2.4 Similar Triangles

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2.4 SIMILAR TRIANGLES

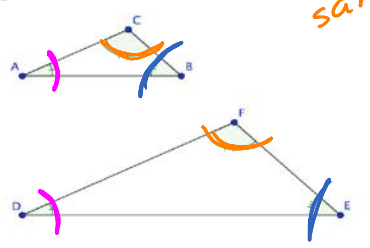
Name:_______________ Block_____

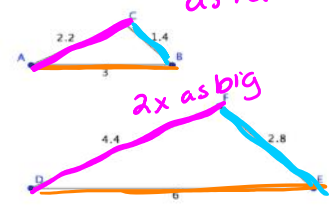
~ means "corresponding" or similar

Similar Triangles

- Triangles are similar if they are either reductions or enlargements of one another. → scale factor

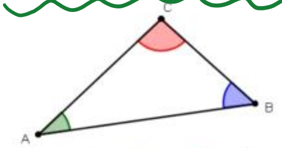
① • Triangles are similar if all corresponding angles are equal. same size $\angle A = \angle D$ $\angle C = \angle F$ $\angle B = \angle E$	OR: Triangles are similar if corresponding pairs of side lengths are proportional. (all have the same scale factor) ② compare as ratio → $\frac{AC}{DF} = \frac{2.2}{4.4} = \frac{1}{2} = 1:2$ $\frac{BC}{EF} = \frac{1.4}{2.8} = \frac{1}{2} = 1:2$ $\frac{AB}{DE} = \frac{3}{6} = \frac{1}{2} = 1:2$ 2x as big





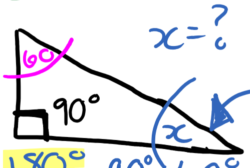
same scale factor = proportional = similar △'s

INTERIOR ANGLE RULE:



$\angle A + \angle B + \angle C = 180$

The angles (∠) inside of a triangle all add up to 180°



$x = ?$

$180° - 90° - 60° = x = 30°$

Like scale diagrams, **similar triangles** have the same ___angles___, but are not necessarily the same ___size___.

When you have a similar triangle:

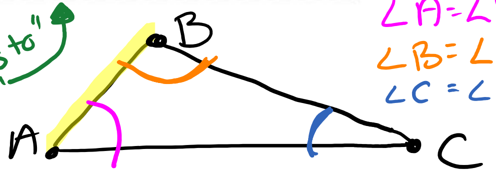
- Matching sides are called ___"corresponding sides"___
  - Pairs of corresponding sides have lengths with the same ratio (ie. The lengths are proportional) NOT equal
- Matching angles are called ___"corresponding angles"___
  - Corresponding angles are equal + are in the same spot (relative position)

Similar triangles can be represented using the symbols: $\triangle ABC \sim \triangle DEF$

"triangle" "corresponds to" "similar"

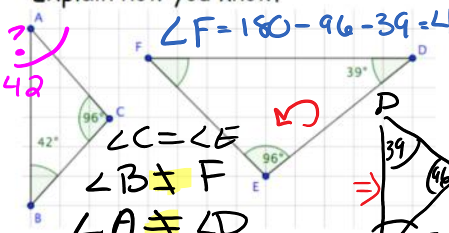
$\angle A = \angle D$
$\angle B = \angle E$
$\angle C = \angle F$

AB ~ DE



PRACTICE

127. Are these two triangles similar? Explain how you know.



$\angle F = 180 - 96 - 39 = 45°$

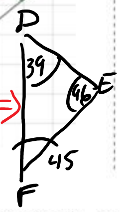
$\angle A = 180 - 96 - 42$

$\angle A = 42°$

$\angle C = \angle E$

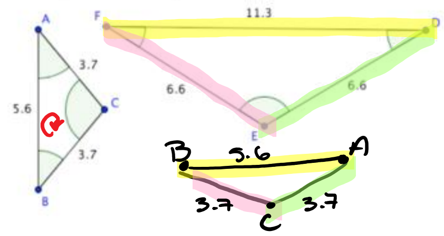
$\angle B \neq F$

$\angle A \neq \angle D$



= NOT similar

128. Are these two triangles similar? Explain how you know.



$\frac{FD}{BA} = \frac{11.3}{5.6} = 2.017$

$\frac{AC}{DE}$

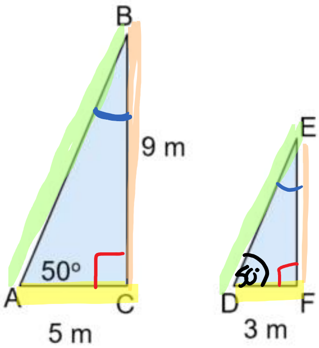
EXAMPLE #1: DETERMINE UNKNOWN ANGLE & SIDE MEASURES

is similar to

a) Given that $\triangle ABC \sim \triangle DEF$, list all of the **corresponding sides** and all of the **corresponding angles**.

"side AB"

"angle"



$\overline{AB} \sim \overline{DE}$

$\overline{AC} \sim \overline{DF}$

$\overline{BC} \sim \overline{EF}$

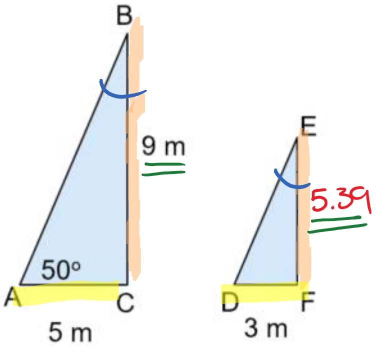
$\angle A = 50° = \angle D$

$\angle C = 90° = \angle F$

$\angle B = 180 - 50 - 90 = 40° = \angle E$

b) Using the same triangles and the fact that $\triangle ABC \sim \triangle DEF$, **determine the measure of** $\angle E$ and the **length of EF**.

$\angle E \sim \angle B = 180° - 90 - 50 = 40° = \angle E$



$\overline{EF} \sim \overline{BC}$

? 9m

$\overline{AC} \sim \overline{DF}$

5m 3cm

① use 2 known sides to find the scale factor

$9 \div 1.67 = \overline{EF}$

$= 5.39m$

$\frac{AC}{DF} = \frac{5}{3} = 1.67$ scale factor

$\triangle ABC$ is 1.67 times larger than $\triangle DEF$

*use proportional reasoning:

$\frac{AC}{DF} = \frac{BC}{EF}$

$\frac{5}{3} = \frac{9}{EF}$

$(3 \times 9) \div 5 = \boxed{5.40m}$

2

We can use proportional reasoning to determine unknown side length of triangles, if we know they are **corresponding**

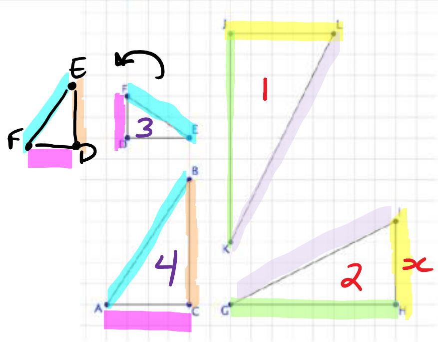
Use the triangles to the right to complete the following proportions.

129. If $\frac{JL}{JK} \sim \frac{x}{GH}$, then x= HI.

130. If $\frac{AB}{BC} \sim \frac{EF}{x}$, then x= ED.

131. If $\frac{GI}{HI} = \frac{x}{JL}$, then x= LK.

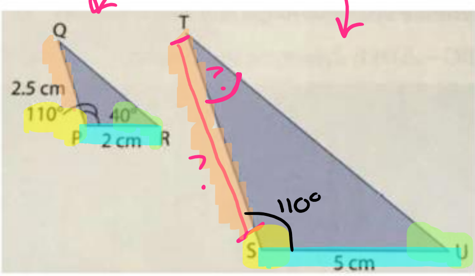
132. If $\frac{BC}{x} = \frac{DE}{FD}$, then x= AC.



PRACTICE

corresponding

1) Given that ΔPQR ~ ΔSTU, determine the measure of ∠T and the length of $\overline{ST}$.



$\angle P = \angle S = 110°$

$\angle R = \angle U = 40°$

$\angle Q = \angle T = ?$

$\angle T = 180 - 110 - 40$

$\boxed{\angle T = 30°}$ ✓

$\overline{QP} \sim \overline{TS}$

$\boxed{\overline{PR} \sim \overline{SU}}$ ← start with the pair where we know both sides.

$\overline{QR} \sim \overline{TU}$

If $\frac{PR}{QP} \sim \frac{SU}{TS}$ TS=x

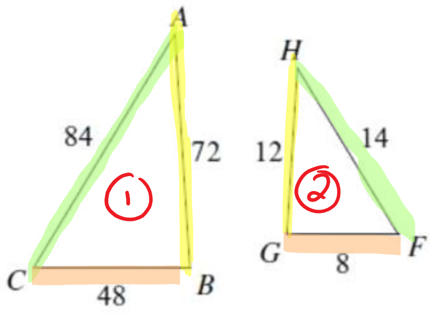
input measurements from diagram.

$\frac{2cm}{2.5cm} = \frac{5cm}{x}$

$\boxed{x = 6.25}$

EXAMPLE #2: DETERMINE WHETHER TWO TRIANGLES ARE SIMILAR

Show that $\Delta ABC \sim \Delta HGF$ $\Rightarrow$ prove by showing that scale factors are equal (ratios are equal)



$$AB \sim HG \Rightarrow \frac{AB}{HG} = \frac{72}{12} = 6$$

?

$$AC \sim HF \Rightarrow \frac{AC}{HF} = \frac{84}{14} = 6$$

$$CB \sim GF \Rightarrow \frac{CB}{GF} = \frac{48}{8} = 6$$

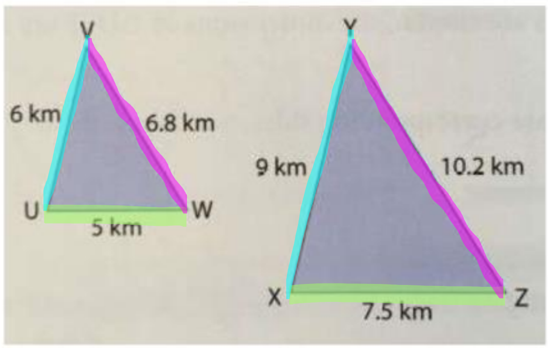
ratios ARE equal Therefore the Δ's ARE similar

Triangle ① values on top

all Δ② values on bottom

PRACTICE

2) Show that $\Delta UVW \sim \Delta XYZ$



$$\frac{UV}{XY} = \frac{6\text{ km}}{9\text{ km}} = 0.67$$

$$\frac{VW}{YZ} = \frac{6.8\text{ km}}{10.2\text{ km}} = 0.67$$

$$\frac{UW}{XZ} = \frac{5\text{ km}}{7.5\text{ km}} = 0.67$$

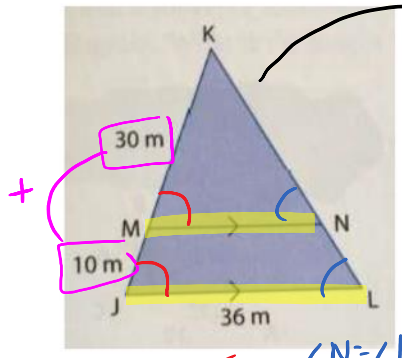
all 0.67

* because the ratio of side lengths are equal, the triangles are similar.

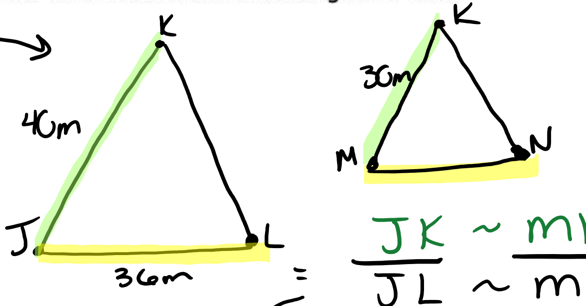
<u>EXAMPLE #3: DETERMINE UNKNOWN MEASURES IN NESTED SIMILAR TRIANGLES</u>

know that angles are equal = similar triangles

In the diagram below, MN is parallel to JL. Determine the length of MN.



$\angle M = \angle J$ $\quad$ $\angle N = \angle L$



$$= \frac{JK}{JL} \sim \frac{MK}{MN}$$

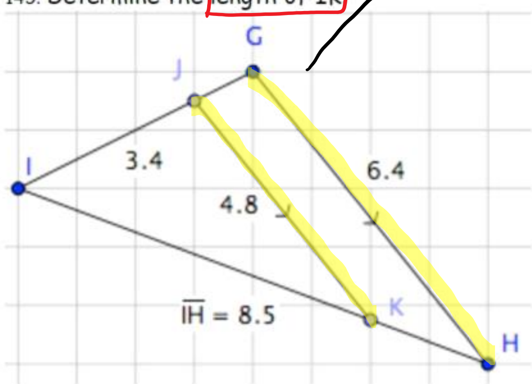
$$= \frac{40}{36} = \frac{30}{MN}$$

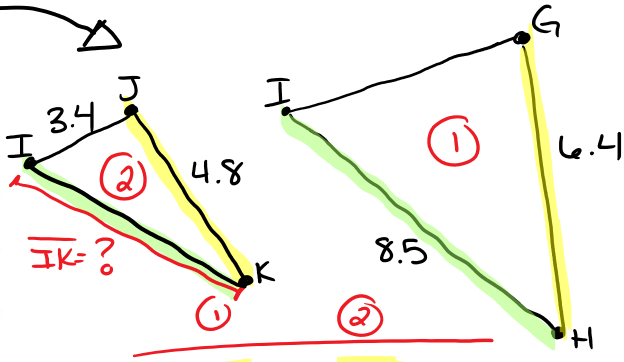
$$(36 \cdot 30) \div 40 = MN$$

$$\boxed{\text{so } \overline{MN} = 27\text{ m}}$$

PRACTICE

145. Determine the length of IK





$$\frac{GH}{IH} \sim \frac{JK}{IK}$$

$$\frac{6.4}{8.5} = \frac{4.8}{IK}$$

$$(8.5 \times 4.8) \div 6.4 = IK$$

$$\boxed{\text{So, } IK = 6.375}$$

We can also use the principles of similar triangles to solve problems.

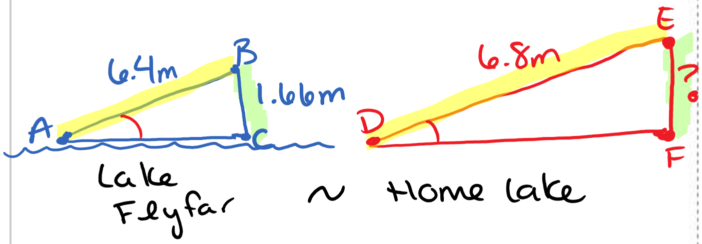
The key is to:

1. Draw a diagram
2. Label the diagram
3. Decide what you know, and solve for the unknown

Using similar triangles to solve problems.

155. Crazeen saw a water ski ramp at Lake Flyfar and determined the height of the ramp to be 1.66m and the ramp surface edge to be 6.4m. He wants to build a ramp on his home lake but wants to build a bigger one. He wants to keep the same proportions but knows the ramp surface edge can be no longer than 6.8m. Determine the height of his ramp to two decimals.

156. Jason found a photograph of a farmhouse with a roof that he really liked. The scale drawing said that the actual height of the roof was 4.5m tall and 6 meters to the center of the roof. He wants to have the same shape of roof for his new home. He has framed the lower part of the house and knows the distance to the center of the roof is 8m. Determine the height of his roof.



$\triangle ABC \sim \triangle DEF$

$$\frac{AB}{BC} \sim \frac{DE}{EF}$$

input numbers

$$\frac{6.4m}{1.66m} = \frac{6.8}{EF}$$

$(1.66 \times 6.8) \div 6.4$

$$\boxed{EF = 1.76m}$$

Homework	Required questions	Extra practice	Extension
ASSIGNMENT #4 2.4 pg 64 - 67	1a, 2, 3, 4, 5, 6, 8, 10, 12, 13	7, 9, 11	15, 16