Relationships: Perpendicular Lines

Definitions:

- A **plane** is a two dimensional geometric object**.** It has infinite length and infinite width but no thickness.

  Parallel lines are lines that lie in the same plane but do not intersect. (Symbol $\|$)

  Perpendicular lines are two lines that meet to form congruent adjacent angles. (Symbol $\perp$)

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Theorem1.6.1: If two lines are perpendicular, then they meet to form right angles.

Given: $\overleftrightarrow{AB} \perp \overleftrightarrow{CD}$ **intersecting at E.**

Prove: $\angle AEC$ **is a right angle**

Statements	Reasons
1. $\overleftrightarrow{AB} \perp \overleftrightarrow{CD}$ **intersecting at E.**	**1.** Given
2. $\angle AEC \cong \angle CEB$	**2.** Perpendicular lines meet to form $\cong$ angles
3. $m\angle AEC = m\angle CEB$	**3.** measures are $\cong$
4. $\angle AEB$ **is a straight angle**	**4.** straight angles measure 180°
5. $m\angle AEC + m\angle CEB = \angle AEB$	**5.** Angle addition postulate
6. $m\angle AEC + m\angle CEB = 180°$	**6.** Substitution
7. $m\angle AEC + m\angle AEC = 180°$ **or** $2(m\angle AEC) = 180°$	**7.** Substitution
8. $m\angle AEC = 90°$	**8.** Division
9. $\angle AEC$ **is a right angle**	**9.** Def of right angle

Table 1.8

Relation	**Object Related**	**Example**
Is equal to	**numbers**	$\mathbf{2 + 3 = 5}$
Is greater than	**numbers**	$\mathbf{7 > 5}$
Is perpendicular to	**lines**	$\boldsymbol{n \perp m}$
Is complementary to	**angles**	$\angle\mathbf{1}$ **is comp to** $\angle\mathbf{2}$
Is congruent to	**line segments**	$\overline{\mathbf{AB}} \equiv \overline{\mathbf{CD}}$
Is a brother	**people**	**Mike is brother of Tom**

Properties:

Relate

Reflexive property: aRa (5 = 5, equality of numbers has a reflexive property).

Symmetric property: If aRb, then bRa. (If $\boldsymbol{n \perp m}$, then $\boldsymbol{m \perp n}$, perpendicular lines have the symmetric property). '<' $2 < 3$ True $3 < 2$ False '<' Symmetric

Transitive property: If aRb and bRc, then aRc, (If $\mathbf{m\angle 1 \equiv m\angle 2}$ and $\mathbf{m\angle 2 \equiv m\angle 3}$, then $\mathbf{m\angle 1 \equiv m\angle 3}$, congruence of angle is transitive).

Example 2: Given the line segment A B C D E

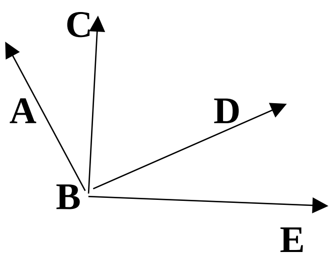
a. **An example of reflexive property:** AB = AB / BC = BC / CD = CD

b. **An example of the transitive property:** suppose AB = CD CD = DE
∴ AB = DE

c. **An example of the symmetric property:** AB = BA

Example 3: **Given: $\angle ABC$ and $\angle CBD$ are complementary, $\angle CBD$ and $\angle DBE$ are complements.**

Use transitive property to show that $\angle ABC \cong \angle DBE$



(a) $m\angle ABC + m\angle CBD = 90^\circ$ (b)

(c) $m\angle CBD + m\angle DBE = 90^\circ$ (b)

$m\angle ABC + m\angle CBD = m\angle CBD + m\angle DBE$

Transitive prop

$\left.\begin{array}{l} a = b \\ c = b \end{array}\right\} \Rightarrow a = c$

$\therefore\ m\angle ABC = m\angle DBE$

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