

Section 2.4 Properties from Algebra and Proof

We are familiar with the properties of algebra and how to use them. This section uses the properties of algebra to introduce you to the two-column proof. The table below gives you the properties of equality for real numbers that we will use to introduce proofs

Properties of Equality for Real Numbers	
Reflexive Property	$a = a$
Symmetric Property	If $a = b$, then $b = a$
Transitive Property	If $a = b$ and $b = c$ then $a = c$
Addition and Subtraction Properties	If $a = b$ then $a + c = b + c$ and $a - c = b - c$
Multiplication and Division Properties	If $a = b$ then $a \cdot c = b \cdot c$ and $a/c = b/c$
Substitution Property	If $a = b$ then a may be replaced by b in any equation or expression
Distributive Property	$a(b + c) = ab + ac$

Since segment angle measures are real numbers these properties can be used to discuss relationships between geometric figures as well. Two column proofs are nothing more than solving problems and justifying each step. We set the proofs up in one column where we do the work (make our statements) and another column where we justify each step (reasons). The example below provides you with a simple two column proof.

Example 1: Solve the problem below and justify each step using the equality properties of real numbers. Organize your work as a two-column proof.

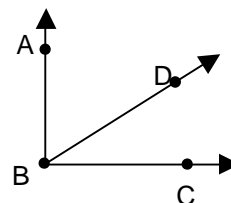
$$2x + 7 = 15$$

Statements	Reasons
1. $2x + 7 = 15$	1. Given
2. $2x = 8$	2. Subtraction Property
3. $x = 4$	3. Division Property

Example 2: Justify the steps for the proof the conditional "If $\angle ABD$ and $\angle DBC$ are complementary, then $\angle ABC$ is a right angle."

Given: $\angle ABD$ and $\angle DBC$ are complementary

Prove: $\angle ABC$ is a right angle



Statements	Reasons
1. $\angle ABD$ and $\angle DBC$ are complementary	1. Given
2. $m\angle ABD + m\angle DBC = 90$	2. Definition of Complementary
3. $m\angle ABD + m\angle DBC = m\angle ABC$	3. Angle Addition Postulate
4. $m\angle ABC = 90$	4. Substitution
5. $\angle ABC = 90$	5. Definition of right angle

There are a few important things to note about the example so that you can learn to do proofs correctly.

1. Always start with the Given and Prove Statements to set up the problem.
2. Your first line of the proof is the given statement
3. The last line of the proof is the Prove statement that you started the problem with.
4. Each statement is justified with a postulate (an accepted true statement).

Make sure each of your proofs meet these criteria. The practice problems in the book set up the proofs for you and give the statements. They simply want you to provide the justification for each step.