<u>Geometry Info Sheet #32</u>

Ratio, Proportion, and Similarity

<u>Definitions</u>

Ratio: The comparison of one value to another, showing the relative size or amount of each; a ratio is usually expressed as the quotient of two numbers (e.g., $\frac{x}{y}$ or x/y or $x:y$)

Proportion: An equation stating that two ratios are equal (e.g., $\frac{a}{b}=\frac{c}{d}$); an **<u>extended proportion</u>** contains three or more ratios (e.g., $\frac{a}{b}=\frac{c}{d}=\frac{e}{f}$)

The sides of two figures are **<u>proportional</u>** if all of the ratios of the corresponding sides are equal.

Dilation: A transformation that changes the size (larger or smaller), but not the shape, of a figure; after a dilation, the original image and the new image are **<u>similar</u>**

Two figures are <u>similar</u> if and only if a <u>dilation</u> (or composition of dilations and rigid transformations) maps one of the figures onto the other. In other words, if the vertices of two figures can be paired so that each pair of <u>corresponding angles are congruent</u> and each pair of <u>corresponding sides are proportional</u>, then the figures are similar.

The mathematical symbol for similarity is: $\sim$

Scale Factor: In a dilation, the number by which the lengths of the sides of a figure are multiplied to determine the lengths of the sides of a new figure (which can be larger or smaller)

For two similar figures, the <u>scale factor</u> is the <u>ratio of any two corresponding lengths</u> (sides, altitudes, medians, diagonals, diameters, radii, etc.).

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

If two polygons are similar, then the ratio of their **<u>areas</u>** is equal to the <u>squares</u> of the ratios of their corresponding side lengths.

<u>Properties of Proportions</u>

If a, b, c, and d are non-zero real numbers, then $\frac{a}{b}=\frac{c}{d}$ is equivalent to:

1) $ad=bc$ 2) $\frac{b}{a}=\frac{d}{c}$ 3) $\frac{a}{c}=\frac{b}{d}$ 4) $\frac{a+b}{b}=\frac{c+d}{d}$

If $\frac{a}{b}=\frac{c}{d}=\frac{e}{f}=\ldots$, then $\frac{a+c+e+\ldots}{b+d+f+\ldots}=\frac{a}{b}=\ldots.$