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Lesson 2.7 - More Geometry Proofs: Segments, Angles \& Lines
In high school geometry in the US, we do something called a two-column proof, where we are given an initial statement and are asked to prove a conjecture. The left column is labelled "Statements" and the right column is labelled
"Reasons", and we proceed to make statements with the reasoning behind those statements until the conjecture is proven.
I. Given $\frac{2 x-9}{5}=1$, Prove: $\quad x=7$

## STATEMENTS

## REASONS

1. $\frac{2 x-9}{5}=1$
2. $2 x-9=5$
3. $2 x=14$
4. $x=7$
5. Given
6. Multiply 5 on both sides
7. Add 9 to both sides
8. Divide both sides by 2
II. Given $\quad \mathrm{AC}=\mathrm{BD}$, Prove: $\quad \mathrm{AB}=\mathrm{CD}$

## STATEMENTS



REASONS

1. $\mathrm{AC}=\mathrm{BD}$
2. $\mathrm{AC}=\mathrm{AB}+\mathrm{BC}$
$B D=B C+C D$
3. $A B+B C=B C+C D$
4. $\mathrm{AB}=\mathrm{CD}$
III. Given $m \angle 1=m \angle 2 ; m \angle 3=m \angle 4$

Prove: $\quad m \angle A B C=m \angle D E F$

## STATEMENTS

1. $m \angle 1=m \angle 2 ; m \angle 3=m \angle 4$
2. $\angle A B C=\angle 1+\angle 3$
$\angle D E F=\angle 2+\angle 4$
3. $\angle A B C=\angle 2+\angle 4$
4. $\boldsymbol{m} \angle A B C=\boldsymbol{m} \angle D E F$
5. Given
6. Segment Addition Postulate
7. Substitution (Statement 1 \& 2)
8. Subtract BC on both sides


REASONS

1. Given
2. Angle Addition Postulate
3. Substitution (Statement 1 \& 2)
4. Substitution (Statement $2 \& 3$ )
IV. Given $\angle 2 \cong \angle 3$

Prove: $\quad \angle 1 \cong \angle 4$


## STATEMENTS

## REASONS

1. $\angle \mathbf{1} \cong \angle 2$
2. $\angle 2 \cong \angle 3$
3. $\angle 3 \cong \angle 4$
4. $\angle 1 \cong \angle 4$
5. Given
6. Vertical angles are congruent
7. Vertical angles are congruent
8. Substitution (Statements $1,2, \& 3$ )
V. Given $\angle 1$ and $\angle 2$ are complementary Prove: $\quad \overrightarrow{X A} \perp \overrightarrow{X C}$

## STATEMENTS

1. $\angle \mathbf{1}$ and $\angle 2$ are complementary
2. $m \angle 1+m \angle 2=$ $\qquad$
3. $m \angle A X C=m \angle 1+m \angle 2$
4. $m \angle A X C=$ $\qquad$
5. $\angle A X C$ is a right angle.
6. $\overrightarrow{X A} \perp \overrightarrow{X C}$

7. Given
8. Def. of complementary angles.
9. Angle Addition Postulate
10. Substitution
11. Def. of right angle
12. Rays of right angle are perpendicular
VI. Given $\angle 1$ and $\angle 2$ are supplementary Prove: $\quad \angle 3$ and $\angle 4$ are supplementary


## STATEMENTS

1. $\angle 1$ and $\angle 2$ are supplementary.
2. $\angle 1+\angle 2=180^{\circ}$
3. $\angle 1 \cong \angle 3, \angle 4 \cong \angle 2$
4. $\angle 3+\angle 4=180^{\circ}$
5. $\angle 3$ and $\angle 4$ are supplementary.

REASONS

1. Given
2. Def. of supplementary angles
3. Vertical angles are congruent
4. Substitution (Statements $2 \& 3$ )
5. Def. of $\qquad$
$\qquad$
VII. Given $\overline{B D}$ bisects $\angle E B C$

Prove: $\quad \angle 1$ and $\angle 3$ are supplementary

## STATEMENTS

1. $\overline{\boldsymbol{B D}}$ bisects $\angle \boldsymbol{E B C}$
2. $m \angle 1=m \angle 2$
3. $m \angle 2+m \angle 3=180$
4. $m \angle 1+m \angle 3=180$
5. $\angle 1$ and $\angle 3$ are supplementary

## REASONS

1. Given
2. Def. of Angle Bisector
3. Linear Pairs are supplementary
4. Substitution (Statements $1 \& 2$ )
5. Def. of supplementary angles
VIII. Given $\angle F E C$ is right angle Prove: $\quad \angle 1$ and $\angle 4$ are complementary

## STATEMENTS

1. $\angle F E C$ is a right angle.
2. $m \angle F E C=90$
3. $m \angle F E C=m \angle 1+m \angle 2$
4. $m \angle 1+m \angle 2=90$
5. $m \angle 2=m \angle 4$
6. $m \angle 1+m \angle 4=90$
7. $\angle 1$ and $\angle 4$ are complementary
IX. Given $\angle 2 \cong \angle 3$

Prove: $\quad \angle 1 \cong \angle 4$

## STATEMENTS



1. $\angle 2 \cong \angle 3$
2. $m \angle 1+m \angle 2=180$ $m \angle 3+m \angle 4=180$
3. $m \angle 1+m \angle 2=m \angle 3+m \angle 4$
4. $m \angle 1+m \angle 2=m \angle 2+m \angle 4$
5. $m \angle 1=m \angle 4$
6. $\angle 1 \cong \angle 4$

## REASONS

1. Given
2. Linear Pairs are supplementary
3. Substitution (Statement 2 to itself)
4. Substitution (Statements $1 \& 3$ )
5. Subtraction
6. Same measure angles are congruent
