# Introduction to Geometric Proof

**Properties of Equality**

| | |
|---|---|
| Addition Property of Equality | If a = b, then a + c = b + c |
| Subtraction Property of Equality | If a = b, then a – c = b – c |
| Multiplication Property of Equality | If a = b, then a • c = b • c |
| Division Property of Equality | If a = b and $c \neq 0$, then $\frac{a}{c} = \frac{b}{c}$ |

**Example 1:**

a. If 3x = 9, then x = 3 uses the multiplication or division property

b. If x + 2 = 10, then x = 8 uses the subtraction property

c. If $\frac{2}{3}x = 8$, then x = 12 uses the multiplicand property

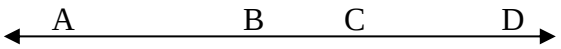
**Further properties of Algebra**

| | |
|---|---|
| Distributive Property | a(b + c)= a • b + a • c |
| Substitution Property | If a = b, then a replaces b in any equation. |
| Transitive Property | If a = b and b = c, then a = c. |
| Symmetric Property | If $a = b$, then $b = a$. |
| Reflexive Property | If $a = a$ |

**Example 2:** Given: 3x + 2= 4 + 5x Prove: x = − 1

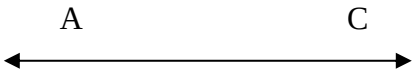
| Statements | Reasons |
|---|---|
| 1. 3x +2 = 4 + 5x | 1. |
| 2. 3x + 2− 4 = 4 − 4 + 5x | 2. |
| 3. 3x − 2 = 5x | 3. |
| 4. 3x − 3x − 2 = 5x − 3x | 4. |
| 5. − 2 = 2x | 5. |
| 6. $\frac{1}{2}(-2) = \left(\frac{1}{2}\right)2x$ | 6. |
| 7. $-1 = x$ | 7. |
| 8. $x = -1$ | 8. |

**Example 3:** Given the drawing




Suppose that AB = 9, BC = 2 and CD = 9 is AC = BD and why?

**Example 4:**




Given: B is the midpoint of the line $\overleftrightarrow{\mathbf{AC}}$

Prove: $AB = \frac{\mathbf{AC}}{\mathbf{2}}$

| Statements | Reasons |
|---|---|
| 1. B is the midpoint of $\overline{AC}$ | 1. |
| 2. AB = BC | 2. |
| 3. AB + BC = AC | 3. |
| 4. AB + AB = AC | 4. |
| 5. 2 (AB) = AC | 5. |
| 6. $AB = \frac{AC}{2}$ | 6. |

**Be sure to study the examples in the book for this section.**

**Example 5:** Answer the following questions.

a. If the $m\angle 1 + m\angle 2 = 90°$ and $m\angle 3 = m\angle 1$ what is true?

b. K is in the interior of $\angle GHJ$ so what can we conclude about $m\angle GHK + m\angle KHJ =$

c. Suppose that $m\angle ABC = 128°$. If $\overline{BD}$ bisects $\angle ABC$, determine the $m\angle ABD$

**NOW TRY FROM TEXBOOK: p. 42 #'s 23, 27, 29**