VOCABULARY

Ratio of a to b If a and b are two numbers or quantities and $b \neq 0$, then the ratio of a to b is $\frac{a}{b}$.

Proportion An equation that states that two ratios are equal is a proportion.

Means, extremes In the proportion $\frac{a}{b} = \frac{c}{d}$, b and c are the means, and a and d are the extremes.

Geometric mean The geometric mean of two positive numbers a and b is the positive number x that satisfies $\frac{a}{x} = \frac{x}{b}$.

A PROPERTY OF PROPORTIONS

1. **Cross Products Property** In a proportion, the product of the extremes equals the product of the means.

   If $\frac{a}{b} = \frac{c}{d}$ where $b \neq 0$ and $d \neq 0$, then $\underline{ad} = \underline{bc}$.

   $\frac{2}{3} = \frac{4}{6}$: $3 \cdot \underline{4} = \underline{12}$, $2 \cdot \underline{6} = \underline{12}$

GEOMETRIC MEAN

The geometric mean of two positive numbers a and b is the positive number x that satisfies $\frac{a}{x} = \frac{x}{b}$.

So, $x^2 = \underline{ab}$ and $x = \sqrt{\underline{ab}}$.

VOCABULARY

Scale drawing A scale drawing is a drawing that is the same shape as the object it represents.

Scale The scale is a ratio that describes how the dimensions in the drawing are related to the actual dimensions of the object.

ADDITIONAL PROPERTIES OF PROPORTIONS

2. **Reciprocal Property** If two ratios are equal, then their reciprocals are also equal.

   If $\frac{a}{b} = \frac{c}{d}$, then $\frac{b}{a} = \underline{\frac{d}{c}}$.

3. If you interchange the means of a proportion, then you form another true proportion.

   If $\frac{a}{b} = \frac{c}{d}$, then $\frac{a}{c} = \underline{\frac{b}{d}}$.

4. In a proportion, if you add the value of each ratio's denominator to its numerator, then you form another true proportion.

   If $\frac{a}{b} = \frac{c}{d}$, then $\frac{a+b}{b} = \underline{\frac{c+d}{d}}$.

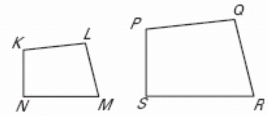
VOCABULARY

Similar polygons Two polygons are similar polygons if corresponding angles are congruent and corresponding side lengths are proportional.

Scale factor of two similar polygons If two polygons are similar, then the ratio of the lengths of two corresponding sides is called the scale factor.

THEOREM 6.1: PERIMETERS OF SIMILAR POLYGONS

If two polygons are similar, then the ratio of their perimeters is equal to the ratios of their corresponding side lengths.



If $KLMN \sim PQRS$, then

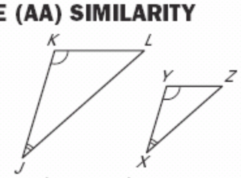
$$\frac{KL + LM + MN + NK}{PQ + QR + RS + SP} = \frac{KL}{PQ} = \frac{LM}{QR} = \frac{MN}{RS} = \frac{NK}{SP}.$$

CORRESPONDING LENGTHS IN SIMILAR POLYGONS

If two polygons are similar, then the ratio of any two corresponding lengths in the polygons is equal to the <u>scale factor</u> of the similar polygons.

POSTULATE 22: ANGLE-ANGLE (AA) SIMILARITY POSTULATE

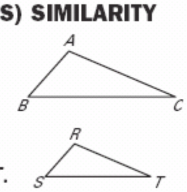
If two angles of one triangle are congruent to two angles of another triangle, then the two triangles are similar.



$\triangle JKL \sim \triangle XYZ$

THEOREM 6.2: SIDE-SIDE-SIDE (SSS) SIMILARITY THEOREM

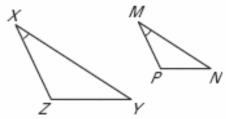
If the corresponding side lengths of two triangles are <u>proportional</u>, then the triangles are similar.



If $\frac{AB}{RS} = \frac{BC}{ST} = \frac{CA}{TR}$, then $\triangle ABC \sim \triangle RST$.

THEOREM 6.3: SIDE-ANGLE-SIDE (SAS) SIMILARITY THEOREM

If an angle of one triangle is congruent to an angle of a second triangle and the lengths of the sides including these angles are proportional, then the triangles are similar.



If $\angle X \cong \angle M$, and $\frac{ZX}{PM} = \frac{XY}{MN}$, then $\triangle XYZ \sim \triangle MNP$.

TRIANGLE SIMILARITY POSTULATE AND THEOREMS

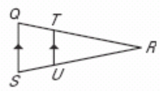
AA Similarity Postulate If $\angle A \cong \angle D$ and $\angle B \cong \angle E$, then $\triangle ABC \sim \triangle DEF$.

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 $\triangle ABC \sim \triangle DEF$.

THEOREM 6.4: TRIANGLE PROPORTIONALITY THEOREM

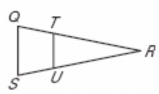
If a line parallel to one side of a triangle intersects the other two sides, then it divides the two sides proportionally.



If $\overline{TU} \parallel \overline{QS}$, then $\frac{RT}{TQ} = \frac{RU}{US}$.

THEOREM 6.5: CONVERSE OF THE TRIANGLE PROPORTIONALITY THEOREM

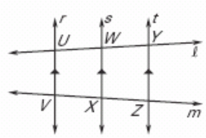
If a line divides two sides of a triangle proportionally, then it is parallel to the third side.



If $\frac{RT}{TQ} = \frac{RU}{US}$, then $\overline{TU} \parallel \overline{QS}$.

THEOREM 6.6

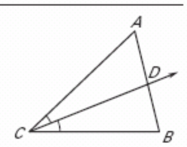
If three parallel lines intersect two transversals, then they divide the transversals proportionally.



$\frac{UW}{WY} = \frac{VX}{XZ}$

THEOREM 6.7

If a ray bisects an angle of a triangle, then it divides the opposite side into segments whose lengths are proportional to the lengths of the other two sides.



$\frac{AD}{DB} = \frac{CA}{CB}$

VOCABULARY

Dilation A dilation is a transformation that stretches or shrinks a figure to create a similar figure.

Center of dilation In a dilation, a figure is enlarged or reduced with respect to a fixed point called the center of dilation.

Scale factor of a dilation The scale factor k of a dilation is the ratio of a side length of the image to the corresponding side length of the original figure.

Reduction A dilation where $0 < k < 1$ is a reduction.

Enlargement A dilation where $k > 1$ is an enlargement.

COORDINATE NOTATION FOR A DILATION

You can describe a dilation with respect to the origin with the notation $(x, y) \rightarrow (kx, ky)$, where k is the scale factor.

If $0 < k < 1$, the dilation is a reduction. If $k > 1$, the dilation is an enlargement.