Geometry H
6.3 Notes: Similar Figures

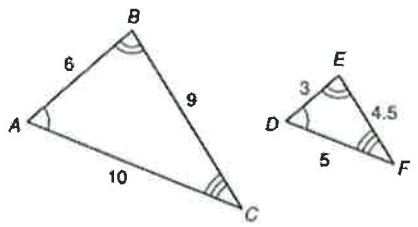
Name: Key
Date: _____ Period: _____

LEARNING TARGETS

- I can use proportions to identify similar polygons.
- I can use similar polygons to solve problems.

Similar polygons are polygons that have the same shape but not necessarily the same size.

Similar Polygons



$\triangle ABC \sim \triangle DEF$ ← is similar to

Corresponding angles are congruent.

$\angle A \cong \angle D$
$\angle B \cong \angle E$
$\angle C \cong \angle F$

Corresponding sides are proportional.

$\frac{AB}{DE} = \frac{6}{3} = 2$

$\frac{BC}{EF} = \frac{9}{4.5} = 2$

$\frac{CA}{FD} = \frac{10}{5} = 2$

A **similarity ratio**, also called the **scale factor** is the ratio of the lengths of corresponding sides.

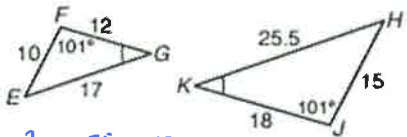
→In the diagram above, for the similarity statement $\Delta ABC \sim \Delta DEF$, the similarity ratio is: $\frac{\Delta ABC}{\Delta DEF} : \frac{AB}{DE} = \frac{6}{3} = \frac{2}{1}$

→In the diagram above, for the similarity statement $\Delta DEF \sim \Delta ABC$, the similarity ratio is: $\frac{\Delta DEF}{\Delta ABC} : \frac{DF}{AB} = \frac{3}{6} = \frac{1}{2}$

Example 1:

Determine whether the polygons are similar. If so, write the scale factor (similarity ratio) and a similarity statement.

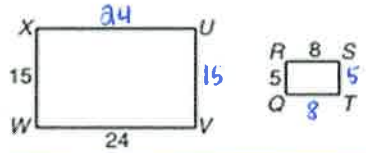
a) ΔEFG and ΔHJK ← look at the order of the letters to determine corresponding sides



$\frac{EF}{HJ} = \frac{10}{15} = \frac{2}{3}$ $\frac{FG}{JK} = \frac{12}{18} = \frac{2}{3}$ $\frac{EG}{HK} = \frac{17}{25.5} = \frac{2}{3}$

Since all 3 scale factors are the same, $\Delta EFG \sim \Delta HJK$ with a scale factor of $2/3$

b) rectangles *QRST* and *UVWX*



$\frac{QR}{UV}, \frac{ST}{WX}, \frac{RS}{VW}, \frac{QT}{UX}$

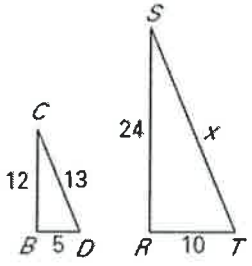
$\frac{5}{15}, \frac{5}{15}, \frac{8}{24}, \frac{8}{24}$

$\frac{1}{3}, \frac{1}{3}, \frac{1}{3}, \frac{1}{3}$

Since all 3 scale factors are the same, $QRST \sim UVWX$ with a scale factor of $\frac{1}{3}$

Example 2:

In the diagram, $\Delta BCD \sim \Delta RST$. Please solve for x.



$\frac{BC}{RS} = \frac{12}{24} = \frac{1}{2}$

$\frac{CD}{ST} = \frac{13}{x}$

$\frac{BD}{RT} = \frac{5}{10} = \frac{1}{2}$

pick 2 sides to set equal & cross multiply

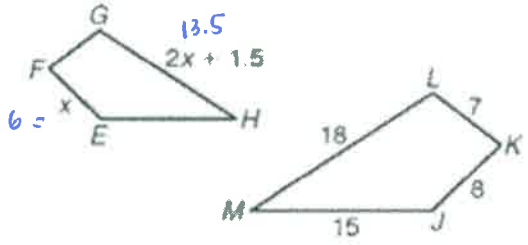
$\frac{BC}{RS} = \frac{CD}{ST} \Rightarrow \frac{1}{2} = \frac{13}{x}$

$x = 26$

✓ **Checkpoint**

In the diagram, $EFGH \sim JKLM$

1) Find the value of x.



$\frac{EFGH}{JKLM} : \frac{EF}{JK} = \frac{GH}{LM} \Rightarrow \frac{x}{8} = \frac{2x+1.5}{18} \Rightarrow$ $18x = 8(2x+1.5)$

$18x = 16x + 12$

$2x = 12$

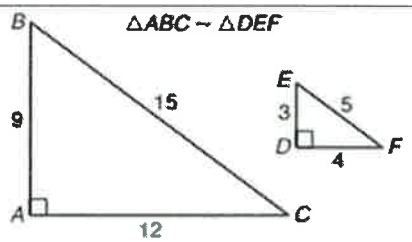
$\boxed{x = 6}$

2) What is the scale factor of *EFGH* to *JKLM*?

$\frac{EFGH}{JKLM} : \frac{EF}{JK} = \frac{6}{8} = \boxed{\frac{3}{4}}$

Perimeters of Similar Polygons Theorem

If two polygons are similar, and their similarity ratio is $\frac{a}{b}$, then the ratio of their perimeters is $\frac{a}{b}$.



$\frac{AB}{DE} = \frac{BC}{EF} = \frac{CA}{FD} = \frac{3}{1}$

$\frac{\text{perimeter of } \triangle ABC}{\text{perimeter of } \triangle DEF} = \frac{36}{12} = \frac{3}{1}$

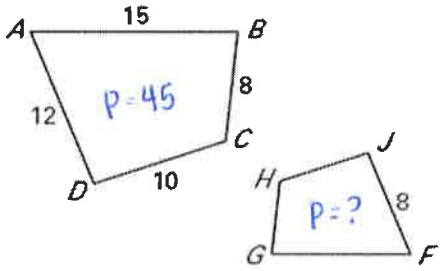
Example 3:

In the diagram, *ABCD* : *FGHJ*.

a) Find the scale factor of *FGHJ* to *ABCD*.

$\frac{FGHJ}{ABCD} = \frac{JF}{DA} = \frac{8}{12} = \boxed{\frac{2}{3}}$

b) Find the perimeter of *FGHJ*.



$\frac{FGHJ}{ABCD} : \frac{2}{3} = \frac{x}{45} \Rightarrow$ $3x = 90$

scale perim. $x = 30$

The perimeter of ABCD is 30 units

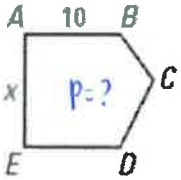
✓ **Checkpoint**

3) In the diagram, *ABCDE* : *FGHJK*.

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

$\frac{FGHJK}{ABCDE} : \frac{FG}{AB} = \frac{15}{10} = \boxed{\frac{3}{2}}$

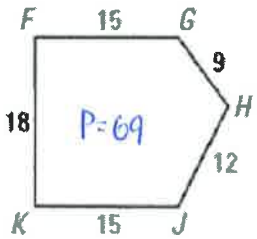
b) Find the value of x.



$\frac{FGHJK}{ABCDE} : \frac{FG}{AB} = \frac{FK}{AE} \Rightarrow \frac{15}{10} = \frac{18}{x} \Rightarrow$ $15x = 1800$

$\boxed{x = 12}$

c) Find the perimeter of *ABCDE*.



$\frac{FGHJK}{ABCDE} : \frac{3}{2} = \frac{69}{x} \Rightarrow$ $3x = 138$

scale perim $x = 46$

The perimeter of ABCDE is 46 units

Example 4:

In the diagram, LMNOP : RSTUV.

a) Find the scale factor of *RSTUV* to *LMNOP*.

$\frac{RSTUV}{LMNOP} : \frac{UT}{ON} = \frac{20}{16} = \boxed{\frac{5}{4}}$

b) Find the perimeter of *RSTUV*.

$\frac{RSTUV}{LMNOP} : \frac{5}{4} = \frac{x}{62} \Rightarrow 4x = 310 \Rightarrow x = 77.5$

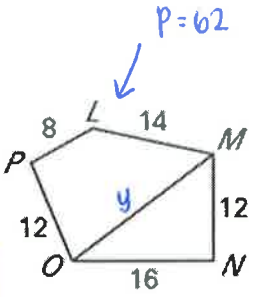
$\boxed{P = 77.5 \text{ units}}$

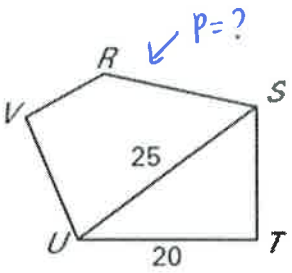
c) Find the length of diagonal $\overline{MO}$.

$\frac{RSTUV}{LMNOP} : \frac{UT}{ON} = \frac{SU}{MO} \Rightarrow \frac{20}{16} = \frac{25}{y} \Rightarrow 20y = 400$

$y = 20$

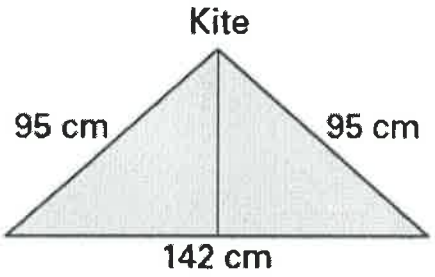
$\boxed{MO = 20}$

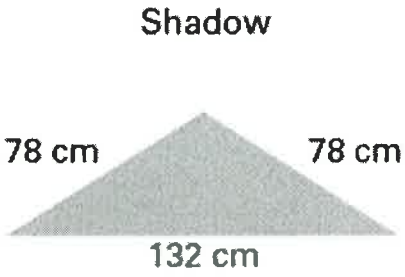


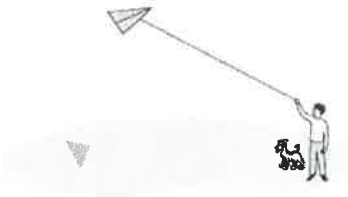


Example 5: Applications!

a) You are flying a kite on a sunny day. The kite has side lengths shown in the figure below at the left. The kite's shadow has the side lengths shown in the figure below at the right.







Is the shadow similar to the kite? *Explain* your reasoning.

$\frac{95}{78} \stackrel{?}{=} \frac{95}{78} \stackrel{?}{=} \frac{142}{132} \Rightarrow 1.2 \stackrel{?}{=} 1.2 \stackrel{?}{=} 1.08$ ← since all 3 scale factors are not the same, the kite & its shadow are <u>not</u> similar

b) The community park has a rectangular swimming pool enclosed by a rectangular fence for sunbathing. The shape of the pool is similar to the shape of the fence. The pool is 30 feet wide. The fence is 50 feet wide and 100 feet long.

- What is the scale factor of the pool to the fence?

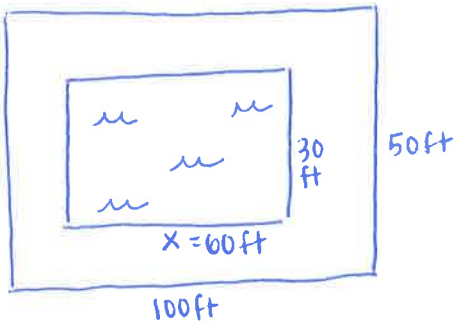
$\frac{\text{pool}}{\text{fence}} : \frac{30}{50} = \boxed{\frac{3}{5}}$

- What is the length of the pool?

$\frac{\text{pool}}{\text{fence}} : \frac{30}{50} = \frac{x}{100} \Rightarrow 50x = 3000$

$x = 60$

The length of the pool is 60 ft



- Find the area reserved strictly for sunbathing.

Area of fence − Area of pool

$= (50)(100) - (30)(60)$

$= 5000 - 1800$

$A = 3200$

The area for sunbathing is $3{,}200\ ft^2$