Reflexive, Symmetric, and Substitution Properties

These are three of the basic properties that you will use to structure geometric proofs.

|  |  |  |
| --- | --- | --- |
| Reflexive Property of Equalitymeans something equals itself | Symmetric Property of Equalitymeans the sides of theequal sign switch | Substitution Propertymeans that you plug something in to replace something of equal value |
| $$Reflexive=Reflexive$$ | $$Property=Symmetric$$$$Symmetric=Property$$ | $$Plug-in Property $$$$Plug-in=Substitution$$$(Substitution) Property$  |

Notice that, for Reflexive, there is no starting step that leads to something being reflexive—it’s only one step, and that’s where you’d write “Reflexive Property of Equality.”

For Symmetric, however, there are two steps: where the switch starts and where it ends. Always write “Symmetric Property of Equality” next to the last step—when the switch is complete.

For Substitution, there are usually at least three steps: two starting steps, one step with the original setup that will get plugged into & one step with the equation that says what gets plugged in (though sometimes all of this information is found in a single starting step) and the ending step where stuff gets plugged in.

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. |  |  | 2. |  |
| $$7x+3=GH$$ | Given |  | $$AB=9x-6$$ | Given |
| $$GH=7x+3$$ |  |  | $$x=8$$ | Given |
|  |  |  | $$AB=9\left(8\right)-6$$ |  |
|  |  |  |  |  |
| 3. |  |  | 4. |  |
| $$LM=PQ \& PQ=2x$$ | Given |  | $$19=19$$ |  |
| $$LM=2x$$ |  |  |  |  |
|  |  |  |  |  |
| 5. |  |  | 6. |  |
| $$DE=DE$$ |  |  | $$5=x$$ | Given |
|  |  |  | $$x=5$$ |  |

**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.**

7.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Where’s the Reflexive Property? | Where’s the Symmetric Property? | Where’s the Substitution Property? |
| $$2x-4=AB$$ | Given Information |
| $$x=17$$ | Given Information |
| $$AB=2x-4$$ |  |  |  |
| $$AB=2\left(17\right)-4$$ |  |  |  |
| $$AB=30$$ |  |  |  |
| $$30=30$$ |  |  |  |

**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.**

8.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Where’s the Reflexive Property? | Where’s the Symmetric Property? | Where’s the Substitution Property? |
| $$MN=3x+8$$ | Given Information |
| $$PQ=3x+8$$ | Given Information |
| $$3x+8=3x+8$$ |  |  |  |
| $$\left(MN\right)=(PQ)$$ |  |  |  |
| $$PQ=MN$$ |  |  |  |

9.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Where’s the Reflexive Property? | Where’s the Symmetric Property? | Where’s the Substitution Property? |
| $$QR=5x-9$$ | Given Information |
| $$QR=QR$$ |  |  |  |
| $$QR=21$$ | Given Information |
| $$\left(21\right)=(5x-9)$$ |  |  |  |
| $$30=5x$$ |  |  |  |
| $$6=x$$ |  |  |  |
| $$x=6$$ |  |  |  |

**Are any of the students correct, and, if so, who? Why?**

Given: $MN=2x+1$ & $27=9x$

Prove: $MN=7$

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Jack’s work: |  |  | Martha’s work: |  |
| $$MN=2x+1$$ | Given |  | $$MN=2x+1$$ | Given |
| $$27=9x$$ | Given |  | $$27=9x$$ | Given |
| $$9x=27$$ | Reflexive Prop. = |  | $$9x=27$$ | Symmetric Prop. = |
| $$x=3$$ | Given |  | $$x=3$$ | Division Prop. = |
| $$MN=2\left(3\right)+1$$ | Substitution Prop. = |  | $$MN=2\left(3\right)+1$$ | Substitution Prop. |
| $$MN=7$$ | Simplify |  | $$MN=7$$ | Simplify  |

|  |  |
| --- | --- |
| Liam’s work: |  |
| $$MN=2x+1$$ | Given |
| $$27=9x$$ | Given |
| $$9x=27$$ | Symmetric Prop. = |
| $$x=3$$ | Substitution Prop. |
| $$MN=2\left(3\right)+1$$ | Simplify |
| $$MN=7$$ | Simplify |