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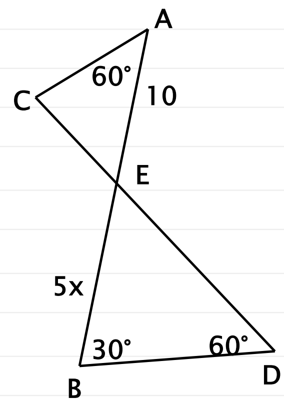
Chapter 07: Similar Polygons
Unit 1: Ratio, Proportion, and Similarity
Section 1: Ratio and Proportion

The **ratio** of a to b means a/b.
For example,
the ratio of 4 to 6 (or 4:6) is $\frac{4}{6}$; the ratio of x to y (or x:y) is $\frac{x}{y}$

A **proportion** is an equation that two ratios are equal.
For example,
the proportion of a:b=c:d is same as $\frac{a}{b} = \frac{c}{d}$



Example

1. See the diagram.
   a. Find the ratio of AE to BE.
   b. Find the ratio of the largest angle of triangle ACE to the smallest angle of triangle DBE.
2. A rectangular field has a length of one kilometer and a width of 300 meters. Find the ratio of the length to the width.
3. A telephone pole 7 meters is divided into the ratio of 3:2. Find the lengths.

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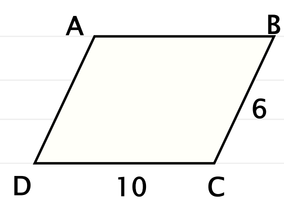
Practice

ABCD is a parallelogram. Find each ratio.



1. AB:BC
2. BC:AD
3. $m\angle A : m\angle C$
4. AB:perimeter of ABCD

5–7: x=2 and y=3. Write each ratio in simplest form.

5. x to y
6. $6x^2$ to 12xy
7. $\frac{y-x}{x}$

Write each algebraic ratio in simplest form.

8. $\frac{6a^2}{12abc}$
9. $\frac{2(a-b)}{3a-3b}$

Notes

Chapter 07: Similar Polygons
Unit 1: Ratio, Proportion, and Similarity
Section 2: Properties of Proportions

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Properties of Proportions

1. $\frac{a}{b}=\frac{c}{d}$ is equivalent to
   a. $ad=bc$ b. $\frac{a}{c}=\frac{b}{d}$ c. $\frac{b}{a}=\frac{d}{c}$ d. $\frac{a+b}{b}=\frac{c+d}{d}$

2. If $\frac{a}{b}=\frac{c}{d}=\frac{e}{f}=\ldots$, then $\frac{a+c+e+\ldots}{b+d+f+\ldots}=\frac{a}{b}=\ldots$

NOTE: a & d are called extremes and b & c are called means. 1a is called the means-extremes multiplication property

__Example__

Use the proportion $\frac{a}{b}=\frac{3}{5}$ to complete each statement.

1. $5a=$

2. $\frac{5}{b}=$

3. $\frac{a+b}{b}=$

4. $\frac{5}{3}=$

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__Practice__

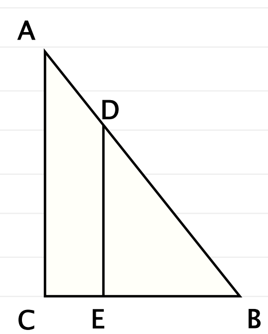
1. If $\frac{x}{7}=\frac{4}{2}$, then $2x=$

2. If $2x=3y$, then $\frac{2}{3}=$

3. If $\frac{x}{7}=\frac{4}{2}$, then $\frac{x+7}{7}=$

4. If $\frac{x}{3}=\frac{y-2}{2}$, then $\frac{x+3}{3}=$

In the figure, $\frac{AD}{DB}=\frac{CE}{EB}$



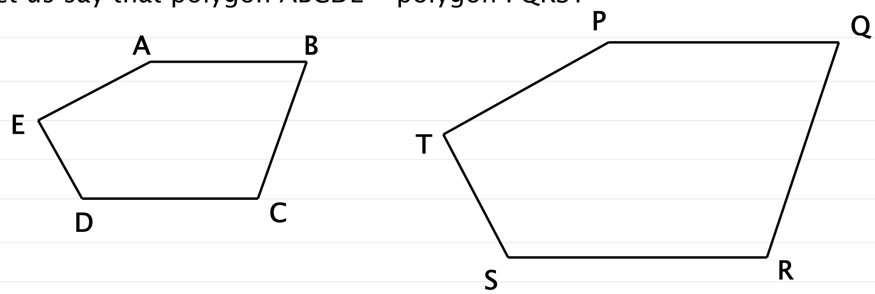
5. If CE=2, EB=6, and AD=3, then DB=

6. If AB=10, DB=8, and CB=7.5, then EB=

Two polygons are **similar** (denoted ~) if their vertices can be paired so that:

- Corresponding angles are congruent
- Corresponding sides are in proportion.

Let us say that polygon ABCDE ~ polygon PQRST



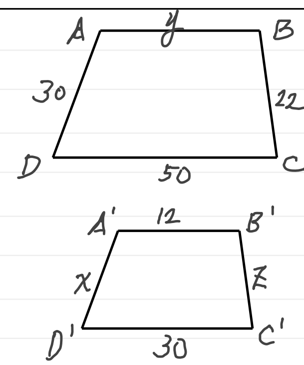
From the definition of similar polygons, we have: (complete the list)

(1) ∠A≅∠P, ∠__≅∠___ , ∠__≅∠___ , ∠__≅∠___ , and ∠__≅∠___.

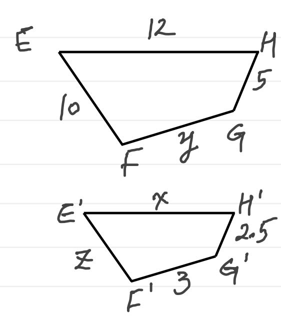
(2) $\frac{PQ}{AB} = \frac{\quad}{\quad} = \frac{\quad}{\quad} = \frac{\quad}{\quad} = \frac{\quad}{\quad}$

Example

1. Quadrilateral ABCD ~ quadrilateral A'B'C'D'.
   a. find their scale factor
   b. the values of x, y, and z
   c. the ratio of the perimeter



2. Quadrilateral EFGH ~ quadrilateral E'F'G'H'
   a. find their scale factor
   b. the values of x, y, and z
   c. the ratio of the perimeter



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Unit 1: Ratio, Proportion, and Similarity
Section 3: Similar Polygons

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Practice

1. Quadrilateral ABCD ~ quadrilateral EFGH.

   a. m∠E=______

   b. m∠G=______

   c. m∠B=______

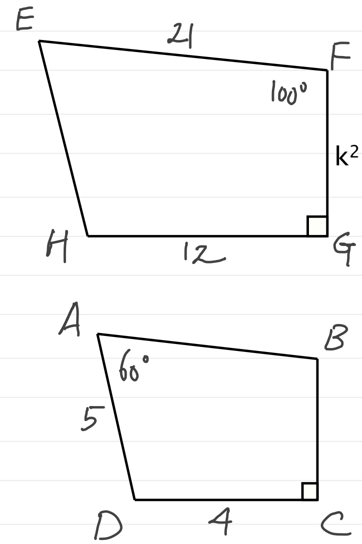
   d. If m∠D=110, then m∠H=______

   e. The scale factor is ________

   f. EH=

   g. BC=

   h. AB=



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Chapter 07: Similar Polygons
Unit 2: Working with Similar Triangles
Section 4: A Postulate for Similar Triangles

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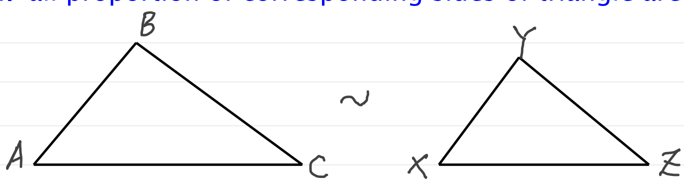
Definition

Two triangles are **similar** if and only if,

1. all corresponding angle of two triangles are congruent, and
2. all proportion of corresponding sides of triangle are equal.



Postulate 15 (AA Similarity Triangle)

If two angles of one triangle are congruent to two angles of another triangle, then the triangles are similar.

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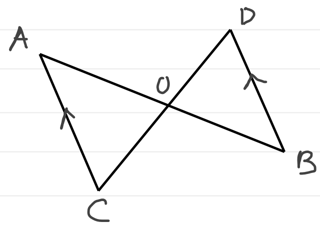
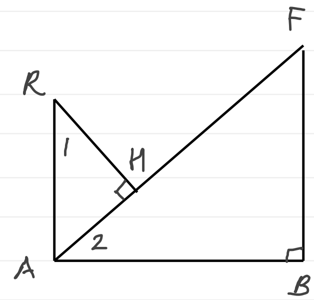
Example

1. Given: $\overline{AC} \parallel \overline{BD}$.
   Prove: $\triangle AOC \sim \triangle BOD$.
   (Provide the reasons for each step.)
   1. $\overline{AC} \parallel \overline{BD}$
   2. $\angle A \cong \angle B$; $\angle C \cong \angle D$
   3. $\triangle AOC \sim \triangle BOD$



2. Given: $\overline{AB} \perp \overline{BF}$; $\overline{RH} \perp \overline{AH}$; $\angle 1 \cong \angle 2$.
   Prove: $HR \cdot BF = BA \cdot HA$
   (Provide the reasons for each step.)
   1. $\overline{AB} \perp \overline{BF}$; $\overline{RH} \perp \overline{AH}$; $\angle 1 \cong \angle 2$
   2. $\angle RHA \cong \angle FBA$
   3. $\triangle RHA \sim \triangle ABF$
   4. $\frac{HA}{BF} = \frac{HR}{BA}$
   5. $HR \cdot BF = BA \cdot HA$



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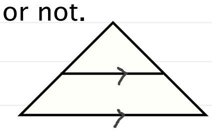
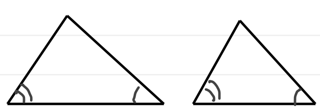
Practice

Tell whether each triangles are similar or not.

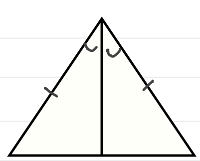
1.



2.



3.



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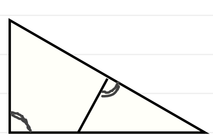
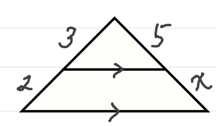
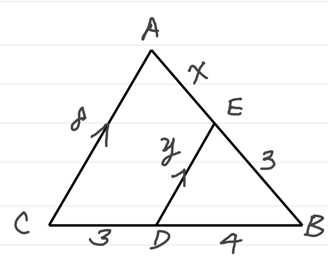


Find the value of x.

5.



6.



a. $\triangle ABC \sim$

b. y=

c. $\frac{BE}{BA} =$, so x=

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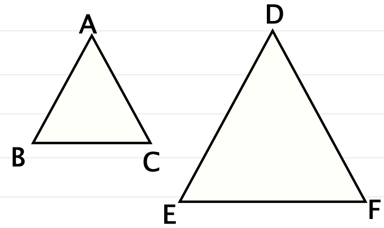
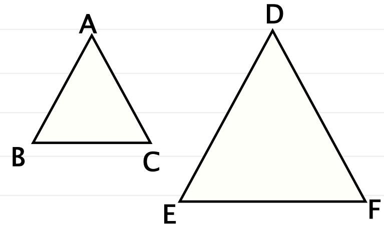
Theorem 7.1 (SAS Similarity Theorem)

If an angle of one triangle is congruent to an angle of another triangle and the sides including those angles are in proportion, then the triangles are similar.



Theorem 7.2 (SSS Similarity Theorem)

If the sides of two triangles are in proportion, then the triangles are similar.



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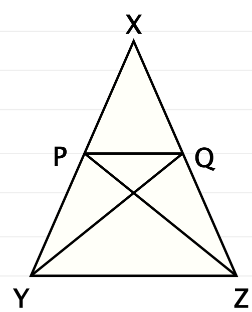
Example

1. The measures of the sides of △ ABC are 4, 5, and 7, and the measures of the sides of △ XYZ are 16, 20, and 28. Are the triangle similar? If so, justify. If not, why not?

2. In △ABC, AB=2, AC=5, and BC=6. In △XYZ, XY=2.5, YZ=2, and XZ=3. Is △ABC ~ △XYZ? If so, justify. If not, why not?

3. If △XYQ ~ △XZP, does it follow that △XPQ~△XZY?



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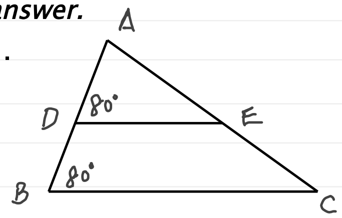
Chapter 07: Similar Polygons
Unit 2: Working with Similar Triangles
Section 5: Theorems for Similar Triangles

PRACTICE

Name similar triangles and state the postulate or theorem that justifies your answer.

1.



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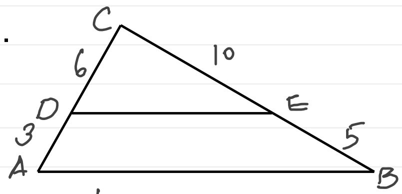
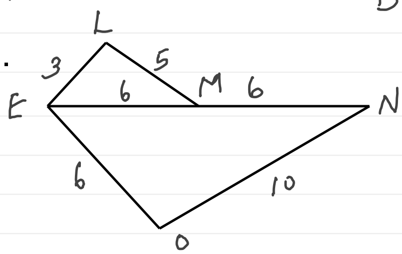


3.



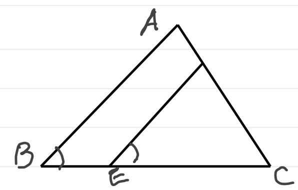
4. If △ABC~△DEF, does the segment AB correspond to the segment DE?

   Does the segment BC correspond to segment EF?

   Does the segment BC correspond to segment EF?

5. Given: ∠B≅∠DEC

   Prove: △ABC~△DEC



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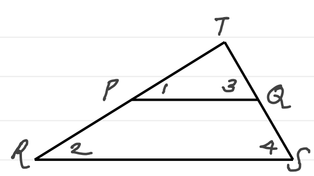
Chapter 07: Similar Polygons
Unit 2: Working with Similar Triangles
Section 6: Proportional Lengths

Theorem 7.3 (Triangle Proportionality Theorem)

If a line parallel to one side of a triangle intersects the other two sides, then it divides those sides proportionally.

Given: △RST; $\overleftrightarrow{PQ} \parallel \overline{RS}$

Prove: $\frac{RP}{PT} = \frac{SQ}{QT}$



Statements	*Reasons*

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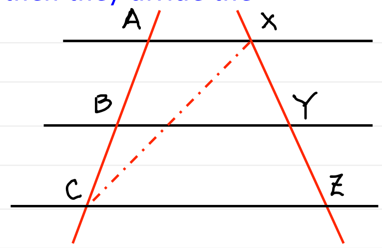
Corollary

If three parallel lines intersect two transversals, then they divide the transversals proportionally.

Given: $\overline{AX} \parallel \overline{BY} \parallel \overline{CZ}$

Prove: $\frac{AB}{BC} = \frac{XY}{YZ}$

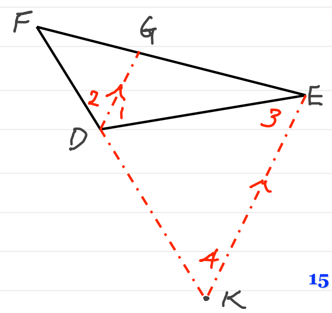


Theorem 7.3 (Triangle Angle-Bisector Theorem)

If a ray bisects an angle of a triangle, then it divides the opposite side into segments proportional to the other two sides.

Given: $\triangle DEF$; DG bisects $\angle FDE$

Prove: $\frac{GF}{GE} = \frac{DF}{DE}$



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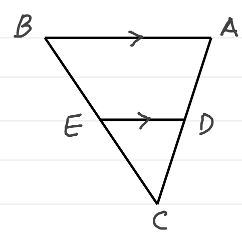
Practice



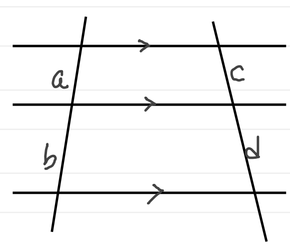
1.

a. $\frac{CD}{DA} =$

b. If CD=3, DA=6, and DE=3.5, then AB=______

c. If CB=12, EB=8, and CD=6, then DA=______

2.



a. If a=2, b=3, and c=5, then d=_______

b. If a=4, b=8, c=5, then c+d=_______

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Section 6: Proportional Lengths

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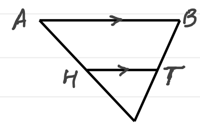
Practice

1. True or false?

a. $\frac{FA}{HA} = \frac{FB}{TB}$ b. $\frac{FT}{FH} = \frac{FB}{FA}$ c. $\frac{FH}{FT} = \frac{HA}{TB}$

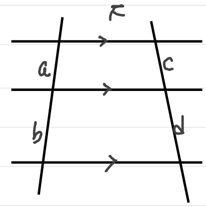
d. $\frac{FA}{FH} = \frac{FT}{TB}$ e. $\frac{FH}{AB} = \frac{AH}{FT}$ f. $\frac{FA}{FB} = \frac{AH}{TB}$



2. True or false?

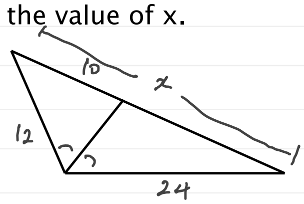
a. $\frac{a}{b} = \frac{c}{d}$ b. $\frac{a}{c} = \frac{c}{d}$

c. $\frac{a}{d} = \frac{c}{b}$ d. $\frac{b}{c} = \frac{a}{d}$



Find the value of x.

3.



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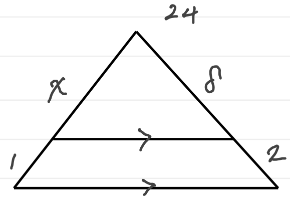

5.