Geometry SOL Review **Study Guide of Important Information**

G.1 Logic

Conditional	Converse	Inverse	Contrapositive	Biconditional
$p \rightarrow q$	$q \rightarrow p$	$\sim p \rightarrow \sim q$	$\sim q \rightarrow \sim p$	$p \leftrightarrow q$

- Contrapositive is true when the conditional is true.
- Converse and inverse have the same truth value
- Additional symbols: "and" "or"

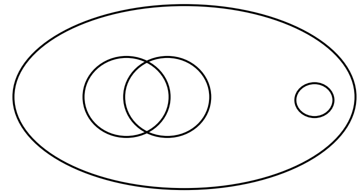
Law of Detachment

*one conditional statement
*second statement sounds like first statement hypothesis
*conclusion sounds like first conclusion

Law of Syllogism

*two conditional statements
*first conclusion repeats as second hypothesis
*conclusion is: If (1st hypothesis then (2nd conclusion)

Venn Diagram



*all small in large
*some large in small
*some of each overlap in the other
*none when no overlap

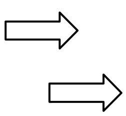
G.2 Coordinate Formulas and Transformations

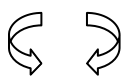
Formulas:

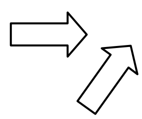
Midpoint	Distance	Slope
$\left(\frac{x_2+x_1}{2}, \frac{y_2+y_1}{2}\right)$	$\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$	$\frac{y_2-y_1}{x_2-x_1}$

Transformations:

Translation (slide) Reflection (flip/fold) Rotation (spin/turn)



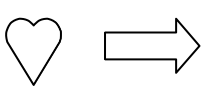




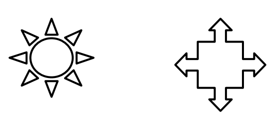
*slopes of parallel lines are equal
*slopes of perpendicular lines are negative reciprocals; product is -1
Vertical Lines:
Slope is undefined
Equation is $x = \#$
Horizontal Lines:
Slope is 0
Equation is $y = \#$

Symmetry:

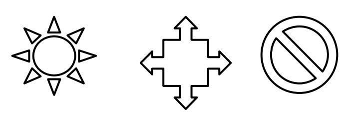
Line
– fold line; folds figure exactly in half, one half onto the other



Rotational
– spin figure by a degree value and figure matches onto itself

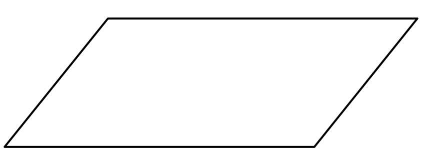


Point
– has rotational symmetry of $180°$

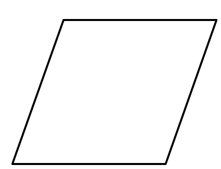


Caution!

Parallelogram – point symmetry only!!!



Rhombus – line symmetry & point symmetry!!!



G.3 – Angle Relationships

Congruent Angles

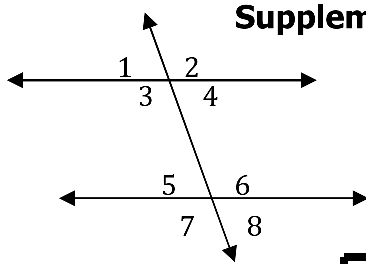
*(If lines are parallel)

Vertical $\angle 2 \cong \angle 3$

Alternate Interior $\angle 4 \cong \angle 5$

Alternate Exterior $\angle 1 \cong \angle 8$

Corresponding $\angle 3 \cong \angle 7$



Supplementary – sum of two angles is 180

Linear pair

$m\angle 5 + m\angle 7 = 180°$

Consecutive Interior

$m\angle 3 + m\angle 5 = 180°$

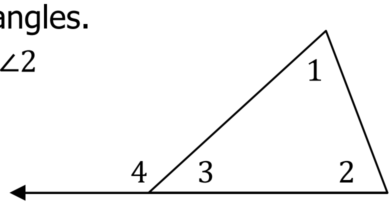
Triangles

Sum of interior angles is 180

$m\angle 1 + m\angle 2 + m\angle 3 = 180°$

Measure of an exterior angle is equal to the sum of its two remote interior angles.

$m\angle 4 = m\angle 1 + m\angle 2$



G.5 Congruent and Similar Triangles

Congruent Triangles

- Corresponding angles are congruent
- Corresponding sides are congruent
- Ways to prove triangles are congruent
  - SSS, SAS, ASA, AAS, HL (for right triangles)

Similar Triangles

- Corresponding angles are congruent
- Corresponding sides are proportional
- Ways to prove triangles are similar
  - AA~, SSS~, SAS~

G.7 Right Triangles

Pythagorean Theorem $c^2 = a^2 + b^2$

*Used when two sides of a right triangle are given

Converse of the Pythagorean Theorem

*Identify a triangle as right, obtuse, or acute

$c^2 = a^2 + b^2$	Right
$c^2 > a^2 + b^2$	Obtuse
$c^2 < a^2 + b^2$	Acute

*Check to see if triangle is possible

Right Triangle Trigonometry – SOH CAH TOA

$\sin\theta = \frac{opposite}{hypotenuse}, \cos\theta = \frac{adjacent}{hypotenuse}, \tan\theta = \frac{opposite}{adjacent}$

G.4 Ways to prove lines are parallel

- Alternate interior angles are congruent
- Corresponding angles are congruent
- Consecutive interior angles are supplementary
- The two lines are perpendicular to the same line

G.6 Triangle Inequalities

To form a triangle, sum of smaller two lengths must be greater than the largest

L>S+M	triangle
L=S+M	flat
L<S+M	gap

Largest angle is opposite largest side, smallest angle is opposite smallest side

Base angles of an isosceles triangle are congruent

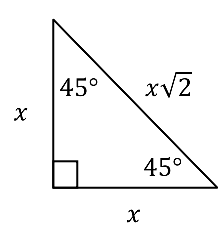
Sides opposite congruent angles are congruent

To find the possible lengths for the third side given the other sides:

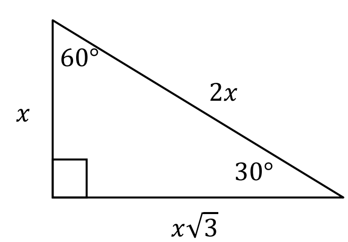
subtract given #'s < x < add given #'s

Special Right Triangles: only when given angle

45 – 45 – 90



30 – 60 – 90



G.8 Quadrilaterals

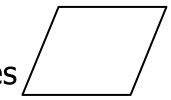
Parallelogram

Opposite sides are parallel
Opposite sides are congruent
Opposite angles are congruent
Consecutive angles are supplementary
Diagonals bisect each other

Rectangle

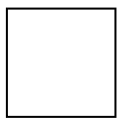
Parallelogram with:
All right angles
Diagonals are congruent

Rhombus



Parallelogram with:
Four congruent sides
Four congruent sides
Diagonals are perpendicular
Diagonals bisect opposite angles

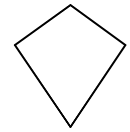
Square



Parallelogram
Rectangle
Rhombus
*all 10 properties listed above

Kite

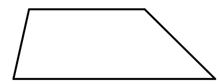
2 pair of adjacent sides are congruent
No opposite sides are congruent



Trapezoid

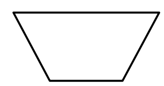
Exactly one pair of opp. sides parallel
Median joins midpoints of legs and is parallel to bases

$m = \frac{1}{2}(b_1 + b_2)$



Isosceles Trapezoid

Legs are congruent
Pairs of base angles are Congruent
Diagonals are congruent



G.9 Polygons

Formulas:

$(n-2)180$	Sum of interior angles
$\frac{(n-2)180}{n}$	Each interior angle (regular)
360	Sum of exterior angles
$\frac{360}{n}$	Each exterior angle (regular)

*Exterior angle + interior angles = 180
*Exterior angle and its interior angle are supplementary

Tessellation Information

*Each vertex must have a sum of 360 degrees

Regular polygons that tessellate:
- Triangle – each angle measures $60°$
- Square – each angle measures $90°$
- Hexagon – each angle measures $120°$

Combinations of regular polygons that tessellate
- square and octagon
- square and triangle
- triangle and hexagon

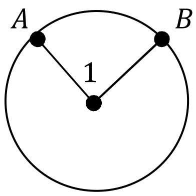
Other common regular polygon measurements (do not tessellate)
- Pentagon – each angle measures $108°$
- Octagon – each angle measures $135°$

**Non-regular figures can tessellate. Make sure that the sum of the angles at any vertex add to 360

G.10 Circles

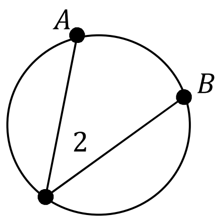
Angles & Arcs

Central Angle



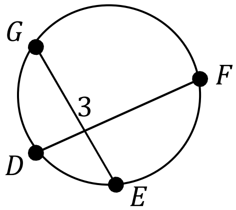
$m\angle 1 = m\overset{\frown}{AB}$

Inscribed Angle



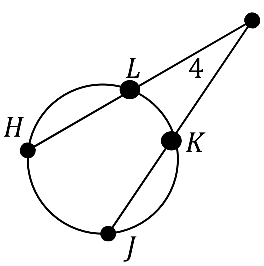
$m\angle 2 = \frac{1}{2} m\overset{\frown}{AB}$

Vertex inside circle



$m\angle 3 = \frac{1}{2}(m\overset{\frown}{DE} + m\overset{\frown}{FG})$

Vertex ouside circle

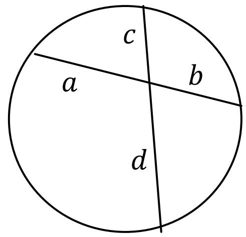


$m\angle 4 = \frac{1}{2}(m\overset{\frown}{HJ} - m\overset{\frown}{LK})$

Segments

Two Chords

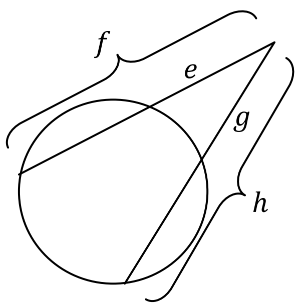
(product of segments from one chord=product of segments from the other)



$ab = cd$

Two Secants

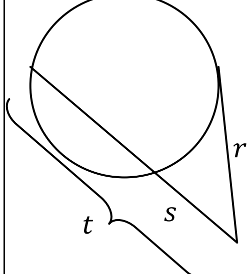
(outer secant segment$_1$ x whole secant$_1$=outer secant segment$_2$ x whole secant$_2$)



$ef = gh$

Tangent and Secant

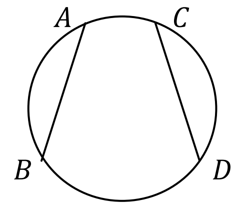
Tangent2=outer secant segment x whole secant



$r^2 = st$

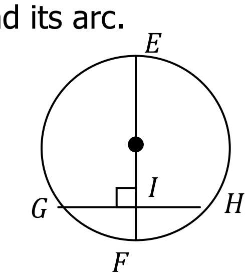
Miscellaneous Topics

Congruent chords have congruent arcs



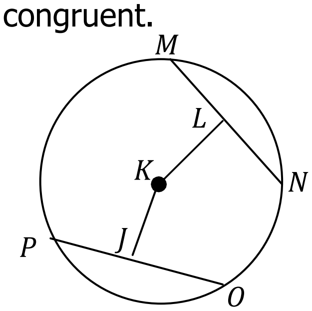
$\overline{AB} \cong \overline{CD} \leftrightarrow arcAB \cong arcCD$

A diameter perpendicular to a chord bisects the chord and its arc.



$\overline{EF} \perp \overline{GH}$ $\leftrightarrow \overline{GI} \cong \overline{IH}$
$\leftrightarrow arcGF \cong arcHF$
$\leftrightarrow arcEG \cong arcEH$

Chords equidistant from the center are congruent.

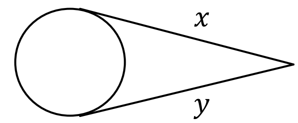


$KL = KJ \leftrightarrow \overline{MN} \cong \overline{PO}$
$\leftrightarrow arcMN \cong arcPO$

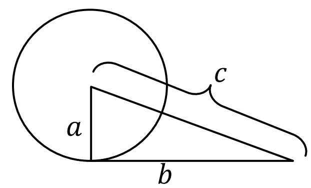
Miscellaneous Topics

Tangents from the same exterior point are congruent.

$x = y$

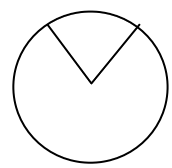


Tangent is perpendicular to the radius drawn to the point of tangency.



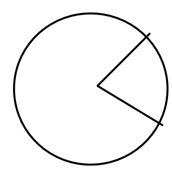
$c^2 = a^2 + b^2$

Arc Length



$\frac{degree}{360} \cdot 2\pi r$

Area of a sector



$\frac{degree}{360} \cdot \pi r$

G.13 Lateral Area, Surface Area & Volume of 3-D Figures

Lateral Area – does not include base areas (ex: toilet paper roll, b-day party hat)

Surface Area – does include base areas (ex: soda can, closed box)

Volume – amount filled inside 3-D figure (ex: soda in a can, helium in a balloon)

G.14 Proportions in similar figures

Scale Factor	$a:b$
Perimeter ratio	$a:b$
Any Area ratio	$a^2:b^2$
Volume ratio	$a^3:b^3$

Think about the measurement units for perimeter, area, and volume to help you remember the power of the ratio