

Lesson 2.5 Reasoning in Algebra and Geometry

Follow the steps of the brainteaser using your age. Then try it using a family member's age. What do you notice? Explain how the brainteaser works.

- Write down your age.
- Multiply it by 10.
- Add 8 to the product.
- Double that answer and then subtract 16.
- Finally, divide the result by 2.

Could you prove that the brainteaser will work for every age? If so, how would you be able to do that?

- Write down your age.
- Multiply it by 10.
- Add 8 to the product.
- Double that answer and then subtract 16.
- Finally, divide the result by 2.

When writing proofs each step must be justified. Justifications come from postulates and properties that are understood to be true without proof. Below are some algebra properties you will use to write a proof.

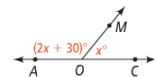
Let a , b , and c be any real numbers.

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 $a = b$ and $c \neq 0$, then $\frac{a}{c} = \frac{b}{c}$.
Reflexive Property	$a = a$
Symmetric Property	If $a = b$, then $b = a$.
Transitive Property	If $a = b$ and $b = c$, then $a = c$.
Substitution Property	If $a = b$, then b can replace a in any expression.

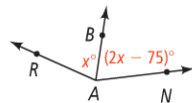
Problem 1 Justifying Steps When Solving an Equation

Algebra What is the value of x ? Justify each step.

- 1. $\angle AOM$ and $\angle MOC$ are supplementary. \triangle that form a linear pair are supplementary.
- 2. $m\angle AOM + m\angle MOC = 180$ Definition of supplementary \triangle
- 3. $(2x + 30) + x = 180$ Substitution Property
- 4. $3x + 30 = 180$ Distributive Property
- 5. $3x = 150$ Subtraction Property of Equality
- 6. $x = 50$ Division Property of Equality



What is the value of x ? Justify each step.
Given: \overrightarrow{AB} bisects $\angle RAN$.



What is the name of the property of equality or congruence that justifies going from the first statement to the second statement?

- A** $2x + 9 = 19$
 $2x = 10$
- B** $\angle O \cong \angle W$ and $\angle W \cong \angle L$
 $\angle O \cong \angle L$
- C** $m\angle E = m\angle T$
 $m\angle T = m\angle E$

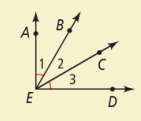
A proof is a convincing argument that uses deductive reasoning. A proof logically shows why a conjecture is true. A two-column proof lists each statement on the left and each justification on the right. Below is an example.

The first statement is usually the given statement.

Each statement should follow logically from the previous statements.

The last statement is what you want to prove.

Given: $m\angle 1 = m\angle 3$
 Prove: $m\angle AEC = m\angle DEB$



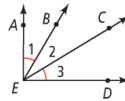
Statements	Reasons
1) $m\angle 1 = m\angle 3$	1) Given
2) ~~~~~	2) ~~~~~
3) ~~~~~	3) ~~~~~
4) ~~~~~	4) ~~~~~
5) $m\angle AEC = m\angle DEB$	5) ~~~~~

Write a two-column proof.

Given: $5x + 1 = 21$
 Prove: $x = 4$

Write a two-column proof.

Given: $m\angle 1 = m\angle 3$
 Prove: $m\angle AEC = m\angle DEB$

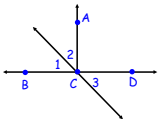


Write a two-column proof.

Given: $\overline{AB} \cong \overline{CD}$
 Prove: $\overline{AC} \cong \overline{BD}$

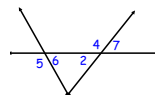


Given: Ray CA is perpendicular to ray BD
 Prove: $m\angle 2 + m\angle 3 = 90^\circ$



Statements	Justifications

If $m\angle 2 = m\angle 6$, then $m\angle 5 + m\angle 7 = 180^\circ$.



Statements	Justifications