

Geometry 2.6

Use algebra to write 2-column proofs

Use properties of equality to write geometric proofs

algebraic proof 

paragraph proof (sentence form...less formal)

2-column proof (formal proof)

Given (hypothesis)

Prove (conclusion)

activity: scrambled proofs

Given:

Prove:

(Drawing)

Statement	Reason
1.	1.
2.	2.
3.	3.

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KeyConcept Properties of Real NumbersThe following properties are true for any real numbers a , b , and c .

Addition Property of Equality	If $a = b$, then $a + c = b + c$.
Subtraction Property of Equality	If $a = b$, then $a - c = b - c$.
Multiplication Property of Equality	If $a = b$, then $a \cdot c = b \cdot c$.
Division Property of Equality	If $a = b$ and $(c \neq 0)$, then, $\frac{a}{c} = \frac{b}{c}$.
<u>Reflexive</u> Property of Equality	$a = a$
Symmetric Property of Equality	If <u>$a = b$</u> , then <u>$b = a$</u> .
Transitive Property of Equality	If $a = b$ and $b = c$, then $a = c$.
Substitution Property of Equality	If $a = b$, then a may be replaced by b in any equation or expression.
Distributive Property	$a(b + c) = ab + ac$

scrambled proofs

An **algebraic proof** is a proof that is made up of a series of algebraic statements. The properties of equality provide justification for many statements in algebraic proofs.



Example 1 Justify Each Step When Solving an Equation

Prove that if $-5(x + 4) = 70$, then $x = -18$. Write a justification for each step.

Start \longrightarrow End

Given to prove

Given: $-5(x+4) = 70$

Prove: $x = -18$

St.	Reas.
1. $-5(x+4) = 70$	1. Given
2. $-5x + -20 = 70$ $+20 \quad +20$	2. Distr. prop
3. $\frac{-5x}{-5} = \frac{90}{-5}$	3. Addition "
4. $x = -18$	4. Division " + Subs.

Real-World Example 2 Write an Algebraic Proof



SCIENCE If the formula to convert a Fahrenheit temperature to a Celsius temperature is $C = \frac{5}{9}(F - 32)$, then the formula to convert a Celsius temperature to a Fahrenheit temperature is $F = \frac{9}{5}C + 32$. Write a two-column proof to verify this conjecture.

Handwritten red annotations:
A red circle around the word "Given" in the text above.
A red circle around the word "Prove" in the text above.



scrambled proofs

Begin by stating what is given and what you are to prove.

Given: $C = \frac{5}{9}(F - 32)$

Prove: $F = \frac{9}{5}C + 32$

Where do I start?
Where am I trying to go?

Proof:

1. $C = \frac{5}{9}(F - 32)$

1. Given

2.

3.

4.

5.

6.

StudyTip

Commutative and Associative Properties

Throughout this text we shall assume that if a , b , and c are real numbers, then the following properties are true.

Commutative Property of Addition

$$a + b = b + a$$

Commutative Property of Multiplication

$$a \cdot b = b \cdot a$$

Associative Property of Addition

$$(a + b) + c = a + (b + c)$$

Associative Property of Multiplication

$$(a \cdot b) \cdot c = a \cdot (b \cdot c)$$

Callback to algebra:

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Property	Segments	Angles
Reflexive	$AB = AB$	$m\angle 1 = m\angle 1$
Symmetric	If $AB = CD$, then $CD = AB$.	If $m\angle 1 = m\angle 2$, then $m\angle 2 = m\angle 1$.
Transitive	If $AB = CD$ and $CD = EF$, then $AB = EF$.	If $m\angle 1 = m\angle 2$ and $m\angle 2 = m\angle 3$, then $m\angle 1 = m\angle 3$.

Copy and complete

5. Complete the following proof.

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5)

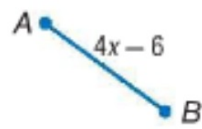
Given: $\frac{y+2}{3} = 3$

Prove: $y = 7$

Proof:

Statements	Reasons
a. $\frac{y+2}{3} = 3$	a. Given
b. $3\left(\frac{y+2}{3}\right) = 3(3)$	b. <u>mult prop.</u>
c. $y+2 = 9$	c. <u>Subst.</u>
d. $y = 7$	d. Subtraction Property

7. If $\overline{AB} \cong \overline{CD}$, then $x = 7$.



hypothesis:

conclusion:

Given:

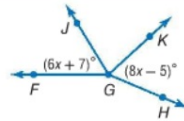
Prove:

Example 3 Write a Geometric Proof

If $\angle FGJ \cong \angle JGK$ and $\angle JGK \cong \angle KGH$, then $x = 6$.
Write a two-column proof to verify this conjecture.

Given: $\angle FGJ \cong \angle JGK$, $\angle JGK \cong \angle KGH$,
 $m\angle FGJ = 6x + 7$, $m\angle KGH = 8x - 5$

Prove: $x = 6$
Proof:



Required: copy **given, prove, diagram**

where to start? where am I going? map?

Logical, convincing, airtight

Each statement must have a reason

Statements	Reasons
1. $m\angle FGH = 6x + 7$, $m\angle KGH = 8x - 5$ $\angle FGJ \cong \angle JGK$; $\angle JGK \cong \angle KGH$	1. Given
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	

State the property that justifies each statement.

- 13.** If $5(x + 7) = -3$, then $5x + 35 = -3$.
- 14.** If $m\angle 1 = 25$ and $m\angle 2 = 25$, then $m\angle 1 = m\angle 2$.
- 15.** If $AB = BC$ and $BC = CD$, then $AB = CD$.
- 16.** If $3\left(x - \frac{2}{3}\right) = 4$, then $3x - 2 = 4$.

Copy and

CCSS ARGUMENTS Complete each proof.

17. Given: $\frac{8 - 3x}{4} = 32$

Prove: $x = -40$

Proof:

Statements	Reasons
a. $\frac{8 - 3x}{4} = 32$	a. Given
b. $4\left(\frac{8 - 3x}{4}\right) = 4(32)$	b. _____ ?
c. $8 - 3x = 128$	c. _____ ?
d. _____ ?	d. Subtraction Property
e. $x = -40$	e. _____ ?