Chapter 7 Similarity

7-1 Ratios & Proportions
7-2 Similar polygons
7-3 Proving Triangles Similar
7-4 Similarity in Right Triangles
7-5 Proportions

7-1

★ ratio - a comparison of 2 quantities → a:b, $\frac{a}{b}$, a to b

★ proportion - a statement that 2 ratios are equal → $\frac{a}{b} = \frac{c}{d}$ and a:b = c:d

PROPERTIES OF PROPORTIONS CROSS MULTIPLY!

• $\frac{a}{b} = \frac{c}{d}$ is equivalent to (1) $ad = bc$ (2) $\frac{b}{a} = \frac{d}{c}$ (3) $\frac{a}{c} = \frac{b}{d}$ (4) $\frac{a+b}{b} = \frac{c+d}{d}$

EXAMPLES • If $\frac{a}{b} = \frac{3}{4}$ then complete each statement [1] $4a = 3b$ [2] $\frac{b}{a} = \frac{4}{3}$

• $\frac{x+3}{3} = \frac{10+4}{4}$ → $\frac{x+3}{3} = \frac{14}{4}$ $4(x+3)$ → $4x+12 = 42$ → $4x = 30$ → $x = 7.5$

7-2

★ Two figures that have the same shape but not necessarily the same size are similar (~)

★ Two polygons are similar if (1) corresponding ∠s are ≅ and (2) corresponding sides are proportional

★ The ratio of the lengths of corresponding sides is the similarity ratio.

EXAMPLES • Find the value of x. → $\frac{5}{6} = \frac{2}{x}$ $5x = 12$ → $x = 2.4$

• Find the value of each variable: $x = 4$ $y = 3$ • $\frac{18}{24} = \frac{3}{4}$ $\frac{15}{20} = \frac{3}{4}$ $\frac{12}{16} = \frac{3}{4}$

7-3

★ Angle-Angle Similarity Postulate (AA~)

The △'s are ~ if 2∠'s on one △ are ≅ to 2∠'s of another △: TRS ~ PLM

★ (SAS~) Theorem Side-∠-Side: If an ∠ of one △ is ≅ to an ∠ on a 2nd △, and the sides with the 2∠'s are proportional, then the △'s are similar. ★ (SSS~) Side-Side-Side Theorem: If the corresponding sides of 2 △s are proportional, then the △s are similar. indirect measurement - uses similar △s and measurements to find the distances that are difficult to measure directly.

Examples: Are the △s similar? If so, write a similarity statement and name the postulate you used:

no b/c $\frac{6}{3} \neq \frac{10}{4}$ • $\frac{8}{x} = \frac{6}{9}$ $x = 12$ yes ≅ by AA~

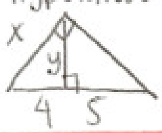
7-4

★ The altitude to the hypotenuse of a rt △ divides the △ into 2 △s that are similar to the original △ and to each other.

★ For any 2 positive #s a and b the geometric mean of a and b is the positive # x such as that $\frac{a}{x} = \frac{x}{b}$ → $x = \sqrt{ab}$ EXAMPLE: Find the geometric mean of 4 and 18 → $\frac{4}{x} = \frac{x}{18}$ → $x^2 = 72$, $x = \sqrt{72}$, $x = 6\sqrt{2}$

★ The length of the altitude to the hypotenuse of a rt △ is the geometric mean of the length of the segments of the hypotenuse. ★ The altitude to the hypotenuse of a rt. △ seperates the hypotenuse so that the length of each leg of the △ is the geometric mean of the length of the adjacent hypotenuse segment and the length of the hypotenuse.

Example: Solve for x and y

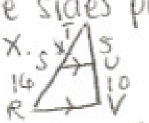


→ $\frac{4}{x} = \frac{x}{4+5}$, $x^2 = 36$, $x = 6$; $\frac{4}{y} = \frac{y}{5}$, $y^2 = 20$, $y = 2\sqrt{5}$

7-5

★ Side-Splitter Theorem: If a line is parallel to one side of a △ and intersects the other two sides, then it divides those sides proportionally.

Example: Find the value of x.



$\frac{TS}{SR} = \frac{TU}{UV}$ $\frac{x}{16} = \frac{5}{10}$ $x = \frac{5}{10} \cdot 16$, $x = 8$

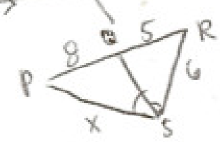
★ Corollary 2 Theorem:

If 3 parallel lines intersect two transversals, then the segments intercepted on the transversals are proportional. →

$\frac{a}{b} = \frac{c}{d}$

★ Triangle-Angle-Bisector Theorem: If a ray bisects an ∠ of a △, then it divides the opposite side into two segments that are proportional to the other 2 sides of the △.

Find the value x.



$\frac{PS}{SR} = \frac{PQ}{RQ}$ $\frac{x}{6} = \frac{8}{5}$ $5x = 48$ $x = 9.6$