Name: _____ Date: _____ Math 9/10 Honors

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.

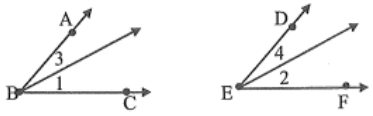
**I.** Given $\frac{2x-9}{5} = 1$, Prove: $x = 7$

| **STATEMENTS** | **REASONS** |
|---|---|
| 1. $\frac{2x-9}{5} = 1$ | 1. Given |
| 2. $2x - 9 = 5$ | 2. Multiply 5 on both sides |
| 3. $2x = 14$ | 3. Add 9 to both sides |
| 4. $x = 7$ | 4. Divide both sides by 2 |

**II.** Given AC = BD, Prove: AB = CD

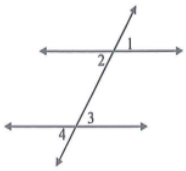

| **STATEMENTS** | **REASONS** |
|---|---|
| 1. $\mathbf{AC = BD}$ | 1. Given |
| 2. $\mathbf{AC = AB + BC}$<br>$\mathbf{BD = BC + CD}$ | 2. Segment Addition Postulate |
| 3. $\mathbf{AB + BC = BC + CD}$ | 3. Substitution (Statement 1 & 2) |
| 4. $\mathbf{AB = CD}$ | 4. Subtract BC on both sides |

**III.** Given $m\angle 1 = m\angle 2;\ m\angle 3 = m\angle 4$
Prove: $m\angle ABC = m\angle DEF$



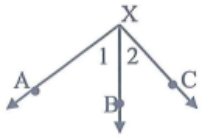

| **STATEMENTS** | **REASONS** |
|---|---|
| 1. $\boldsymbol{m\angle 1 = m\angle 2;\ m\angle 3 = m\angle 4}$ | 1. Given |
| 2. $\angle ABC = \angle 1 + \angle 3$<br>$\angle DEF = \angle 2 + \angle 4$ | 2. Angle Addition Postulate |
| 3. $\angle ABC = \angle 2 + \angle 4$ | 3. Substitution (Statement 1 & 2) |
| 4. $\boldsymbol{m\angle ABC = m\angle DEF}$ | 4. Substitution (Statement 2 & 3) |

**IV.** Given $\angle 2 \cong \angle 3$
Prove: $\angle 1 \cong \angle 4$



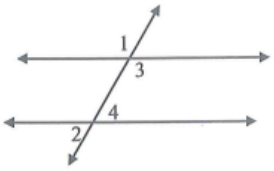

| STATEMENTS | REASONS |
|---|---|
| 1. $\angle \mathbf{1} \cong \angle \mathbf{2}$ | 1. Given |
| 2. $\angle \mathbf{2} \cong \angle \mathbf{3}$ | 2. Vertical angles are congruent |
| 3. $\angle \mathbf{3} \cong \angle \mathbf{4}$ | 3. Vertical angles are congruent |
| 4. $\angle \mathbf{1} \cong \angle \mathbf{4}$ | 4. Substitution (Statements 1, 2, & 3) |

**V.** Given $\angle 1$ and $\angle 2$ are complementary
Prove: $\overrightarrow{XA} \perp \overrightarrow{XC}$




| STATEMENTS | REASONS |
|---|---|
| 1. $\angle \mathbf{1}$ and $\angle \mathbf{2}$ are complementary | 1. Given |
| 2. $\boldsymbol{m\angle 1 + m\angle 2 =}$ _____ | 2. Def. of complementary angles. |
| 3. $\boldsymbol{m\angle AXC = m\angle 1 + m\angle 2}$ | 3. Angle Addition Postulate |
| 4. $\boldsymbol{m\angle AXC =}$ _____ | 4. Substitution |
| 5. $\boldsymbol{\angle AXC}$ is a right angle. | 5. Def. of right angle |
| 6. $\boldsymbol{\overrightarrow{XA} \perp \overrightarrow{XC}}$ | 6. Rays of right angle are perpendicular |

**VI.** Given $\angle 1$ and $\angle 2$ are supplementary
Prove: $\angle 3$ and $\angle 4$ are supplementary

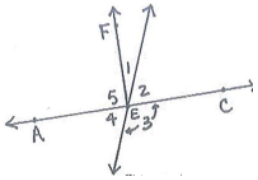



| STATEMENTS | REASONS |
|---|---|
| 1. $\angle \mathbf{1}$ and $\angle \mathbf{2}$ are supplementary. | 1. Given |
| 2. $\boldsymbol{\angle 1 + \angle 2 = 180°}$ | 2. Def. of supplementary angles |
| 3. $\boldsymbol{\angle 1 \cong \angle 3,\ \angle 4 \cong \angle 2}$ | 3. Vertical angles are congruent |
| 4. $\boldsymbol{\angle 3 + \angle 4 = 180°}$ | 4. Substitution (Statements 2 & 3) |
| 5. $\boldsymbol{\angle 3}$ and $\boldsymbol{\angle 4}$ are supplementary. | 5. Def. of _____ |

**VII.** Given $\overline{BD}$ bisects $\angle EBC$
Prove: $\angle 1$ and $\angle 3$ are supplementary

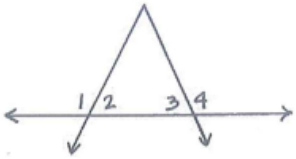
| STATEMENTS | REASONS |
|---|---|
| 1. $\overline{BD}$ bisects $\angle EBC$ | 1. Given |
| 2. $m\angle 1 = m\angle 2$ | 2. Def. of Angle Bisector |
| 3. $m\angle 2 + m\angle 3 = 180$ | 3. Linear Pairs are supplementary |
| 4. $m\angle 1 + m\angle 3 = 180$ | 4. Substitution (Statements 1 & 2) |
| 5. $\angle 1$ and $\angle 3$ are supplementary | 5. Def. of supplementary angles |

**VIII.** Given $\angle FEC$ is right angle
Prove: $\angle 1$ and $\angle 4$ are complementary




| STATEMENTS | REASONS |
|---|---|
| 1. $\angle FEC$ is a right angle. | 1. Given |
| 2. $m\angle FEC = 90$ | 2. Def. of right angle |
| 3. $m\angle FEC = m\angle 1 + m\angle 2$ | 3. Angle Addition Postulate |
| 4. $m\angle 1 + m\angle 2 = 90$ | 4. Substitution (Statements 2 & 3) |
| 5. $m\angle 2 = m\angle 4$ | 5. Vertical angles are congruent |
| 6. $m\angle 1 + m\angle 4 = 90$ | 6. Substitution (Statements 4 & 6) |
| 7. $\angle 1$ and $\angle 4$ are complementary | 7. Def. of complementary angles |

**IX.** Given $\angle 2 \cong \angle 3$
Prove: $\angle 1 \cong \angle 4$




| STATEMENTS | REASONS |
|---|---|
| 1. $\angle 2 \cong \angle 3$ | 1. Given |
| 2. $m\angle 1 + m\angle 2 = 180$<br>$m\angle 3 + m\angle 4 = 180$ | 2. Linear Pairs are supplementary |
| 3. $m\angle 1 + m\angle 2 = m\angle 3 + m\angle 4$ | 3. Substitution (Statement 2 to itself) |
| 4. $m\angle 1 + m\angle 2 = m\angle 2 + m\angle 4$ | 4. Substitution (Statements 1 & 3) |
| 5. $m\angle 1 = m\angle 4$ | 5. Subtraction |
| 6. $\angle 1 \cong \angle 4$ | 6. Same measure angles are congruent |