Secondary Math 2 | 1.1 Notes | Reasoning with Properties from Algebra and Geometry

Objective:

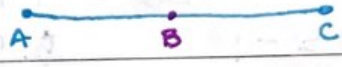
- During the next two units we will be focusing on algebraic and geometric proofs. By the end of class you will be able to justify your reasoning using mathematical properties.

A true statement that follows as a result of other true statements is called a Theorem. All theorems must be proven. You can prove a theorem using a 2-Columned Proof.
A two-column proof has numbered statements and reasons that show the logical order of an argument

Algebraic Properties of Equality

Addition Property:	If $a = b$, then $a+c = b+c$
Subtraction Property:	If $a = b$, then $a-c = b-c$
Multiplication Property:	If $a = b$, then $a \cdot c = b \cdot c$
Division Property:	If $a = b$, then $\frac{a}{c} = \frac{b}{c}$ $c \neq 0$
Distributive Property:	Ex: $a(b + c) = a \cdot b + a \cdot c$
Combining Like Terms:	Adding/Subtracting terms with the same variable and exponent
Substitution Property:	Replacing a term with an equivalent term

Geometric Properties of Equality

Midpoint Theorem:	If B is the Midpoint of line $\overline{AC}$, then $\overline{AB} \cong \overline{BC}$	
Segment Addition Postulate:	If B is collinear and between A and C, then $\overline{AB} + \overline{BC} = \overline{AC}$	

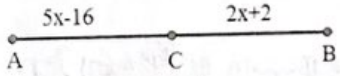
***When writing a Two-Column Proof, always begin with the GIVEN.**

Example Set: Starting with the given, prove the following.

Given: $2x - 5 = 13$
Prove: $x = 9$

Statement	Reason
1. $2x-5=13$	Given
2. $2x=18$	Addition Property
3. $x=9$	Division Property

Given: C is the midpoint of $\overline{AB}$
Prove: $x = 6$



Statement	Reason
1. C is the midpoint of $\overline{AB}$	Given
2. $\overline{AC} \cong \overline{CB}$	C is the midpoint
3. $5x-16=2x+2$	Substitution
4. $3x-16=2$	subtraction Property
5. $3x=18$	Addition Property
6. $x=6$	Division Property

Practice Problems: Starting with the given, prove the following.

1) **Given:** $5x - 18 = 3x + 2$
Prove: $x = 10$

Statement	Reason
1. $5x-18=3x+2$	1. Given
2. $2x-18=2$	2. Subtraction Prop.
3. $2x=20$	3. Addition Prop
4. $x=10$	4. Division Prop.

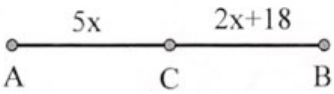
2) **Given:** $\frac{1}{2}x + 12 = -18$
Prove: $x = -60$

Statement	Reason
1. $\frac{1}{2}x+12=-18$	1. Given
2. $\frac{1}{2}x=-30$	2. subtraction Prop
3. $x=-60$	3. mult. Property.

3) **Given:** $55x - 3(9x + 12) = -64$
Prove: $x = -1$

Statement	Reason
1. $55x-3(9x+12)=-64$	1. Given
2. $55x-27x-36=-64$	2. Distributive
3. $28x-36=-64$	3. Combine like-terms
4. $28x=-28$	4. Addition.
5. $x=-1$	5. Division Prop

4) **Given:** C is the midpoint of $\overline{AB}$
Prove: $x = 6$



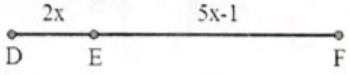
Statement	Reason
1. C is midpoint $\overline{AB}$	1. Given
2. $AC \cong CB$	2. C is the midpoint
3. $5x=2x+18$	3. Substitution
4. $3x=18$	4. subtraction
5. $x=6$	5. division prop.

5) **Given:** C is the midpoint of $\overline{AB}$
Prove: $x = 3$

Statement	Reason
1. C is the midpoint of $\overline{AB}$	1. Given
2. $\overline{AC} \cong CB$	2. C is midpoint
3. $2x+1=5x-8$	3. substitution
4. $-3x+1=-8$	4. subtraction
5. $-3x=-9$	5. Subtraction
6. $x=3$	6. division. prop.

combine

6) **Given:** $DF = 27$
Prove: $x = 4$



Statement	Reason
1. $DF=27$	1. Given
2. $DE+EF=DF$	2. Segment Add. Postulate
3. $2x+5x-1=27$	3. Substitution.
4. $7x-1=27$	4. Combine like-terms
5. $7x=28$	5 Addition.
6. $x=4$	6. Division.

*Don't forget to number your statements and reasons!