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Similar Polygons

Geometry

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Objectives/Assignment

- Identify similar polygons
- Use similar polygons to solve real-life problems, such as making an enlargement similar to an original photo.

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Identifying similar polygons

- When there is a correspondence between two polygons such that their corresponding angles are congruent and the lengths of corresponding sides are proportional the two polygons are called similar polygons.
- In the next slide, ABCD is similar to EFGH. The symbol ~ is used to indicate similarity. So, ABCD ~ EFGH.

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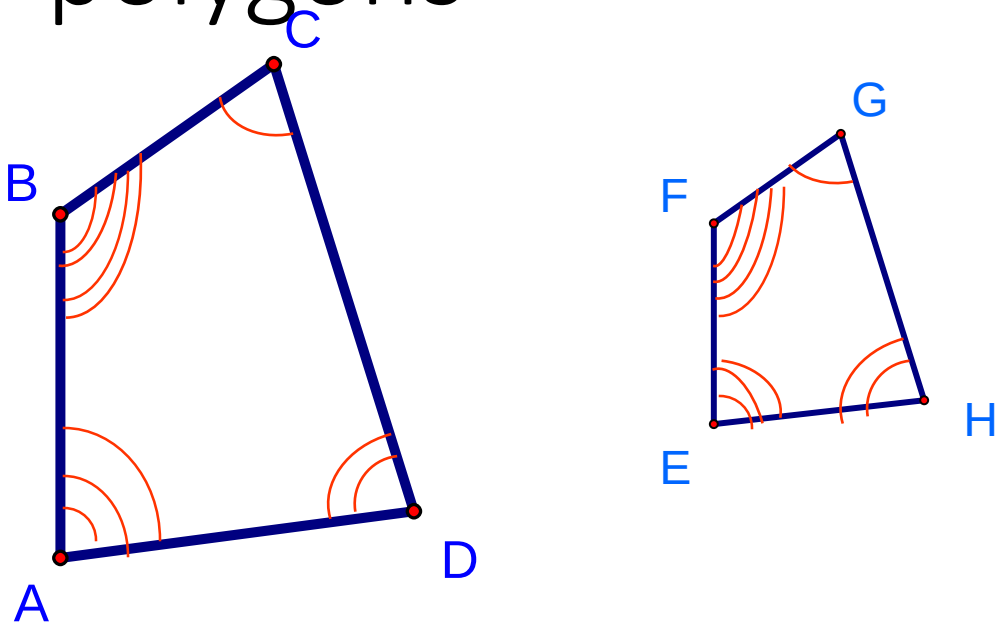
Similar polygons



$$\frac{AB}{EF} = \frac{BC}{FG} = \frac{CD}{GH} = \frac{DA}{HE}$$

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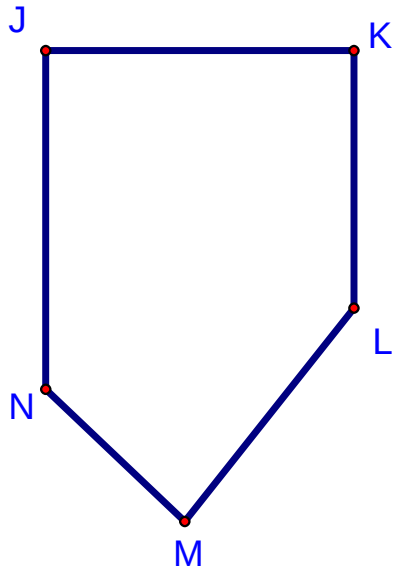
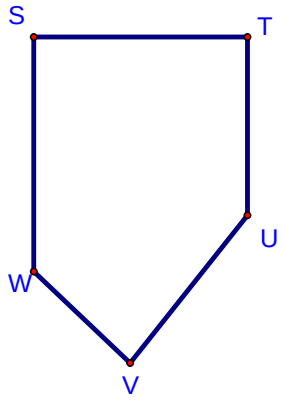
Ex. 1: Writing Similarity Statements

- Pentagons JKLMN and STUVW are similar. List all the pairs of congruent angles. Write the ratios of the corresponding sides in a statement of proportionality.





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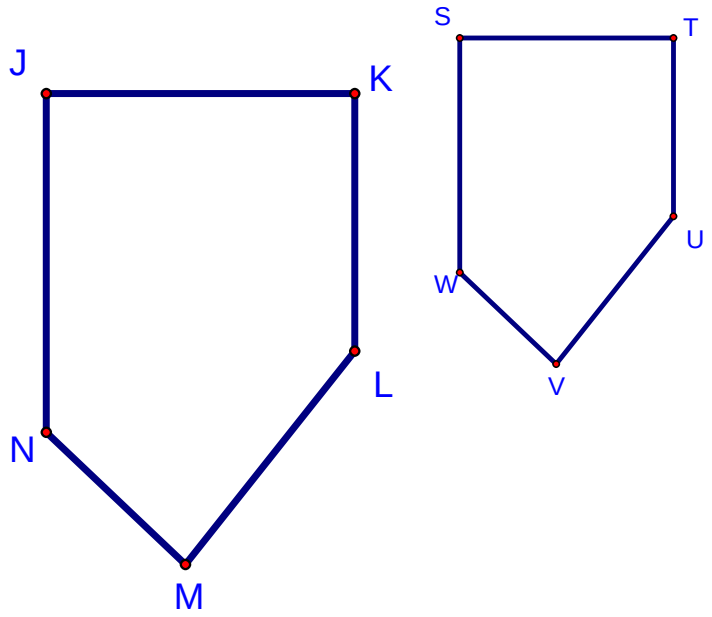
Ex. 1: Writing Similarity Statements



Because JKLMN ~ STUVW, you can write $\angle J \cong \angle S$, $\angle K \cong \angle T$, $\angle L \cong \angle U$, $\angle M \cong \angle V$ AND $\angle N \cong \angle W$.

You can write the proportionality statement as follows:

$$\frac{JK}{ST} = \frac{KL}{TU} = \frac{LM}{UV} = \frac{MN}{VW} = \frac{NJ}{WS}$$

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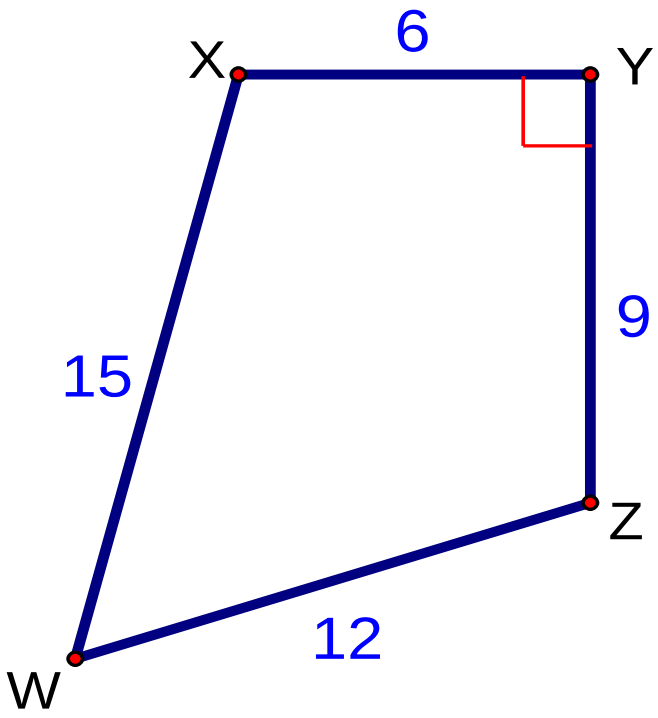
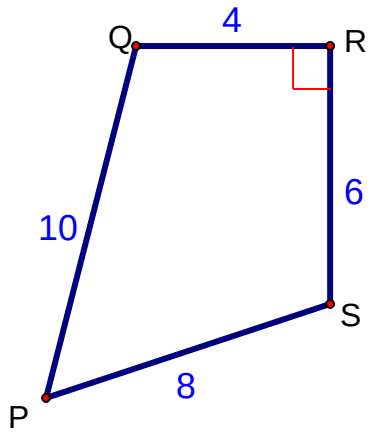
Ex. 2: Comparing Similar Polygons

- Decide whether the figures are similar. If they are similar, write a similarity statement.





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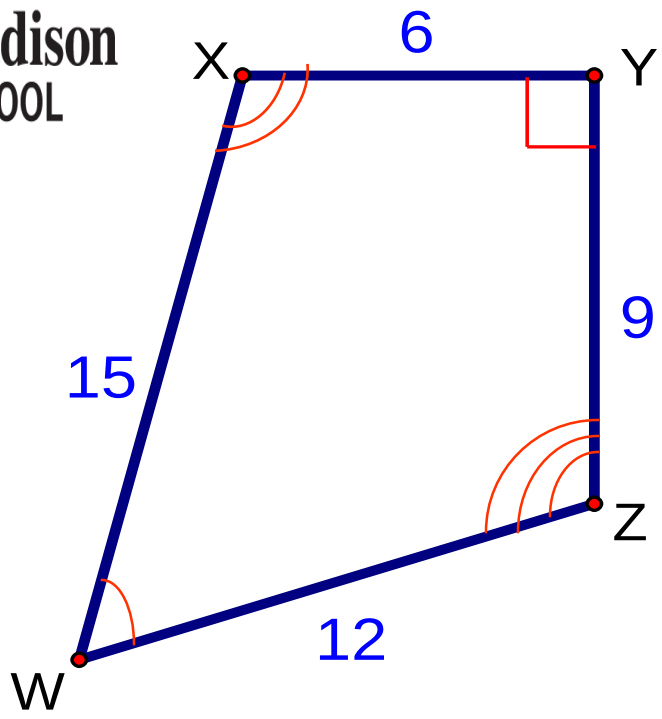

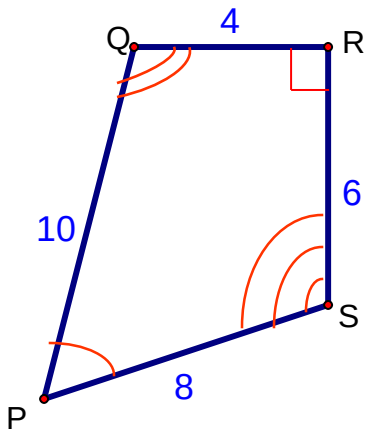

SOLUTION:

As shown, the corresponding angles of WXYZ and PQRS are congruent. Also, the corresponding side lengths are proportional.

$$\frac{WX}{PQ} = \frac{15}{10} = \frac{3}{2}$$

$$\frac{XY}{QR} = \frac{6}{4} = \frac{3}{2}$$

$$\frac{YZ}{RS} = \frac{9}{6} = \frac{3}{2}$$

$$\frac{WX}{PQ} = \frac{15}{10} = \frac{3}{2}$$

So, the two figures are similar and you can write WXYZ ~ PQRS.

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Ex. 3: Comparing Photographic Enlargements

- POSTER DESIGN. You have been asked to create a poster to advertise a field trip to see the Liberty Bell. You have a 3.5 inch by 5 inch photo that you want to enlarge. You want the enlargement to be 16 inches wide. How long will it be?

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Solution:

- To find the length of the enlargement, you can compare the enlargement to the original measurements of the photo.

$$\frac{16 \text{ in.}}{3.5 \text{ in.}} = \frac{x \text{ in.}}{5 \text{ in.}}$$

$$x = \frac{16}{3.5} \cdot 5$$

$$x \approx 22.9 \text{ inches}$$

The length of the enlargement will be about 23 inches.

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Using similar polygons in real life

- If two polygons are similar, then the ratio of lengths of two corresponding sides is called the scale factor. In Example 2 on the previous page, the common ratio of $\frac{3}{2}$ is the scale factor of WXYZ to PQRS.

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Ex. 4: Using similar polygons

- The rectangular patio around a pool is similar to the pool as shown. Calculate the scale factor of the patio to the pool, and find the ratio of their perimeters.

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- Because the rectangles are similar, the scale factor of the patio to the pool is 48 ft: 32 ft. , which is 3:2 in simplified form.
- The perimeter of the patio is 2(24) + 2(48) = 144 feet and the perimeter of the pool is 2(16) + 2(32) = 96 feet The ratio of the perimeters is

$$\frac{144}{96}, \text{ or } \frac{3}{2}$$

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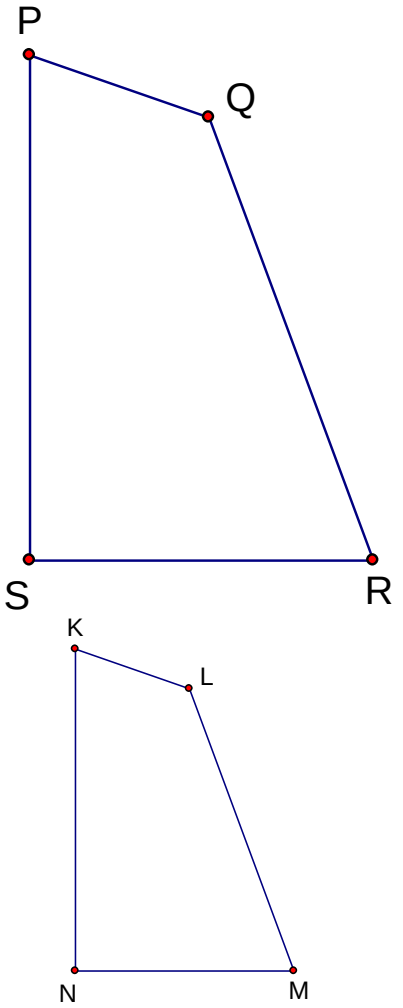
- Theorem : If two polygons are similar, then the ratio of their perimeters is equal to the ratios of their corresponding parts.
- If KLMN ~ PQRS, then

$$\frac{KL + LM + MN + NK}{PQ + QR + RS + SP} =$$

$$\frac{KL}{PQ} = \frac{LM}{QR} = \frac{MN}{RS} = \frac{NK}{SP}$$



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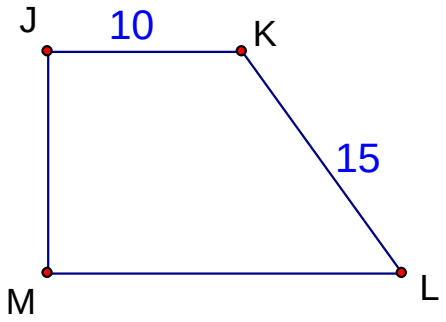
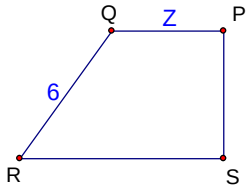
Ex. 5: Using Similar Polygons

- Quadrilateral JKLM is similar to PQRS. Find the value of z.





Set up a proportion that contains PQ

$$\frac{KL}{QR} = \frac{JK}{PQ}$$ Write the proportion.

$$\frac{15}{6} = \frac{10}{Z}$$ Substitute

$Z = 4$ Cross multiply and divide by 15.