PROPERTIES OF EQUALITY

Reference

Property	Meaning
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 $\frac{a}{c} = \frac{b}{c}$.
Distributive Property	$a(b+c)$, then $a(b+c) = ab + ac$.
Substitution Property	If $a=b$ then a may be replaced by b in any expression or equation.
Reflexive Property	For any real number a, $a=a$. *(A value always will equal itself!)*
Symmetric Property	If $a=b$, then $b=a$.
Transitive Property	If $a=b$, and $b=c$, then $a=c$.

Name that property! Write the name of the property that justifies each statement.

1. If $k = 3$, then $3 = k$	1. Symmetric property
2. If $2x = 14$, then $x = 7$	2. division property
3. $10y = 10y$	3. reflexive property
4. If $-5x - 1 = -11$, then $-5x = -10$	4. addition property
5. If $10a = 2b$ and $2b = c$, then $10a = c$	5. transitive property
6. $-7(n - 4) = -7n + 28$	6. distributive property
7. If $6y = 24$, then $6y - 3 = 24 - 3$	7. Subtraction property
8. If $10x + w = 41$ and $w = 1$, then $10x + 1 = 41$	8. substitution property
9. If $3x = 2y$ and $2y = z$, then $3x = z$	9. transitive property
10. If $7m = 35$, then $7m + 4 = 35 + 4$	10. addition property
11. If $-2c = 18$, then $18 = -2c$	11. Symmetric property
12. Given $3x^2 + 1$, if $x = 5$, then $3(5)^2 + 1$	12. substitution property
13. If $m = -2$, then $8m = -16$	13. multiplication property
14. $5x + 8x = x(5 + 8)$	14. distributive property

ALGEBRAIC Proofs — SET I

What is a TWO-COLUMN PROOF?

- **The two-column proof is a common format used to organize a proof:**
  - The statements (or steps) are listed on the **LEFT SIDE.**
  - The reasons justifying each statement are listed on the **RIGHT SIDE.**
- **What can be used as reasons?** properties, definitions, postulates, theorems

Use the properties of equality to complete each proof.

1 **Given:** $4x - 1 = 27$; **Prove:** $x = 7$

Statements	Reasons
1. $4x - 1 = 27$	1. Given
2. $4x = 28$	2. Addition Property
3. $x = 7$	3. Division Property

2 **Given:** $\frac{a}{-6} + 2 = 5$; **Prove:** $a = -18$

Statements	Reasons
1. $\frac{a}{-6} + 2 = 5$	1. Given
2. $\frac{a}{-6} = 3$	2. Subtraction Property
3. $a = -18$	3. Multiplication Property

3 **Given:** $-9(2x - 3) = 63$; **Prove:** $x = -2$

Statements	Reasons
1. $-9(2x - 3) = 63$	1. Given
2. $-18x + 27 = 63$	2. Distributive Property
3. $-18x = 36$	3. Subtraction Property
4. $x = -2$	4. Division Property

4 **Given:** $6x + 7 = 8x - 17$; **Prove:** $x = 12$

Statements	Reasons
1. $6x + 7 = 8x - 17$	1. Given
2. $7 = 2x - 17$	2. Subtraction Property
3. $24 = 2x$	3. Addition Property
4. $12 = x$	4. Division Property
5. $x = 12$	5. Symmetric Property

5 **Given:** $-7(x + 2) + 4x = 6(2x - 4)$; **Prove:** $x = 2/3$

Statements	Reasons
1. $-7(x + 2) + 4x = 6(2x - 4)$	1. Given
2. $-7x - 14 + 4x = 12x - 24$	2. Distributive Property
3. $-3x - 14 = 12x - 24$	3. Simplify
4. $-15x - 14 = -24$	4. Subtraction Property
5. $-15x = -10$	5. Addition Property
6. $x = 2/3$	6. Division Property

6 **Given:** $3x + 1 = -14$; **Prove:** $x = -5$

Statements	Reasons
1. $3x+1 = -14$	1. Given
2. $3x = -15$	2. Subtraction Property
3. $x = -5$	3. Division Property

7 **Given:** $2(x - 9) = -10$; **Prove:** $x = 4$

Statements	Reasons
1. $2(x-9) = -10$	1. Given
2. $2x - 18 = -10$	2. Distributive Property
3. $2x = 8$	3. Addition Property
4. $x = 4$	4. Division Property

8 **Given:** $\frac{5y-1}{2}=7$; **Prove:** $y=3$

Statements	Reasons
1. $\frac{5y-1}{2}=7$	1. Given
2. $5y-1=14$	2. Multiplication Property
3. $5y=15$	3. Addition Property
4. $y=3$	4. Division Property

9 **Given:** $10k-4=2k-20$; **Prove:** $k=-2$

Statements	Reasons
1. $10k-4=2k-20$	1. Given
2. $8k-4=-20$	2. Subtraction Property
3. $8k=-16$	3. Addition Property
4. $k=-2$	4. Division Property

10 **Given:** $-8(w+1)=-5(w+10)$; **Prove:** $w=14$

Statements	Reasons
1. $-8(w+1)=-5(w+10)$	1. Given
2. $-8w-8=-5w-50$	2. Distributive Property
3. $-3w-8=-50$	3. Addition Property
4. $-3w=-42$	4. Addition Property
5. $w=14$	5. Division Property

11 **Given:** $14-2(x+8)=5x-(3x-34)$; **Prove:** $x=-9$

Statements	Reasons
1. $14-2(x+8)=5x-(3x-34)$	1. Given
2. $14-2x-16=5x-3x+34$	2. Distributive Property
3. $-2x-2=2x+34$	3. Simplify
4. $-4x-2=34$	4. Subtraction Property
5. $-4x=36$	5. Addition Property
6. $x=-9$	6. Division Property