

I. What is a proof?

Deductive Reasoning

A proof is an argument that uses logic, definitions, properties, and previously proven statements to show that a conclusion is true.

II. What are the Properties of Equality?

An algebraic proof uses algebraic properties such as the properties of equality and the Distributive Property.

Properties of Equality	Example
Addition Property of Equality	If $a = b$, then $a + \underline{c} = b + \underline{c}$.
Subtraction Property of Equality	If $a = b$, then $a - \underline{c} = b - \underline{c}$.
Multiplication Property of Equality	If $a = b$, then $\underline{ac} = \underline{bc}$.
Division Property of Equality	If $a = b$ and $c \neq 0$, then $a \div \underline{c} = b \div \underline{c}$.
Reflexive Property of Equality	$a = a$
Symmetric Property of Equality	If $a = b$, then $b = a$. <i>SWITCH!!</i>
Transitive Property of Equality	If $a = b$ and $b = c$, then $a = c$. <i>* THINK OF YOUR CHAIN RULE *</i>
Substitution Property of Equality	If $a = b$, then <u>b can be substituted for a</u> in any expression.
Distributive Property	$a(b+c) = \underline{ab} + \underline{bc}$ or $a(b-c) = \underline{ab} - \underline{bc}$ <i>ab+ac ab-ac</i>

III. Solving Basic Equations

Example 1: Write a justification for each step.

Given: $-5 = 3n + 1$.

Prove: $n = -2$

Statement	Justification
1. $-5 = 3n + 1$	1. Given
2. $-6 = 3n$	2. Subtraction Prop. of Equality
3. $-2 = n$	3. Division Property of Equality
4. $n = -2$	4. Symmetric Prop. of Equality

Example 2: Write a justification for each step.

Given: $\frac{1}{2}t - 5 = -7$.

Prove: $t = -4$

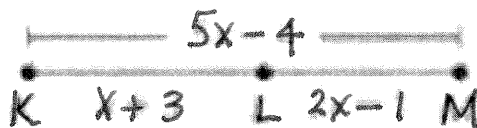
Statement	Justification
1. $\frac{1}{2}t - 5 = -7$	1. Given
2. $\frac{1}{2}t = -2$	2. Addition Prop. of Equality
3. $t = -4$	3. Multiplication Prop. of Equality

IV. Solving an Equation in Geometry

Example 4: Write a justification for each step.

Given: The figure below.

Prove: $x = 3$



Plugin!
General Statement

Statements	Justification
1. $KL + LM = KM$	1. Segment Addition Postulate
2. $x + 3 + 2x - 1 = 5x - 4$	2. Substitution Property of Equality
3. $3x + 2 = 5x - 4$	3. Simplify
4. $3x + 6 = 5x$	4. Addition Property of Equality
5. $6 = 2x$	5. Subtraction Property of Equality
6. $3 = x$	6. Division Property of Equality
7. $x = 3$	7. Symmetric Prop. of Equality

Example 5: Write a justification for each step.

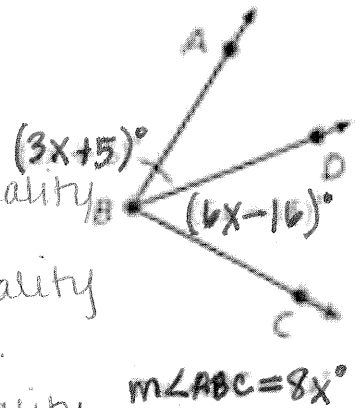
Given: The figure at the right.

Prove: $x = 11$

Plug in!
general statement

Statements	Justification
1. $m\angle ABD + m\angle DBC = m\angle ABC$	1. Angle Addition Postulate
2. $3x+5 + 4x-16 = 8x$	2. Substitution Prop. of Equality
3. $9x-11 = 8x$	3. Simplify
4. $-11 = -1x$	4. Subtraction Prop. of Equality
5. $11 = x$	5. Division Prop. of Equality
6. $x = 11$	6. Symmetric Prop. of Equality

Justification



IV. Properties of Congruence

Symbols	Example
<p>Reflexive Property of Congruence</p> <p>figure $A \cong$ figure A</p>	<p>$\overline{EF} \cong \overline{EF}$</p> <p>$\triangle ABC \cong \triangle ABC$</p>
<p>Symmetric Property of Congruence</p> <p>If figure $A \cong$ figure B, then figure $B \cong$ figure A.</p>	<p>If $\angle 1 \cong \angle 2$, then $\angle 2 \cong \angle 1$.</p> <p>If $\triangle ABC \cong \triangle DEF$, then $\triangle DEF \cong \triangle ABC$.</p>
<p>Transitive Property of Congruence</p> <p>If figure $A \cong$ figure B and figure $B \cong$ figure C, then figure $A \cong$ figure C.</p>	<p>If $\overline{PQ} \cong \overline{RS}$ and $\overline{RS} \cong \overline{TU}$, then $\overline{PQ} \cong \overline{TU}$.</p>

Example 6: Identify the property that justifies each statement.

- A. $DE = GH$, so $GH = DE$. Symmetric Prop. of Equality.
- B. $94^\circ = 94^\circ$ Reflexive Prop. of Equality
- C. $0 = a$, and $a = x$. So $0 = x$. Transitive Prop. of Equality
- D. $\angle A \cong \angle Y$, so $\angle Y \cong \angle A$. Symmetric Prop. of Congruence