Math 1312
Section 5.2
Similar Polygons

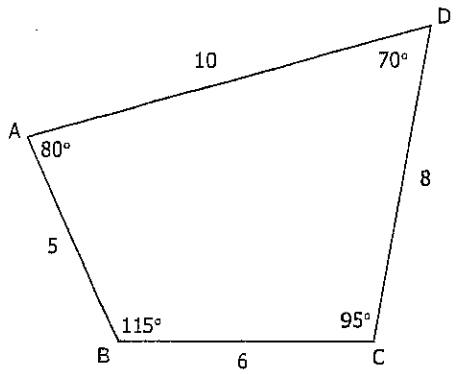
Definition:
Two polygons are **similar** (~) if and only if two conditions are satisfied:

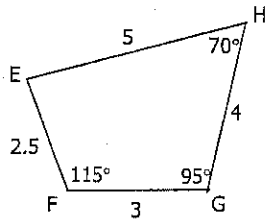
1. All pairs of corresponding angles are congruent.
2. The ratios of the measures of corresponding sides are equal.

The symbol "~" means "similar to"

Definition:
Scale Factor (constant of proportionality) is the ratio of the lengths of two corresponding sides of two similar polygons.

Example 1:
The following quadrilaterals are similar:





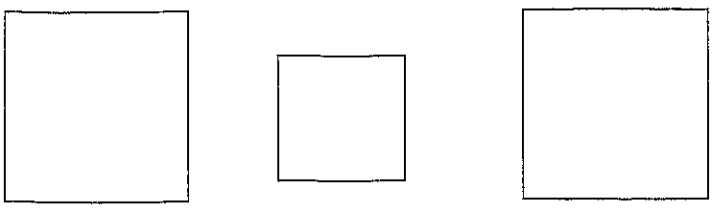
Why are they similar? Because.....

1) $\angle A \cong \angle E$ $\angle B \cong \angle F$ $\angle C \cong \angle G$ $\angle D \cong \angle H$

2) $\frac{AB}{EF} = \frac{BC}{FG} = \frac{CD}{GH} = \frac{DA}{HE} = \frac{2}{1}$ ← This is the scale factor.

Similar figures have the **same shape** but not necessarily the same size.

Example 2:
Which figures are similar?



All

Two congruent polygons are also similar.

Question:
Two similar polygons are always congruent, true or false?

Example 3:
Which figures must be similar?

a. Any two isosceles triangles

NO

b. Any two regular pentagons

Yes

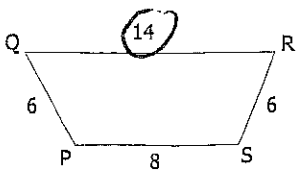
c. Any two rectangles

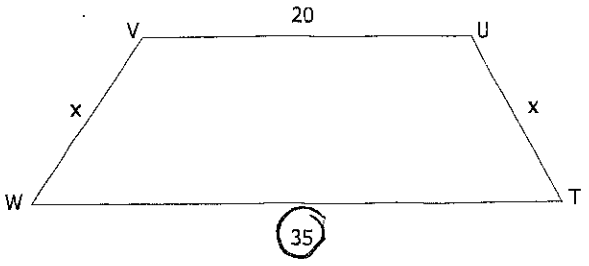
NO

d. Any two squares

Yes

Example 4:
Trapezoid PQRS is similar to trapezoid UTWV. Find the value of x.





a. identify the scale factor

$\frac{14}{35} = \frac{2}{5}$

b. set up a proportion (make sure to put ratios of the proportions in the same order)

$\frac{6}{x} = \frac{12}{5}$

c. cross multiply

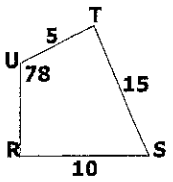
$2x = 6 \cdot 5 = 30$

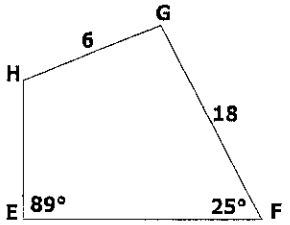
d. solve

$x = 15$

Example 5:

Complete each statement - RSTU ~ EFGH





1. $\angle R =$ 89°
2. $\angle S =$ 25°
3. $\angle H =$ 78°
4. $\angle G =$ 68°

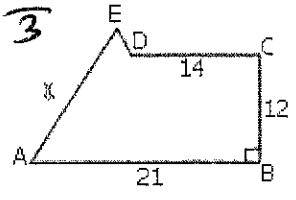
$360 - (61 + 25 + 76)$
$= 360 - 192 = 68$

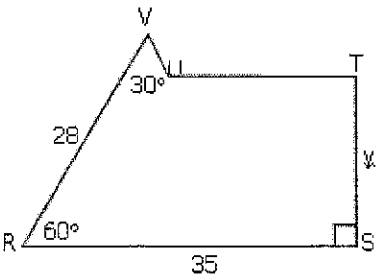
5. $\frac{HG}{UT} =$ $\frac{6}{5}$
6. $\frac{ST}{FG} =$ $\frac{15}{18} = \frac{5}{6}$

Example 6:

Complete each statement - ABCDE~RSTUV

1. The scale factor of ABCDE to RSTUV is $\frac{35}{21} = \frac{5}{3}$.





2. $m\angle E =$ 30
3. $m\angle A =$ 60°
4. $m\angle B =$ 90
5. $x =$ $28 \cdot \frac{3}{5} = \frac{84}{5} = 16\frac{4}{5}$

6. y = $\frac{5}{3} \cdot 12 = 20$

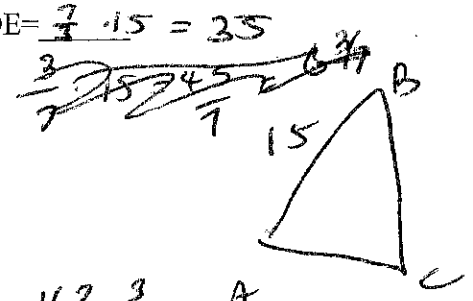
7. UT = $\frac{5}{3} \cdot 14 = \frac{70}{3} = 26\frac{2}{3}$

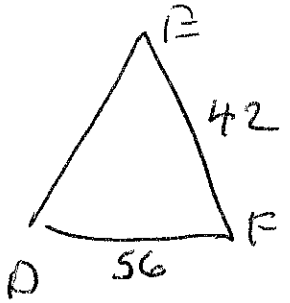
8. UV = 20, DE = $\frac{3}{5} 20 = 12$

Example 7:

$\Delta ABC \sim \Delta DEF$. The scale factor of ΔABC to ΔDEF is $\frac{3}{7}$. Draw a picture and then complete each statement. We don't know which Δ is bigger we will assume Δ DEF is

1. If AB=15, then DE= $\frac{7}{3} \cdot 15 = 35$

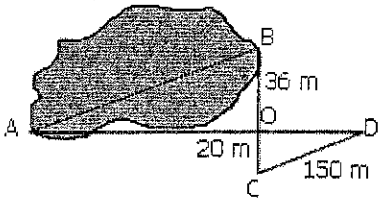




2. If EF=42, then BC= $42 \frac{3}{7} = 18$

3. If DF=56, then AC= $56 \cdot \frac{3}{7} = 24$

Example 8:
In order to find the distance AB across a lake, a surveyor constructed ΔOCD similar to ΔOBA. He measured OB (36m), OC (20m), and CD (150m) directly to obtain the lengths shown. Find the length of AB.

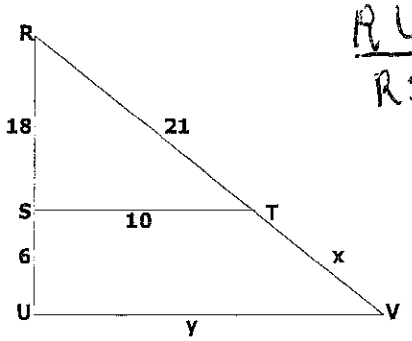


$\frac{AB}{150} = \frac{OB}{OC} = \frac{36}{20} = \frac{9}{5}$

$5AB = 9(150) = 1350$

$AB = 270$

Example 9:
ΔRST ~ ΔRUV find x and y



$\frac{RU}{RS} = \frac{16+6}{16} = \frac{24}{16} = \frac{4}{3}$

$\frac{y}{10} = \frac{4}{3}$

$y = \frac{40}{3} = 13\frac{1}{3}$

$\frac{x+21}{21} = \frac{4}{3}$

$3x + 63 = 84$

$3x = 21$

$x = 7$