

Reasoning and Proof – Algebraic Proofs

Notes Section 2.2

Name _____

Properties of Equality

For all real numbers a , b and c ...

Reflexive Property of Equality

For every number a , $a = a$.

Symmetric Property of Equality

If $a = b$, then $b = a$.

Transitive Property of Equality

If $a = b$, and $b = c$, then $a = c$.

Addition & Subtraction Properties of Equality

If $a = b$, then $a \pm c = b \pm c$.

Multiplication & Division Properties of Equality

If $a = b$, then $a \cdot c = b \cdot c$, and $a/c = b/c$.

Distributive Property of Equality

$a(b + c) = ab + ac$.

Substitution Property of Equality

If $a = b$, then a may be replaced by b in an equation.

Examples: Tell which property justifies each conclusion.

1. Given: $6x + 2 = 12$

Conclusion: $6x = 10$

Subst. prop of =

2. Given: $45 = x$

Conclusion: $x = 45$

Symmetric prop of =

3. Given: $3x - 7x = 20$

Conclusion: $-4x = 20^\circ$

Subst. prop of =

4. Given: $4(q - x) = r$

Conclusion: $4q - 4x = r$

Distributive prop of =

5. If $a = r$ and $r = 60^\circ$,
then $a = 60^\circ$.

Transitive prop of =

6. If B is the midpoint of \overline{GH} ,
then... $\underline{GB = BH}$

Def'n of Midpoint

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A two-column proof lists each statement on the left with a justification on the right. Each step follows logically from the line before it.

Fill in the missing statements or reasons for the following two-column proof.

Given: $45 + 2(x - 10) = 85$

Prove: $x = 30$

← This line tells you everything that has been given, or everything that is known to be true.

← This line tells you what you must prove.

Statement	Reason
1. $45 + 2(x - 10) = 85$	1. Given
2. $2(x - 10) = 40$	2. Subtr. prop of =
3. $2x - 20 = 40$	3. Dist. prop of =
4. $2x = 60$	4. Add'n prop of =
5. $x = 30$	5. Div'n prop of =

Prove the following.

#8. Prove that if $2x - 7 = \frac{1}{3}x - 2$, then $x = 3$.

Given: $2x - 7 = \frac{1}{3}x - 2$

Prove: $x = 3$

Statement	Reason
1. $2x - 7 = \frac{1}{3}x - 2$	1. Given
2. $6x - 21 = x - 6$	2. Mult prop of equality
3. $5x - 21 = -6$	3. Subtraction PoE
4. $5x = 15$	4. Addition PoE
5. $x = 3$	5. Div'n PoE
6.	6.

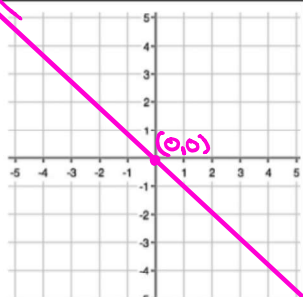
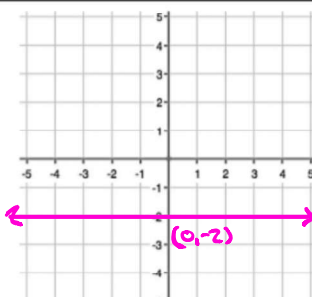
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9. Justify each step in solving the equation. $2x - 3 = \frac{2}{3}$

Statement	Reason
1. $2x - 3 = \frac{2}{3}$	1. Given
2. $6x - 9 = 2$	2. Mult PoE
3. $6x = 11$	3. Add'n PoE
4. $x = \frac{11}{6}$	4. Div'n PoE
5.	5.

Solve each equation for x!		Multiply!	Factor!
1. $10x - 3 = 12$ $10x = 15$ $x = \frac{15}{10}$ $x = \frac{3}{2}$	2. $2x + -4 = 3x - 4$ $-4 = x - 4$ $0 = x$	3. $x(x - 3)$ $= x^2 - 3x$	4. $2x^2 - 32x$ $= 2x(x - 16)$
5. Graph the equation: $y = -x$		6. Graph the equation: $y = -2$	

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