Geometry: *Hutschenreuter* Name KEY

Section 6.3: Use Similar Polygons

Essential Question: If two figures are similar, how do you find the length of a missing side?

VOCABULARY:

Similar Polygons → Symbol is ~

Two polygons are similar if:

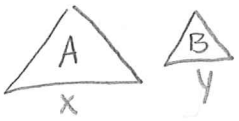
1) Corresponding angles are ≅

AND

2) Corresponding side lengths are proportional

Scale Factor

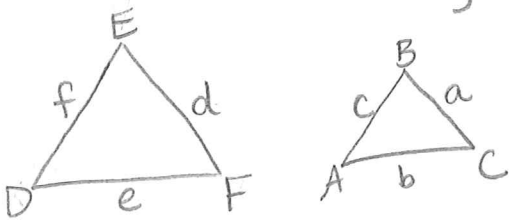
If two polygons are similar then the scale factor (k) is the ratio of the lengths of two corresponding sides



If $\triangle A \sim \triangle B$ then scale factor $k = \frac{x}{y}$

Theorem 6.1: Perimeters of Similar Polygons Theorem

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



If $\triangle DEF \sim \triangle ABC$ then $\frac{d+e+f}{a+b+c} = \frac{d}{a}$

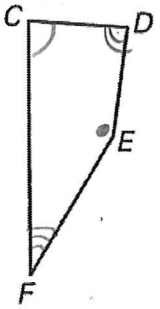
NOTE: Corresponding lengths in similar triangles include side lengths, altitudes, medians, midsegments, and so on.

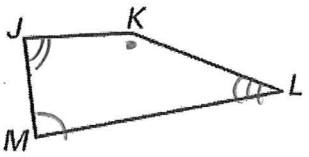
perimeter of $\triangle DEF = d+e+f$

" " $\triangle ABC = a+b+c$

EXAMPLES:

A1. In the diagram, *CDEF*~*MJKL*.





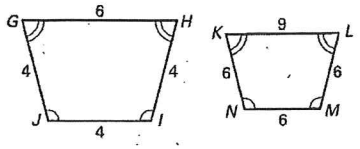
a) List all pairs of congruent angles.

$\angle C \cong \angle M$
$\angle D \cong \angle J$
$\angle E \cong \angle K$
$\angle F \cong \angle L$

b) Write the ratios of corresponding side lengths in a statement of proportionality.

$$\frac{CD}{MJ} = \frac{DE}{JK} = \frac{EF}{KL} = \frac{FC}{LM}$$

A2. **Determine if the polygons are similar. If they are, write a similarity statement and give the scale factor.**

a) 

① corresponding ∠'s ≅ ✓

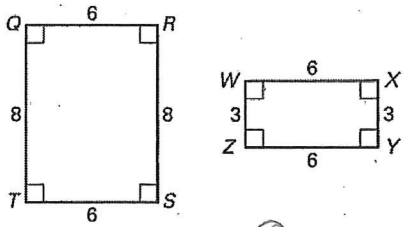
② $\frac{6}{9} \overset{\div 3}{=} \frac{4}{6} \overset{\div 2}{=} \frac{4}{6} = \frac{4}{6}$

$\frac{2}{3} = \frac{2}{3} = \frac{2}{3} = \frac{2}{3}$ ✓

corresponding sides proportional ✓

scale factor = $K = \frac{2}{3}$

$GHIJ \sim KLMN$

b) 

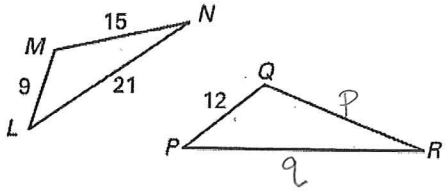
① corresponding ∠'s ≅

② $\frac{8}{6} \overset{\div 2}{\overset{?}{=}} \frac{6}{3} \overset{\div 3}{}$ sides Not proportional

$\frac{4}{3} \neq \frac{2}{1}$

∴ Not similar

A3. **Use $\Delta LMN \sim \Delta PQR$ to find a scale factor. Then find the missing side lengths.**



$\frac{LM}{PQ} = \frac{MN}{QR} = \frac{NL}{RP}$

$\frac{LM}{PQ} = \frac{9}{12} \overset{\div 3}{=} \frac{3}{4} = K$ = scale factor

① Set up proportion

② cross multiply

③ Divide

$\frac{3}{4} = \frac{15}{QR} \rightarrow 3(QR) = 4(15)$

$\frac{3(QR)}{3} = \frac{60}{3}$

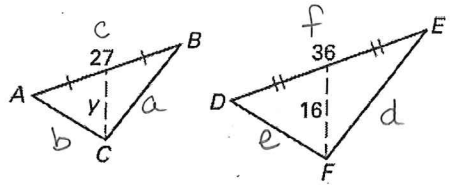
$QR = 20$

$\frac{3}{4} = \frac{21}{RP} \rightarrow 3(RP) = 4(21)$

$\frac{3(RP)}{3} = \frac{84}{3}$

$RP = 28$

A4. **In the figure, $\Delta ABC \sim \Delta DEF$. Find the value of the variable AND indicate the type of special segment shown as a dashed segment.**

a) 

$\frac{AB}{y} = \frac{DE}{16} \rightarrow \frac{c}{y} = \frac{f}{16}$

$\frac{27}{y} = \frac{36}{16}$

cross multiply

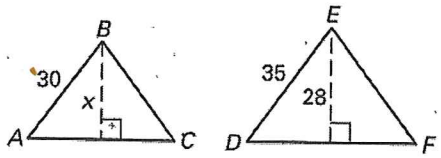
$36y = 27(16)$

$\frac{36y}{36} = \frac{432}{36}$

$y = 12$

Median

(bisects side opposite of vertex)

b) 

$\frac{AB}{X} \rightarrow \frac{30}{X} = \frac{35}{28} \leftarrow \frac{DE}{28}$

$35X = 30(28)$

$\frac{35X}{35} = \frac{840}{35}$

$X = 24$

Altitude

(⊥ to opp. side of vertex)

A5. The corresponding median lengths of similar triangles ΔXYZ and ΔMNO have a ratio of 5: 3. The perimeter of ΔMNO is 87 inches. What is the perimeter of ΔXYZ?

$\frac{\text{perimeter } (\Delta XYZ)}{\text{perimeter } (\Delta MNO)} = \frac{5}{3} \rightarrow \frac{\Delta XYZ}{87} = \frac{5}{3}$ $\quad \frac{87(5)}{3} = 145 \text{ in} = \text{Perimeter of } \Delta XYZ$

A6. Triangles JAN and FEB are similar. The sides of ΔJAN are 22 cm, 30 cm, and 17 cm. The longest side of ΔFEB is 100 cm. What is ΔFEB's perimeter?

$\frac{JAN}{FEB} = \frac{30}{100} = \frac{3}{10} = K$ $\quad \frac{3}{10} = \frac{69}{FEB} \rightarrow \frac{10(69)}{3} = 230$

per. of JAN = 22 + 30 + 17
= 69 cm

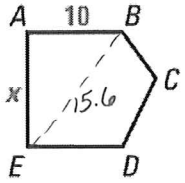
Per. of ΔFEB = 230 cm

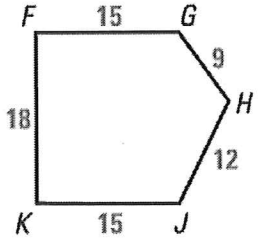
A7. In the diagram, $ABCDE \sim FGHJK$. The measures are in inches.

a) Find the scale factor of $FGHJK$ to $ABCDE$.

$\frac{FG}{AB} = \frac{15}{10} \div 5 = \frac{3}{2} = K$ (over)

Note: $\frac{F}{A} = \frac{3}{2}$, but $\frac{A}{F} = \frac{2}{3}$





b) Find the value of x.

$\frac{FigF}{FigA} = \frac{3}{2} = \frac{FK}{AE}$

$\frac{3}{2} = \frac{18}{x}$ $\quad 3x = 2(18)$

$x = \frac{2(18)}{3}$

$x = 12 \text{ in}$

c) If $BE = 15.6$ *in*, find GK.

$\frac{3}{2} = \frac{GK}{BE}$

$\frac{3}{2} = \frac{GK}{15.6} \rightarrow GK = \frac{3(15.6)}{2}$

$GK = 23.4 \text{ in}$

Section 6.3 Summary:

Similar figures have proportional sides. You can find the scale factor by writing and reducing a ratio of two corresponding sides. Then set up a proportion using the scale factor and the corresponding side to the unknown side length. Cross multiply, then divide to solve for the unknown side length.

(See ex #3)