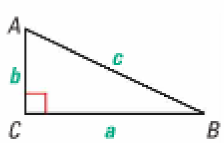
You also learned about dilations, a type of similarity transformation. In a dilation, a figure is either enlarged or reduced in size.

<u>The student will demonstrate both applied and conceptual knowledge of:</u>

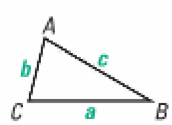
- All terms listed on page 494 in textbook.
- Use the Pythagorean Theorem and Its Converse

The Pythagorean Theorem states that in a right triangle the square of the length of the hypotenuse c is equal to the sum of the squares of the lengths of the legs a and b, so that $c^2 = a^2 + b^2$.

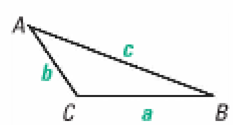
The Converse of the Pythagorean Theorem can be used to determine if a triangle is a right triangle.



If $c^2 = a^2 + b^2$, then $m\angle C = 90°$ and $\triangle ABC$ is a right triangle.



If $c^2 < a^2 + b^2$, then $m\angle C < 90°$ and $\triangle ABC$ is an acute triangle.

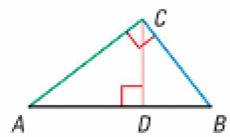


If $c^2 > a^2 + b^2$, then $m\angle C > 90°$ and $\triangle ABC$ is an obtuse triangle.

- Using Special Relationships in Right Triangles

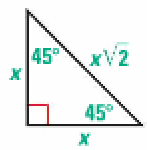
GEOMETRIC MEAN In right $\triangle ABC$, altitude $\overline{CD}$ forms two smaller triangles so that $\triangle CBD \sim \triangle ACD \sim \triangle ABC$.

Also, $\frac{BD}{CD} = \frac{CD}{AD}$, $\frac{AB}{CB} = \frac{CB}{DB}$, and $\frac{AB}{AC} = \frac{AC}{AD}$.



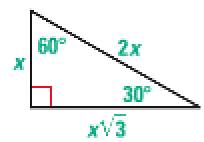
SPECIAL RIGHT TRIANGLES

45°-45°-90° Triangle



hypotenuse = leg • $\sqrt{2}$

30°-60°-90° Triangle



hypotenuse = 2 • shorter leg

longer leg = shorter leg • $\sqrt{3}$

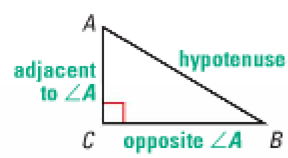
- Using Trigonometric Ratios to Solve Right Triangles

The tangent, sine, and cosine ratios can be used to find unknown side lengths and angle measures of right triangles. The values of tan $x°$, sin $x°$, and cos $x°$ depend only on the angle measure and not on the side length.

$\tan A = \frac{\text{opp.}}{\text{adj.}} = \frac{BC}{AC}$ $\quad \tan^{-1} \frac{BC}{AC} = m\angle A$

$\sin A = \frac{\text{opp.}}{\text{hyp.}} = \frac{BC}{AB}$ $\quad \sin^{-1} \frac{BC}{AB} = m\angle A$

$\cos A = \frac{\text{adj.}}{\text{hyp.}} = \frac{AC}{AB}$ $\quad \cos^{-1} \frac{AC}{AB} = m\angle A$



<u>The student will demonstrate both applied and conceptual knowledge of:</u>

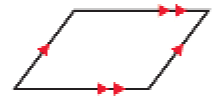
- All terms listed on page 560 in textbook.
- Using Angle Relationships in Polygons

You can use theorems about the interior and exterior angles of convex polygons to solve problems.

Polygon Interior Angles Theorem	**Polygon Exterior Angles Theorem**
The sum of the interior angle measures of a convex n-gon is $(n - 2) \cdot 180°$.	The sum of the exterior angle measures of a convex n-gon is 360°.

- Using Properties of Parallelograms

By definition, a parallelogram is a quadrilateral with both pairs of opposite sides parallel. Other properties of parallelograms:



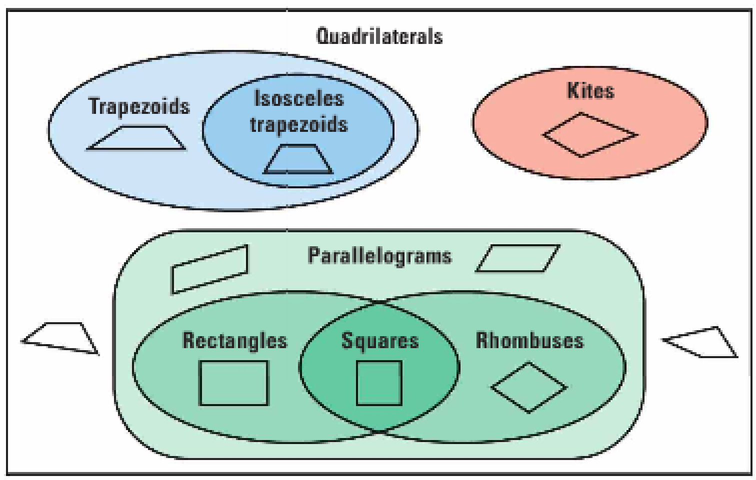
- Opposite sides are congruent.
- Diagonals bisect each other.
- Opposite angles are congruent.
- Consecutive angles are supplementary.

Ways to show that a quadrilateral is a parallelogram:

- Show both pairs of opposite sides are parallel.
- Show both pairs of opposite sides or opposite angles are congruent.
- Show one pair of opposite sides are congruent and parallel.
- Show the diagonals bisect each other.

- Classifying Quadrilaterals by Their Properties

  Special quadrilaterals can be classified by their properties. In a parallelogram, both pairs of opposite sides are parallel. In a trapezoid, only one pair of sides are parallel. A kite has two pairs of consecutive congruent sides, but opposite sides are not congruent.

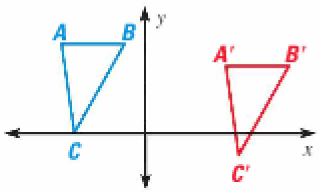


<u>The student will demonstrate both applied and conceptual knowledge of:</u>

- All terms listed on page 636 in textbook.
- Performing Congruence and Similarity Transformations

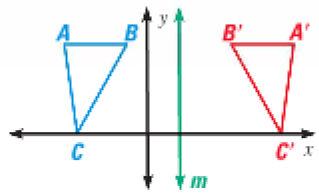
Translation

Translate a figure right or left, up or down.



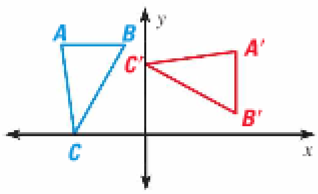
Reflection

Reflect a figure in a line.



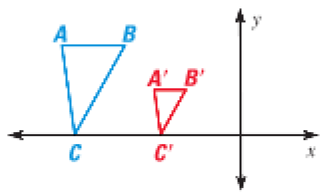
Rotation

Rotate a figure about a point.



Dilation

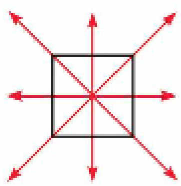
Dilate a figure to change the size but not the shape.



You can combine congruence and similarity transformations to make a composition of transformations, such as a glide reflection.

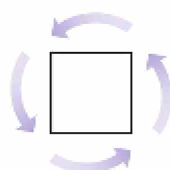
- Making Real-World Connections to Symmetry and Tessellations

Line symmetry



4 lines of symmetry

Rotational symmetry



90° rotational symmetry

- Applying Matrices and Vectors in Geometry

You can use matrices to represent points and polygons in the coordinate plane. Then you can use matrix addition to represent translations, matrix multiplication to represent reflections and rotations, and scalar multiplication to represent dilations. You can also use vectors to represent translations.

<u>The student will demonstrate both applied and conceptual knowledge of:</u>

- All terms listed on page 780 in textbook.
- Using Area Formulas for Polygons

Polygon	Formula	
Triangle	$A = \frac{1}{2}bh,$	with base b and height h
Parallelogram	$A = bh,$	with base b and height h
Trapezoid	$A = \frac{1}{2}h(b_1 + b_2),$	with bases b_1 and b_2 and height h
Rhombus	$A = \frac{1}{2}d_1d_2,$	with diagonals d_1 and d_2
Kite	$A = \frac{1}{2}d_1d_2,$	with diagonals d_1 and d_2
Regular polygon	$A = \frac{1}{2}a \cdot ns,$	with apothem a, n sides, and side length s

Sometimes you need to use the Pythagorean Theorem, special right triangles, or trigonometry to find a length in a polygon before you can find its area.

- Relating Length, Perimeter, and Area Ratios in Similar Polygons

You can use ratios of corresponding measures to find other ratios of measures. You can solve proportions to find unknown lengths or areas.

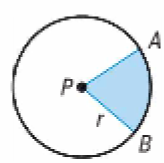
If two figures are similar and ...	then ...
the ratio of side lengths is $a:b$	• the ratio of perimeters is also $a:b$. • the ratio of areas is $a^2:b^2$.
the ratio of perimeters is $c:d$	• the ratio of side lengths is also $c:d$. • the ratio of areas is $c^2:d^2$.
the ratio of areas is $e:f$	• the ratio of side lengths is $\sqrt{e}:\sqrt{f}$. • the ratio of perimeters is $\sqrt{e}:\sqrt{f}$.

- Comparing Measures for Parts of Circles and the Whole Circle

Given $\odot P$ with radius r, you can use proportional reasoning to find measures of parts of the circle.

Arc length $\frac{\text{Arc length of } \widehat{AB}}{2\pi r} = \frac{m\widehat{AB}}{360^\circ}$ ← **Part** ← **Whole**

Area of sector $\frac{\text{Area of sector } APB}{\pi r^2} = \frac{m\widehat{AB}}{360^\circ}$ ← **Part** ← **Whole**



<u>The student will demonstrate both applied and conceptual knowledge of:</u>

- All terms listed on page 857 in textbook.
- Exploring solids and Their Properties

Euler's Theorem is useful when finding the number of faces, edges, or vertices on a polyhedron, especially when one of those quantities is difficult to count by hand.

For example, suppose you want to find the number of edges on a regular icosahedron, which has 20 faces. You count 12 vertices on the solid. To calculate the number of edges, use Euler's Theorem:

$F + V = E + 2$	Write Euler's Theorem.
$20 + 12 = E + 2$	Substitute known values.
$30 = E$	Solve for E.

- Solving Problems Using Surface Area and Volume

Figure	Surface Area	Volume
Right prism	$S = 2B + Ph$	$V = Bh$
Right cylinder	$S = 2B + Ch$	$V = Bh$
Regular pyramid	$S = B + \frac{1}{2}P\ell$	$V = \frac{1}{3}Bh$
Right cone	$S = B + \frac{1}{2}C\ell$	$V = \frac{1}{3}Bh$
Sphere	$S = 4\pi r^2$	$V = \frac{4}{3}\pi r^3$

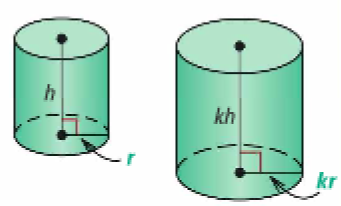
The volume formulas for prisms, cylinders, pyramids, and cones can be used for oblique solids.

While many of the above formulas can be written in terms of more detailed variables, it is more important to remember the more general formulas for a greater understanding of why they are true.

- Connecting Similarity to Solids

The similarity concepts learned in Chapter 6 can be extended to 3-dimensional figures as well.

Suppose you have a right cylindrical can whose surface area and volume are known. You are then given a new can whose linear dimensions are k times the dimensions of the original can. If the surface area of the original can is S and the volume of the original can is V, then the surface area and volume of the new can can be expressed as k^2S and k^3V, respectively.



IV. Suggested Resources:

Geometry textbook (McDougal-Littel,2008)

www.classzone.com (website for textbook – additional sample questions and practice assessments) http://www.ohiodocs.org/OGT/2009_2010/OGT_Math_Ref_Sheet_English.pdf

(OGT reference sheet –may be used with all parts of the exam)

http://www.utc.edu/~cpmawata/geom/geom.htm (Interactive Geometry tutorial)

http://matti.usu.edu/nlvm/nav/vlibrary.html (National Library of Virtual Manipulatives)

http://math.rice.edu/~lanius/Patterns/ (fraction shapes)

http://www.quia.com/jg/67017.html (Online geometry flashcards)

http://www.stetson.edu/~efriedma/puzzle.html (Puzzles)

http://www.analyzemath.com/geometry.html (construction instructions)

http://www.suelebeau.com/geometry.htm (good comprehensive geometry site)

http://www.brunnermath.com/geometry.htm (bank of multiple choice geometry questions with helpful hints – good for OGT review)