AMDG

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Adv Geo – 8

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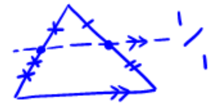
Date M 25 JAN 16

Similar Polygons: Three Theorems Involving Proportions (8.5)

Objective

After studying this section, you will be able to

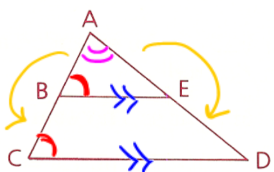
- Apply three theorems frequently used to establish proportionality



Theorem 65 ***If a line is parallel to one side of a triangle and intersects the other two sides, it divides those two sides proportionally. (Side-Splitter Theorem)***

Given: $\overleftrightarrow{BE} \parallel \overleftrightarrow{CD}$

Prove: $\frac{AB}{BC} = \frac{AE}{ED}$

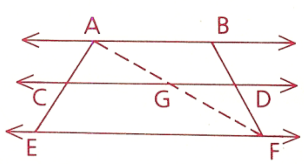


Statements	Reasons
1. $\overleftrightarrow{BE} \parallel \overleftrightarrow{CD}$	1. GIVEN
2. $\angle ABE \cong \angle C$	2. $\parallel \Rightarrow$ CORR. $\angle$s $\cong$
3. $\angle A \cong \angle A$	3. REF
4. $\Delta ABE \sim \Delta ACD$	4. AA~
5. $\frac{AB}{BC} = \frac{AE}{ED}$	5. $\sim\triangle \Rightarrow$ CORR SDS PROP

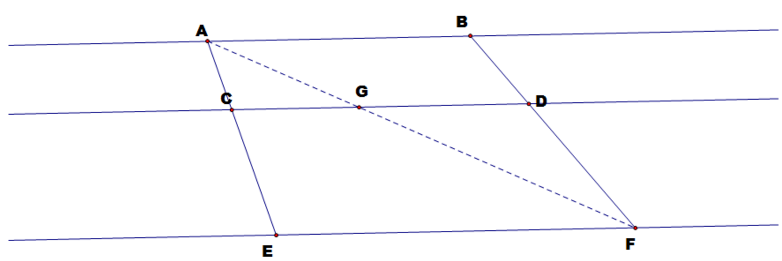
Theorem 66 ***If three or more parallel lines are intersected by two transversals, the parallel lines divide the transversals proportionally.***

Given: $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD} \parallel \overleftrightarrow{EF}$

Conclusion: $\frac{AC}{CE} = \frac{BD}{DF}$



GSP Demo:



TOP	**AC = 2.19 cm**	**AG = 4.96 cm**	**BD = 2.69 cm**
BOTTOM	**CE = 3.99 cm**	**GF = 9.04 cm**	**DF = 4.91 cm**

$\frac{AC}{CE} = 0.55$ $\frac{AG}{GF} = 0.55$ $\frac{BD}{DF} = 0.55$

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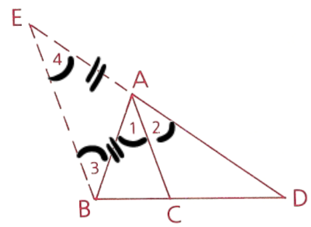
Theorem 67 *If a ray bisects an angle of a triangle, it divides the opposite side into segments that are proportional to the adjacent sides. (Angle Bisector Theorem)*

Given: $\triangle ABD$;
$\overrightarrow{AC}$ bisects $\angle BAD$.

Prove: $\frac{BC}{CD} = \frac{AB}{AD}$



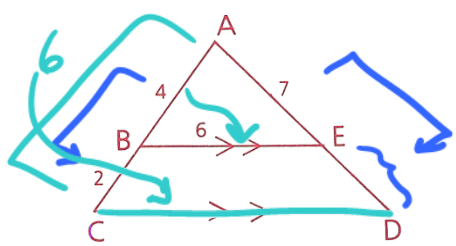
Proof:

1 $\triangle ABD$	1 GIVEN
2 $\overrightarrow{AC}$ bisects $\angle BAD$.	2 GIVEN
3 $\angle 1 \cong \angle 2$	3 BIS $\Rightarrow \cong \angle$S
4 Draw through B the line that is $\parallel$ to $\overline{AC}$.	4 PARALLEL POSTULATE
5 Extend $\overleftrightarrow{DA}$ to intersect the $\parallel$ line at some point E.	5 DEF OF LINE
6 $\frac{BC}{CD} = \frac{EA}{AD}$	6 SIDE-SPLITTER
7 $\angle 1 \cong \angle 3$	7 $\parallel \Rightarrow$ ALT INT $\angle$S $\cong$
8 $\angle 2 \cong \angle 4$	8 $\parallel \Rightarrow$ CORR $\angle$S $\cong$
9 $\angle 3 \cong \angle 4$	9 Trans
10 $\overline{EA} \cong \overline{AB}$	10 $\triangle \Rightarrow \cong$
11 $\frac{BC}{CD} = \frac{AB}{AD}$	11 Substitute

Practice Problems

Problem 1 Given: $\overleftrightarrow{BE} \parallel \overleftrightarrow{CD}$,
lengths as shown

Find: **a** ED
b CD



a) Side Splitter : $\frac{4}{2} = \frac{7}{ED}$, $4ED = 14$, $ED = \frac{7}{2}$

b) $\sim\triangle$s $\Rightarrow$ corr sds prop $\frac{4}{6} = \frac{6}{CD}$, $4CD = 36$, $CD = 9$

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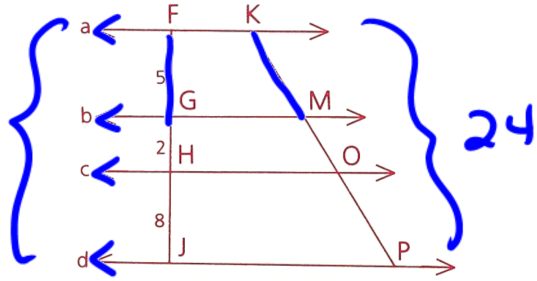
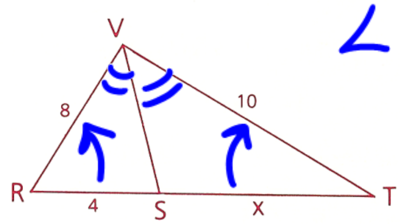
Problem 2 *Given:* a ∥ b ∥ c ∥ d,
lengths as shown,
KP = 24
Find: KM



$$\frac{5}{15} = \frac{KM}{24}$$

$$\frac{1}{3} = \frac{KM}{24}, \quad 3KM = 24, \quad KM = 8$$

Problem 3 *Given:* ∠RVS ≅ ∠SVT,
lengths as shown
Find: ST

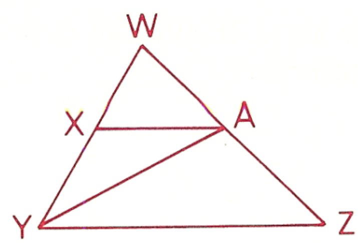


∠ BIS. THM.

$$\frac{4}{8} = \frac{x}{10}, \quad \frac{1}{2} = \frac{x}{10}, \quad x = 5$$

Problem 4 *Given:* $\overleftrightarrow{XA} \parallel \overleftrightarrow{YZ}$, $\angle XAY \cong \angle XYA$

Conclusion: $\dfrac{WX}{XA} = \dfrac{WA}{AZ}$

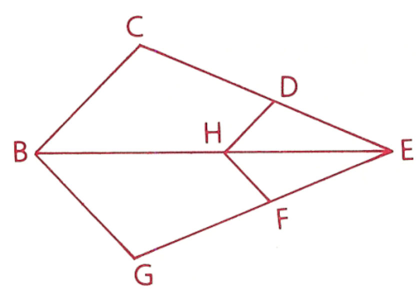


Proof

1 $\overleftrightarrow{XA} \parallel \overleftrightarrow{YZ}$	1
2 $\dfrac{WX}{XY} = \dfrac{WA}{AZ}$	2
3 $\angle XAY \cong \angle XYA$	3
4 $\overline{XA} \cong \overline{XY}$	4
5 $\dfrac{WX}{XA} = \dfrac{WA}{AZ}$	5

Problem 5 *Given:* $\overleftrightarrow{DH} \parallel \overleftrightarrow{BC}$, $\overleftrightarrow{HF} \parallel \overleftrightarrow{BG}$

Prove: $\dfrac{CD}{DE} = \dfrac{GF}{FE}$



Proof

1 $\overleftrightarrow{DH} \parallel \overleftrightarrow{BC}$	1
2 $\dfrac{CD}{DE} = \dfrac{BH}{HE}$	2
3 $\overleftrightarrow{HF} \parallel \overleftrightarrow{BG}$	3
4 $\dfrac{BH}{HE} = \dfrac{GF}{FE}$	4
5 $\dfrac{CD}{DE} = \dfrac{GF}{FE}$	5

10 Given: $\overleftrightarrow{SV} \parallel \overleftrightarrow{RW}$,
$RW = 15$, $RS = 10$,
$ST = 3$, $WV = 8$

Find: SV and VT