Operations Properties $(+- ∙ ÷)$

These properties are the ones used to solve multi-step equations.

|  |  |  |
| --- | --- | --- |
| **Simplify** | **Addition Property of Equality** | **Subtraction Property of Equality** |
| …means basic math done on one side of an equation to make it easier. | …means adding something to both sides of the equation. | …means subtracting something from both sides of the equation. |
| *Property* = *that makes one side easier**Property* = *Simplify* | *Addition* = *of Equality – Property**Addition + Property* = *of Equality* | *Subtraction* = *Property + of Equality**Subtraction – Property* = *of Equality* |

|  |  |
| --- | --- |
| **Multiplication Property of Equality** | **Division Property of Equality** |
| …means multiplying something to both sides of the equation. | …means dividing something from both sides of the equation. |
| $$Property=\frac{of Equality}{Multiplication}$$$$\left(Multiplication\right)\left(Property\right)=of Equality$$ | $$\left(Multiplication\right)\left(of Equality\right)= Property$$$$Multiplication=\frac{Property}{of Equality}$$ |

Notice the difference between “Simplify” and the other operations properties. “Simplify” works on the sides of the equation, without moving anything from one side to the other.

The “Addition,” “Subtraction,” “Multiplication,” and “Division” properties are when you use these operations to move terms from one side to the other.

**Write the name of the property shown on the ending step.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. |  |  | 2. |  |
| $$5x-7=12$$ | Given |  | $$\frac{15}{x}=3$$ | Given |
| $$5x=19$$ |  |  | $$15=3x$$ |  |
|  |  |  |  |  |
| 3. |  |  | 4. |  |
| $$8x-3+2x=7$$ | Given |  | $$\left(3g+6\right)+8=2$$ | Given |
| $$10x-3=7$$ |  |  | $$8=2-(3g+6)$$ |  |
|  |  |  |  |  |
| 5. |  |  | 6. |  |
| $$\frac{8x}{4}=10$$ | Given |  | $$AB-MP=RS$$ | Given |
| $$2x=10$$ |  |  | $$AB=RS+MP$$ |  |
|  |  |  |  |  |
| 7. |  |  | 8. |  |
| $$6x+1-2x=7x$$ | Given |  | $$AB=\frac{DE}{GH}$$ | Given |
| $$6x+1=9x$$ |  |  | $$\left(AB\right)\left(GH\right)=DE$$ |  |

**For each problem below, look for each of the three properties. In each property’s column, write stars in the box(es) next to the starting step(s) and write the name of the property in the box next to the ending step. If you notice any of the previous three properties—reflexive, symmetric, or substitution—, write that property as well.**

9.

|  |  |
| --- | --- |
|  | What properties can you find? |
| $$m∠R=5x+3$$ | Given |
| $$4x+12=10x-6$$ | Given |
| $$12=6x-6$$ |  |
| $$18=6x$$ |  |
| $$3=x$$ |  |
| $$x=3$$ |  |
| $$m∠R=5\left(3\right)+3$$ |  |
| $$m∠R=18$$ |  |

10.

|  |  |
| --- | --- |
| $$\frac{x}{5}+3=2x-1+3x$$ | Given |
| $$\frac{x}{5}+3=5x-1$$ |  |
| $$\frac{x}{5}=5x-4$$ |  |
| $$x=25x-20$$ |  |
| $$-24x=-20$$ |  |
| $$x=\frac{-20}{-24}$$ |  |
| $$x=\frac{5}{6}$$ |  |
| $$\frac{5}{6}=\frac{5}{6}$$ |  |

**11. Who is right—Tyson or Grant? Why?**

Given: $6x+3-4=7x$

Prove: $2x+4=2$

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Tyson’s work: |  |  | Grant’s work: |  |
| $$6x+3-4=7x$$ | Subtraction |  | $$6x+3-4=7x$$ | Given |
| $$6x-1=7x$$ | Subtraction |  | $$6x-1=7x$$ | Simplify |
| $$-1=x$$ | Symmetric |  | $$-1=x$$ | Subtraction |
| $$x=-1$$ | Reflexive |  | $$x=-1$$ | Symmetric |
| $$2x+4=2x+4$$ | Substitution |  | $$2x+4=2x+4$$ | Reflexive |
| $$2x+4=2(-1)+4$$ | Simplify |  | $$2x+4=2(-1)+4$$ | Substitution |
| $$2x+4=2$$ | Prove |  | $$2x+4=2$$ | Simplify |