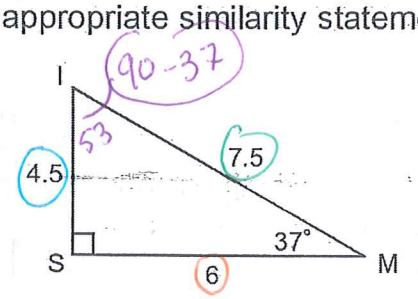
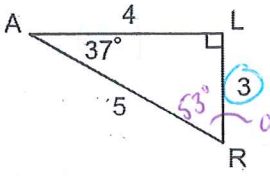
Geometry - 6.2 - Similar Polygons

- When polygons have the same shape but may be different in size, they are called similar polygons.
- Similar polygons always have congruent angles and proportional sides.

Ex 1 - Determine whether each pair of figures is similar. If they are similar, write an appropriate similarity statement.

a)





Angles
- All are ≅

Sides

$\frac{4.5}{3} = 1.5$

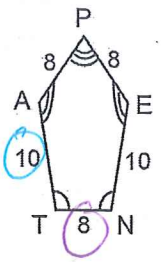
$\frac{6}{4} = 1.5$

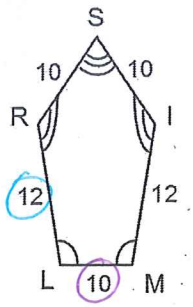
$\frac{7.5}{5} = 1.5$

- All same so sides proportional

$\Delta SIM \sim \Delta LRA$

b)





Angles: A are ≅

Sides: $\frac{8}{10} = 0.8$

$\frac{10}{12} = 0.83$

- Not same so sides are not proportional

∴ Not similar

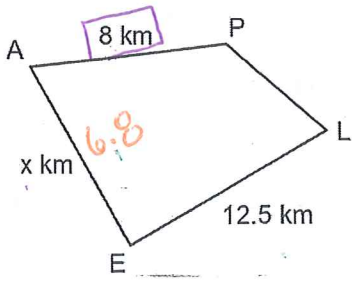
- The ratio of the lengths of two corresponding sides of similar polygons is called the scale factor.

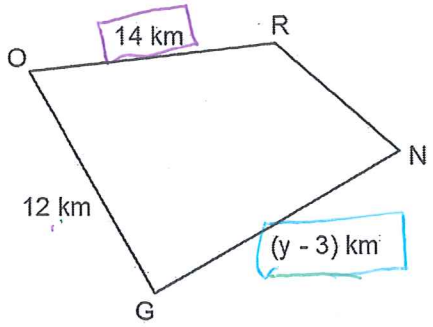
Ex 2 - What is the scale factor of a 9 inch model of the Statue of Liberty and the actual 305 foot Statue of Liberty?

Scale Factor = $\frac{9 \text{ inches}}{305 \text{ Ft}} = \frac{9 \text{ inches}}{3{,}660 \text{ inches}} = \frac{3}{1220} \approx 0.00246$

×12

Ex 3 - Assume the quadrilaterals below are similar. First, write a similarity statement. Then find x, y, and GN. Finally, find the scale factor of the larger quadrilateral to the smaller quadrilateral.





$\triangle APLE \sim \triangle ORNG$

$\frac{8}{14} = \frac{x}{12}$

$14 \cdot x = 8 \cdot 12$

$\frac{14x}{14} = \frac{96}{14}$

$x = 6.8$

$\frac{8}{14} = \frac{12.5}{(y-3)}$

$8(y-3) = 175$

$8y - 24 = 175$

$+24 \quad +24$

$8y = 199$

$y = 24.9$

GN

$y - 3$

$24.9 - 3$

21.9

Scale factor $= \frac{14}{8}$

$= 1.75$

Ex 4 - $\triangle MAT \sim \triangle RIX$ with a scale factor of 3/5. If the lengths of the sides of $\triangle MAT$ are 24, 36, and ~~60~~ 51 yards, what are the lengths of the sides of $\triangle RIX$?

$\frac{3}{5} = \frac{24}{r}$

$3r = 120$

$r = 40$

$\frac{3}{5} = \frac{36}{i}$

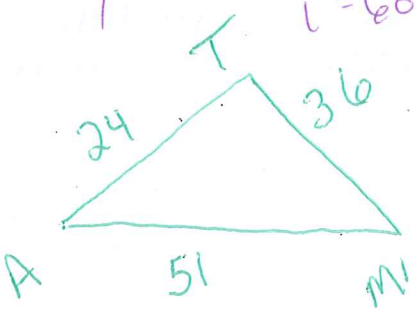
$3i = 180$

$i = 60$

$\frac{3}{5} = \frac{51}{x}$

$\frac{3x}{3} = \frac{255}{3}$

$x = 85$



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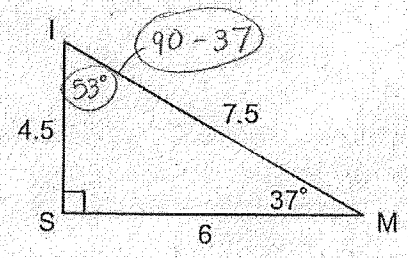
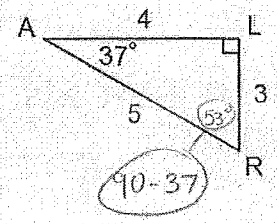




Angles:
- All are ≅

Sides:

$\frac{4.5}{3} = 1.5$

$\frac{6}{4} = 1.5$

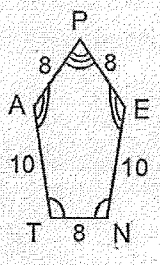
$\frac{7.5}{5} = 1.5$

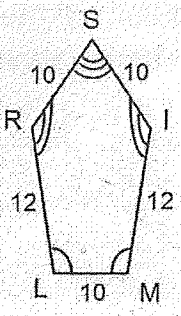
All same, so sides proportional

Must compare matching sides!

∴ $\triangle SIM \sim \triangle LRA$

b)





Angles: All are ≅

Sides: $\frac{8}{10} = \frac{4}{5}$

$\frac{10}{12} = \frac{5}{6}$

Not same, so sides are not proportional

∴ not similar

- The ratio of the lengths of two corresponding sides of similar polygons is called the scale factor.

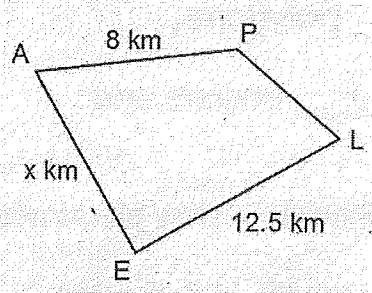
Ex 2 - What is the scale factor of a 9 inch model of the Statue of Liberty and the actual 305 foot Statue of Liberty?

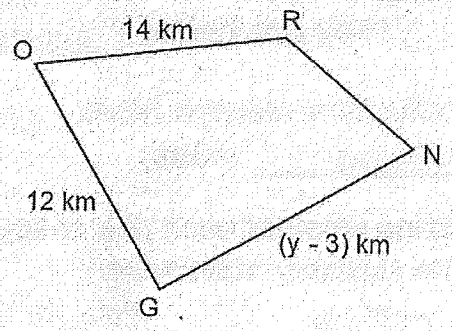
$$\text{scale factor} = \frac{9 \text{ inches}}{305 \text{ feet}} = \frac{9 \text{ in}}{3660 \text{ in}} = \frac{3}{1220} \approx 0.00246$$

(×12)

Units must be the same!

Ex 3 - Assume the quadrilaterals below are similar. First, write a similarity statement. Then find x, y, and GN. Finally, find the scale factor of the larger quadrilateral to the smaller quadrilateral.





$\triangle APLE \sim \triangle ORNG$

$\frac{8}{14} = \frac{x}{12}$

$\frac{14x}{14} = \frac{96}{14}$

$x = \frac{48}{7} = 6\frac{6}{7}$

$\frac{8}{14} = \frac{12.5}{(y-3)}$

$8(y-3) = 175$

$8y - 24 = 175$

$+24 \quad +24$

$\frac{8y}{8} = \frac{199}{8}$ → $y = \frac{199}{8} = 24\frac{7}{8}$

$GN = 24\frac{7}{8} - 3$

$GN = 21\frac{7}{8} = \frac{175}{8}$

Scale factor $= \frac{14}{8} = \frac{7}{4}$

Ex 4 - $\triangle MAT \sim \triangle RIX$ with a scale factor of 3/5. If the lengths of the sides of $\triangle MAT$ are 24, 36, and ~~60~~ 51 yards, what are the lengths of the sides of $\triangle RIX$?

$\triangle MAT \rightarrow \frac{3}{5} = \frac{24}{r}$

$\triangle RIX \rightarrow$

$\frac{3r}{3} = \frac{120}{3}$

$r = 40$ yds

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$\frac{3}{5} = \frac{51}{x}$

$\frac{3x}{3} = \frac{255}{3}$

$x = 85$ yds