

Chapter 2, Packet 1: Algebra Proofs

In today's lesson, you will be ready for a quiz when you can:

Learning Targets:

1. Solve basic algebra equations (get the variable by itself).
2. Explain which math rule you use each step of the way.

What is a proof? People often think proofs are very complicated, but they really aren't. A proof is just when you solve a problem, but there's a catch...**every time you do a step, you have to write down which math rule allowed you to do the step.** When you do that, you are doing a proof.

Because Algebra proofs are easier than Geometry proofs (because you already had a whole year of it), we will do Algebra proofs first. Here's the basic Algebra rules:

Name of the Reason:	What it looks like:	Where to use it:
Reflexive Property	$a = a$	Use to "recycle" a number. <i>(will be used a lot in chapter 4!)</i>
Symmetric Property	if $a = b$ then $b = a$	Use to reverse the direction of an equation.
Transitive Property	if $a = b$ and $b = c$ then $a = c$	Use when showing that all three parts are equal.
Addition (and Subtraction) Properties	if $a = b$ then $a + c = b + c$	Use when adding (or subtracting) the same number on both sides of the equation.
Multiplication (and Division) Properties	if $a = b$ then $ac = bc$	Use when multiplying (or dividing) by the same number on both sides of the equation.
Substitution Property	if $a = b$ then a can be used instead of b	Use when combining like terms. <i>Use this whenever you are "cleaning up" a problem.</i>
Distributive Property	$a(b + c) = ab + ac$	Use when multiplying to remove parenthesis.

Here's an example of an algebraic proof:

Statements	Reasons
$2(2r + 5) + 1 = 5 - 2(3 - r)$	Given
$4r + 10 + 1 = 5 - 6 + 2r$	Distributive Property
$4r + 11 = -1 + 2r$	Substitution Property
$4r - 2r + 11 = -1 + 2r - 2r$	Subtraction Property
$2r + 11 = -1$	Substitution Property
$2r + 11 - 11 = -1 - 11$	Subtraction Property
$2r = -12$	Substitution Property
$\frac{2r}{2} = \frac{-12}{2}$	Division Property
$r = -6$	Substitution Property

We only need to write the *name* of the reason since we are all using the same list. It saves us time when we all have the same set of reasons to use.

Directions: In each of the following algebra problems, provide the reason that matches each step.

1. Statements	Reasons
$3x + 7 = 13$	Given
$3x + 7 - 7 = 13 - 7$	
$3x = 6$	
$\frac{3x}{3} = \frac{6}{3}$	
$x = 2$	

2. Statements	Reasons
$\frac{t - 6}{7} = 8$	
$7\left(\frac{t - 6}{7}\right) = 7(8)$	
$t - 6 = 56$	
$t - 6 + 6 = 56 + 6$	
$t = 62$	

3. Statements	Reasons
$3(x - 5) = -6$	Given
$3x - 15 = -6$	
$3x - 15 + 15 = -6 + 15$	
$3x = 9$	
$\frac{3x}{3} = \frac{9}{3}$	
$x = 3$	

4. Statements	Reasons
$\frac{x + y}{c} = d$	
$c\left(\frac{x + y}{c}\right) = c(d)$	
$x + y = cd$	
$x + y - y = cd - y$	
$x = cd - y$	

For each of the following statements, decide which property it is showing.

5. If $t = y$ and $y = k$, then $t = k$ _____

6. If $2x + 4 = 12$, then $2x + 4 - 4 = 12 - 4$ _____

7. If $5(2x - 4) = 40$, then $10x - 20 = 40$ _____

8. If $12 = 3x + 6$, then $3x + 6 = 12$ _____

For each of the following algebraic proofs, write the missing steps or reasons. *Hint: watch for what changes! What does it take to turn a particular row into the next row?*

9. Statements	Reasons
$\frac{1}{3}(x + 6) = 7$	Given
$3\left(\frac{1}{3}(x + 6)\right) = 3(7)$	
	Substitution
$x + 6 - 6 = 21 - 6$	
	Substitution

10. Statements	Reasons
$10\left(t - \frac{3}{5}\right) = 8$	
$\frac{10\left(t - \frac{3}{5}\right)}{10} = \frac{8}{10}$	
$t - \frac{3}{5} = \frac{8}{10}$	
$t - \frac{3}{5} + \frac{3}{5} = \frac{8}{10} + \frac{3}{5}$	
$t = \frac{4}{5} + \frac{3}{5}$	
$t = \frac{7}{5}$	

11. Statements	Reasons
$7(x - 3) - 2 = 5$	Given
$7(x - 3) - 2 + 2 = 5 + 2$	
	Substitution
$7x - 21 = 7$	
$7x - 21 + 21 = 7 + 21$	
$7x = 28$	
	Division
	Substitution

12. Statements	Reasons
$6(2x - 3) = -9$	
	Distribute
	Addition
	Substitution
	Division
$x = \frac{3}{4}$	

Your turn! For each of the following algebraic proofs, write each step and the justification that matches. You are given a blank table without any rows marked, so create as many rows as needed.

13. Given: $2(x - 3) = 6$

Prove: $x = 6$

Statements	Reasons

14. Given: $4\left(2x + \frac{3}{4}\right) = 35$

Prove: $x = 4$

Statements	Reasons