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 Property of Equalitymeans that you plug something in to replace an equal something |
| $$Reflexive=Reflexive$$ | $$Property=Symmetric$$$$Symmetric=Property$$ | $$Plug-in Property $$$$Plug-in=Substitution$$$(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.

**Put a star next to any starting step(s), and write the name of the property shown on the ending step.**

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

**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? |
| $$2x-4=AB$$ |  |  |  |
| $$x=17$$ |  |  |  |
| $$AB=2x-4$$ |  |  |  |
| $$AB=2\left(17\right)-4$$ |  |  |  |
| $$AB=30$$ |  |  |  |
| $$30=30$$ |  |  |  |

**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? |
| $$MN=3x+8$$ |  |  |  |
| $$PQ=3x+8$$ |  |  |  |
| $$3x+8=3x+8$$ |  |  |  |
| $$\left(MN\right)=(PQ)$$ |  |  |  |
| $$PQ=MN$$ |  |  |  |

9.

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

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

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

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