# Chapter 7
# Proportions and Similarity

# Lesson 7.1
# Proportions

1. PROPORTION:
An equation that states that two ratios are equal.

## 2. RATIO:

A comparison of two numbers by division.

A ratio can be expressed (written) in 3 ways:

| | |
|---|---|
| 1. words (to) | 3 to 5 |
| 2. colon (:) | 3 : 5 |
| 3. fraction | 3 / 5 |

# Ratios

**Write each ratio in three ways. Write your answer in simplest form.**

| | |
|---|---|
| 1. ▽▽▽▽▽□□□<br>triangles to total | 2. ○○○○○○○○▽▽<br>circles to triangles |
| 3. ○□□□□□□□□<br>all figures to circle | 4. ▽▽□□□□<br>triangles to squares |
| 5. ○○○▽▽▽<br>triangles to circles | [redacted] |
| 7. ▽▽▽▽▽▽□<br>square to all figures | |
| 9. ▽▽□□□□□<br>squares to total | 10. ○○○○○□□□□<br>total to squares |
| 11. ○○○○○○○▽▽▽<br>circles to total | 12. ○▽▽▽▽▽▽▽<br>circle to triangles |
| 13. ▽□□□□□<br>all figures to triangle | 14. ○○○○○○○○□<br>square to circles |
| 15. ○○○○○▽<br>triangle to circles | 16. ▽▽▽□□□□□□<br>triangles to squares |
| 17. ○○□□□□<br>all figures to circles | 18. ○○○○○○□<br>circles to all figures |
| 19. ○▽▽▽▽▽<br>total to triangles | 20. ▽▽▽□□□□□□□<br>triangles to squares |

3. Means-Extremes Property of Proportions:
Words: In a proportion, the product of the extremes is equal to the product of the means.
(Also called the Cross Product Property)
Symbols: If $a / b = c / d$, then $ad = bc$

The proportion is read "a is to b as c is to d". When the ratios are written in this order, the "a" and "d" are the <u>extremes</u> and the "b" and "c" are the <u>means</u> of the proportions.

4. RECIPORCAL PROPERTY:
If two ratios are equal, then their reciprocals are also equal.

If $a / b = c / d$ , then $b / a = d / c$

If $a / b = c / d$, then $a / c = b / d$

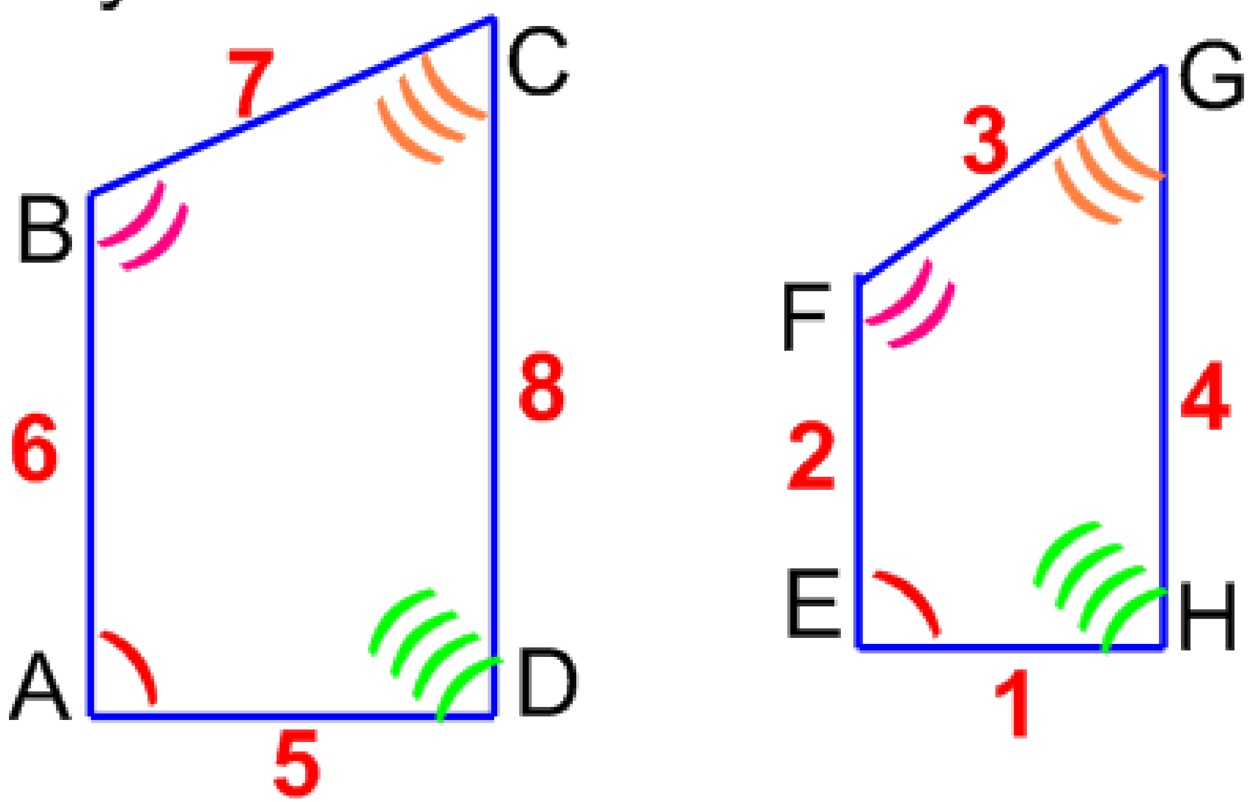
If $a / b = c / d$ , then $(a+b) / b = (c+d) / d$

# Lesson 7.2
# Similar Polygons

1. SIMILAR POLYGONS:

Two polygons are similar if and only if their corresponding angles are congruent and the measures of their corresponding sides are propotrional.

The symbol for "is similar to" is $\sim$



| similarity statement | congruent angles | corresponding sides |
| --- | --- | --- |
| ABCD ~ EFGH | <A ≅ <E<br><B ≅ <F<br><C ≅ <G<br><D ≅ <H | $\frac{AB}{EF}$ = $\frac{BC}{FG}$ = $\frac{CD}{GH}$ = $\frac{DA}{HE}$ = |

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## 2. SCALE FACTOR:

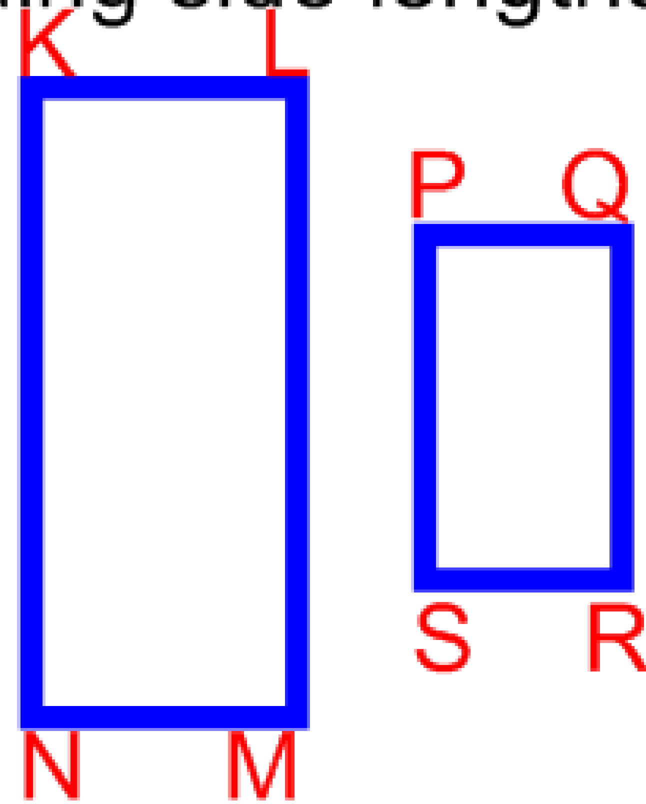
The ratio of the lengths of two corresponding sides of two similar polygons.

Theorem: If two polygons are similar, then the ratio of their perimeters is equal to the ratios of their corresponding side lengths.

If $KLMN \sim PQRS$, then

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

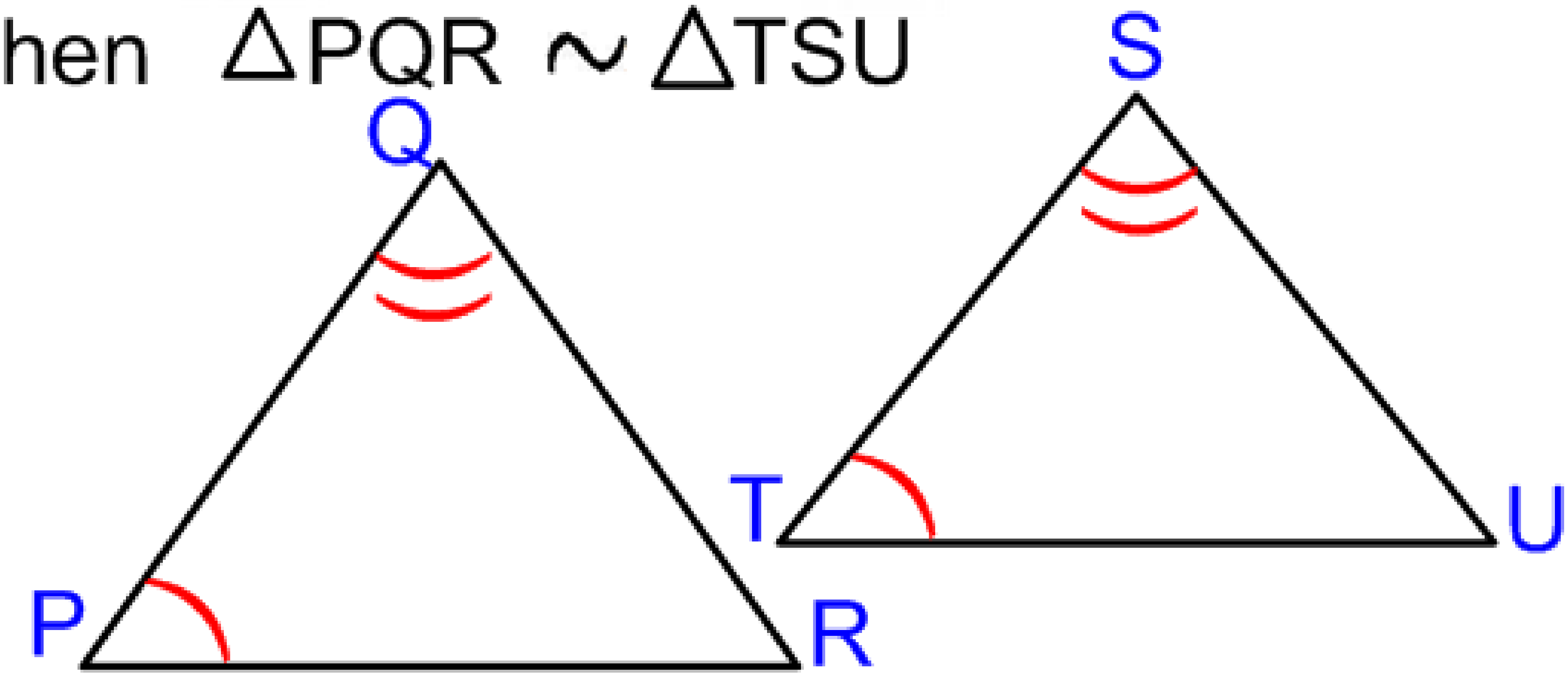
$$\frac{KL}{PQ} = \frac{LM}{QR} = \frac{MN}{RS} = \frac{NK}{SP}$$



# Chapter 7
# Lesson 7.3
## Similar Triangles

ANGLE-ANGLE (AA) SIMILARITY THEOREM:
If the two angles of one triangle are congruent to two angles of another triangle, then the triangles are similar.

If <P ≅ <T and <Q ≅ <S,
then $\triangle PQR \sim \triangle TSU$

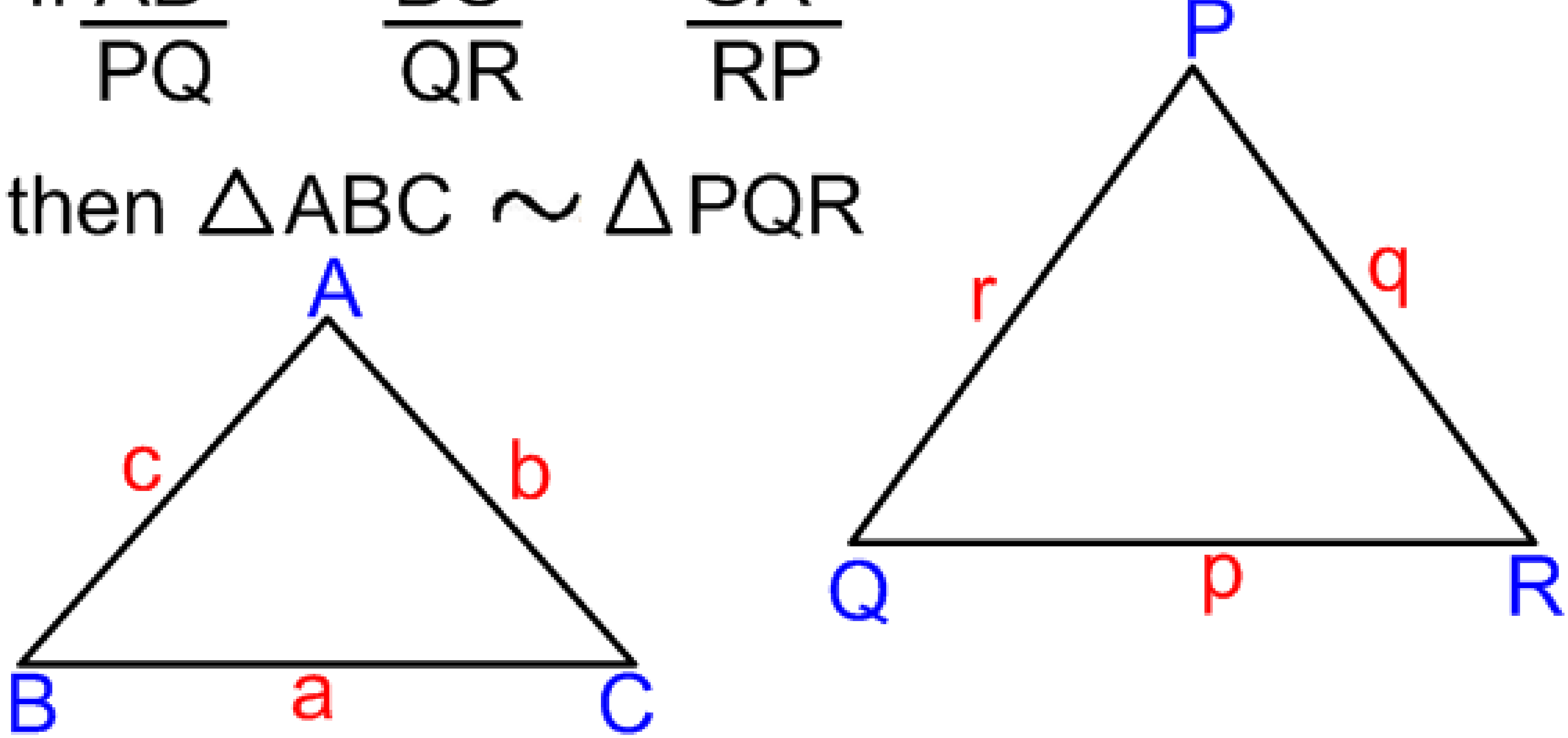


# SIDE-SIDE-SIDE (SSS) SIMILARITY THEOREM:

If the measures of the corresponding sides of two triangles are proportional, then the triangles are similar.

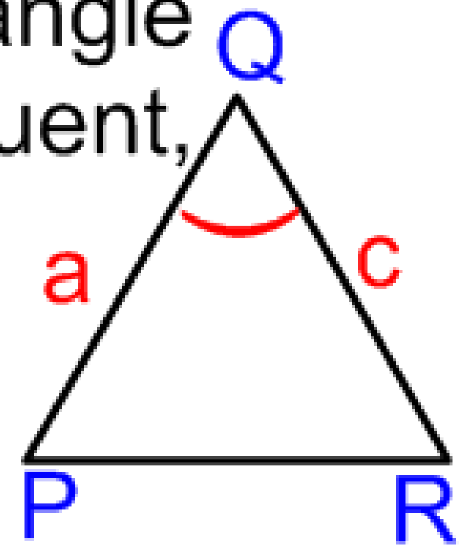
If $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{CA}{RP}$

then $\triangle ABC \sim \triangle PQR$



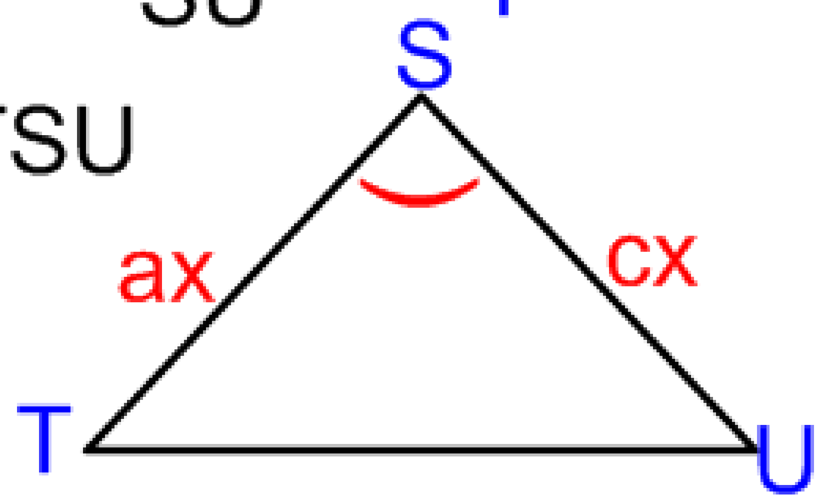
SIDE-ANGLE-SIDE (SAS) SIMILARITY THEOREM:

If the measure of two sides of a triangle are proportional to the measures of two corresponding sides of another triangle and the included angles are congruent, then the triangles are similar.




If $\angle Q \cong \angle S$ and $\frac{PQ}{TS} = \frac{QR}{SU}$

then $\triangle PQR \sim \triangle TSU$

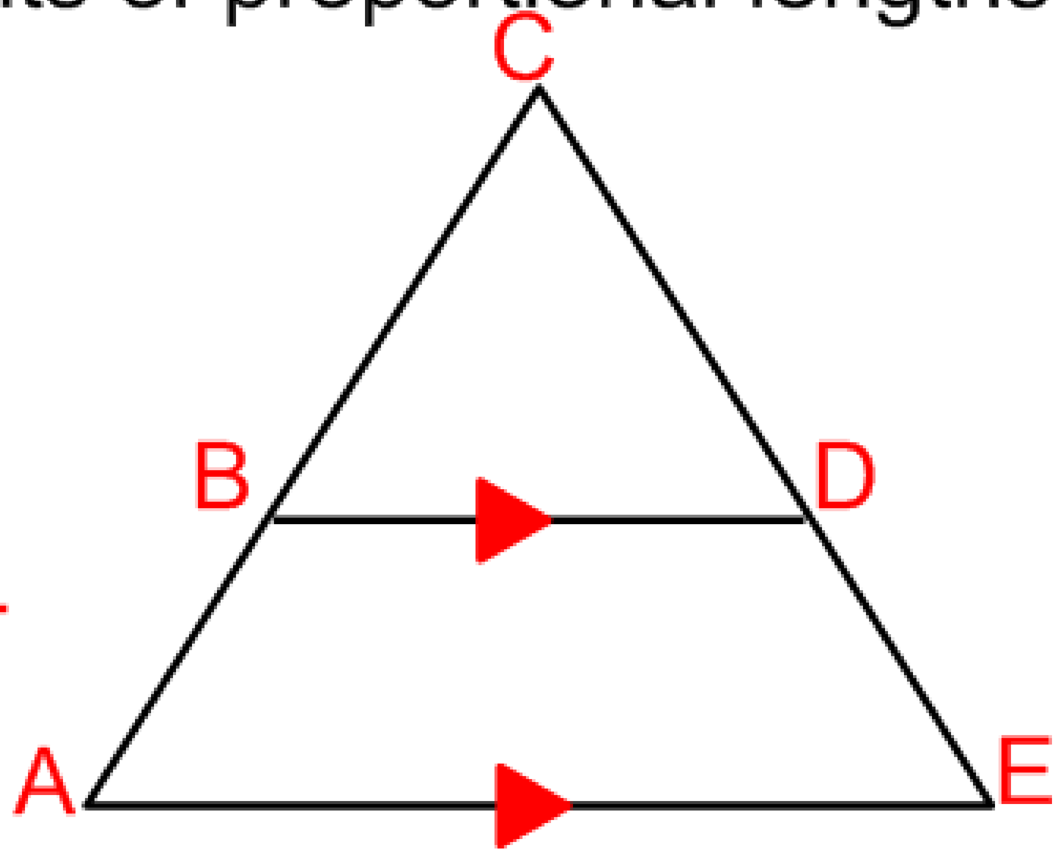


# LESSON 7.4
# PARALLEL LINES AND PROPORTIONAL PARTS

TRIANGLE PROPORTIONALITY THEOREM: If a line is parallel to one side of a triangle and intersects the other two sides in two distinct points, then it seperates these sides into segments of proportional lengths.

If BD // AE

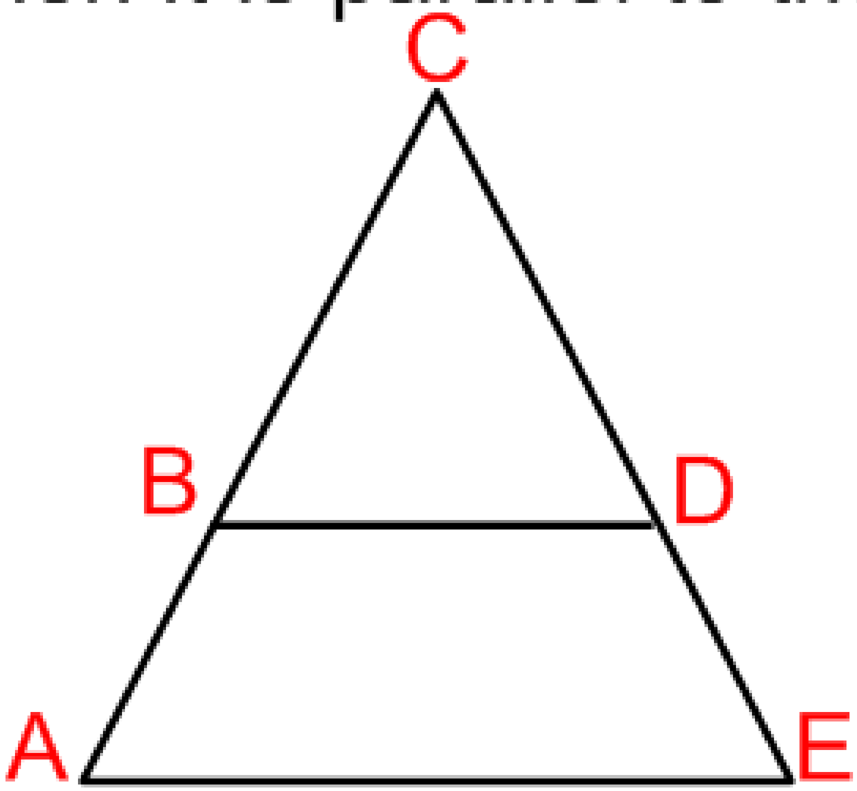
then $\frac{BA}{CB} = \frac{DE}{CD}$



Theorem:

Converse of the triangle ProportionalityTheorem

If a line divides two sides of a triangle proportionally, then it is parallel to the third side.



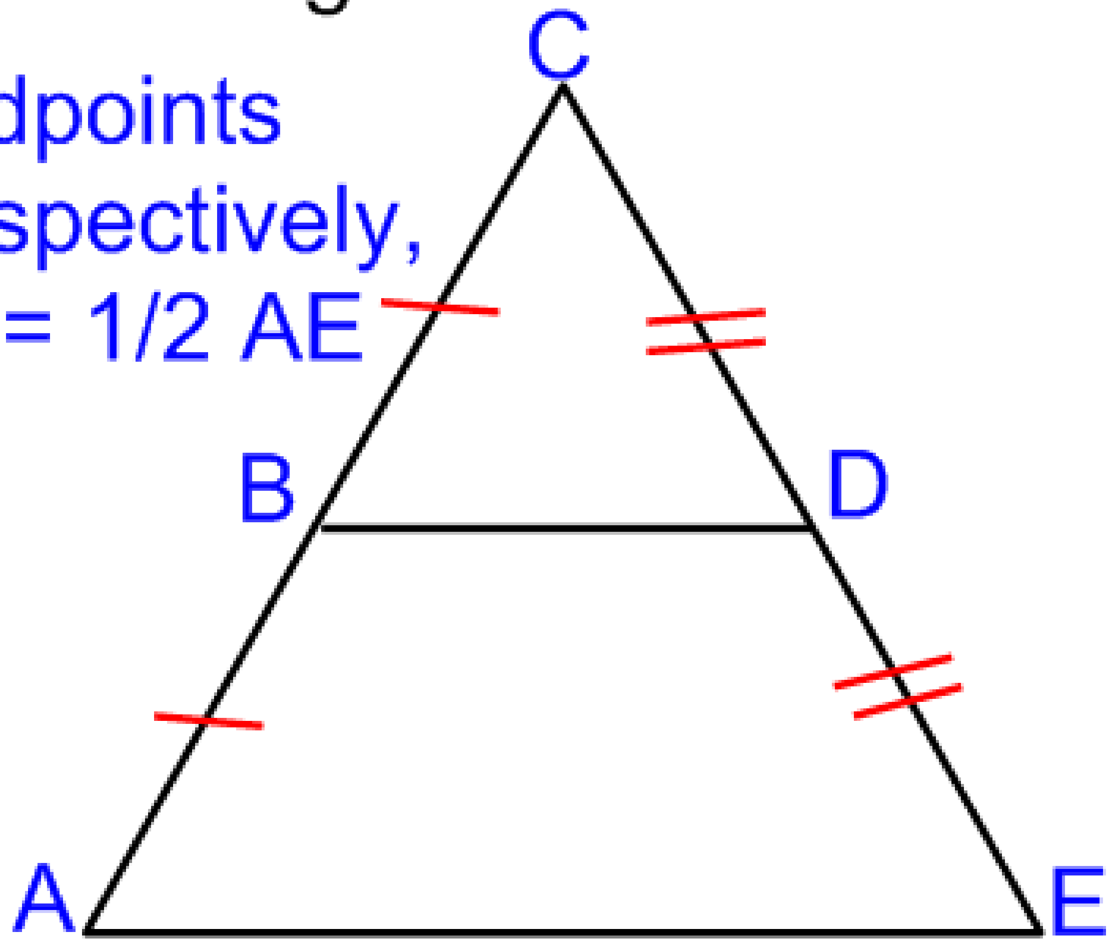

If $\frac{BA}{CB} = \frac{DE}{CD}$

then $\overline{BD} \parallel \overline{AE}$

Theorem: Triangle Midsegment Theorem

A midsegment of a triangle is parallel to one side of the triangle, and its length is one-half the length of that side.

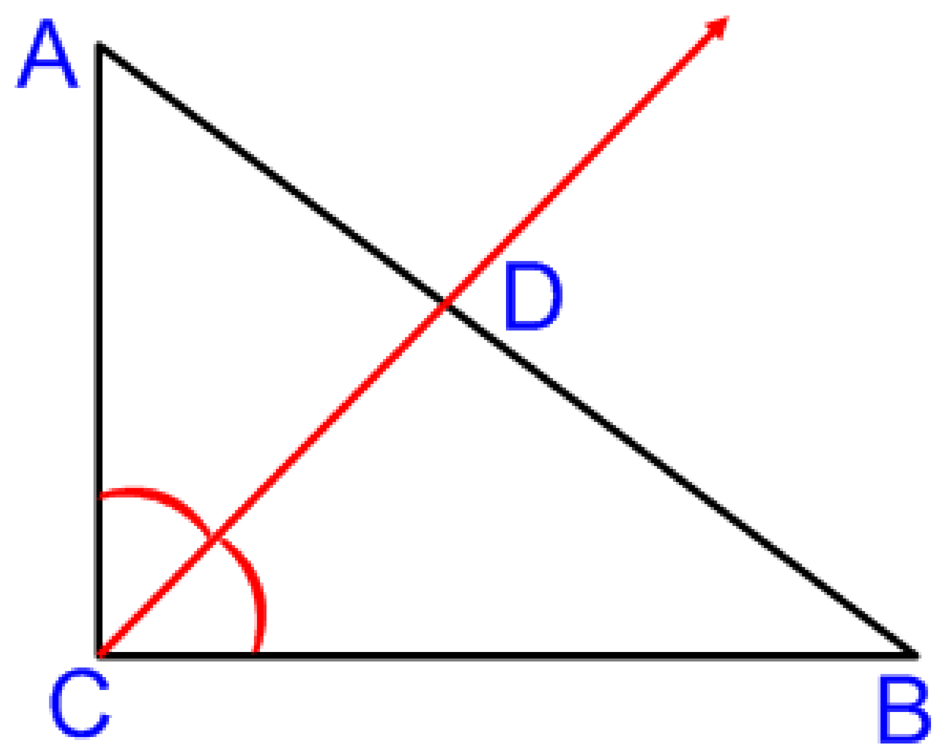
If B and D are midpoints of $\overline{AC}$ and $\overline{EC}$, respectively, $\overline{BD} \parallel \overline{AE}$ and BD = 1/2 AE



Theorem:
If a ray bisects an angle of a triangle, then it divides the opposite side into sements whose are proportional to the lengths of the other two sides.

If $\overrightarrow{CD}$ bisects <ACB, then

$$\frac{AD}{DB} = \frac{CA}{CB}$$



Theorem:

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

If r // s and s // t, the *l* and *m* intersect *r*, *s*, and *t*, then $\frac{UW}{WY} = \frac{VX}{XZ}$