JUSTIFICATION FOR SOLVING EQUATIONS

SIMPLE LINEAR EQUATIONS

The following algebraic properties are commonly used in solving equations:

The addition property of equality: if $a = b$, then $a + d = b + d$.

The multiplication property of equality: if $a = b$, then $d \cdot a = d \cdot b$.

The additive inverse property: $a + (-a) = 0$.

The multiplicative inverse property: if $a \neq 0$, then $\frac{1}{a} \cdot a = 1$.

The additive identity property: $a + 0 = a$.

The multiplicative identity property: $1 \cdot a = a$.

The distributive property: $a(b + c) = a \cdot b + a \cdot c$.

In formal mathematics, justification of each step in a process may be required.

Example 1 Solve the equation $x + 6 = -4$ and justify each step.

$x + 6 = -4$	given
$x + 6 + (-6) = -4 + (-6)$	addition property of equality
$x + 0 = -10$	additive inverse
$x = -10$	additive identity

Example 2 Solve the equation $-3x = \frac{1}{6}$ and justify each step.

$-3x = \frac{1}{6}$	given
$-\frac{1}{3}(-3x) = -\frac{1}{3}(\frac{1}{6})$	multiplicative property of equality
$1x = -\frac{1}{18}$	multiplicative inverse
$x = -\frac{1}{18}$	multiplicative identity

Example 3 Solve the equation $3x - 6 = -1$ and justify each step.

$3x - 6 = -1$	given
$3x - 6 + (6) = -1 + (6)$	addition property of equality
$3x + 0 = 5$	additive inverses
$3x = 5$	additive identity
$\frac{1}{3}(3x) = \frac{1}{3}(5)$	multiplication property of equality
$1x = \frac{5}{3}$	multiplicative inverses
$x = \frac{5}{3}$	multiplicative identity

Problems

In problem 1 provide the justification for each step and in problems 2 through 9 solve the equation and justify each step.

1.

$2(x + 4) = -7$	given
$2x + 8 = -7$	a. _____
$2x + 8 + -8 = -7 + -8$	b. _____
$2x + 0 = -15$	c. _____
$2x = -15$	d. _____
$\frac{1}{2}(2x) = \frac{1}{2}(-15)$	e. _____
$1x = -\frac{15}{2}$	f. _____
$x = -\frac{15}{2} = -7\frac{1}{2}$	g. _____

2. $-3x = 10$

3. $7 + y = -3$

4. $x + \frac{2}{3} = 1\frac{1}{2}$

5. $3x + 2 = -7$

6. $-9 = \frac{1}{2}m + 3$

7. $-\frac{2}{3}y = 5$

8. $-2x - 6 = -7$

9. $3(x - 2) = -9$

10. $-5 = \frac{c-4}{3}$

Answers (Justifications for problems 2 through 9 may vary.)

1a. distributive prop. 1b. (+) prop. of equal. 1c. (+) inverses 1d. (+) identity

1e. (x) prop. of equal. 1f. (x) inverses 1g. (x) identity

2. $-\frac{10}{3}$

3. -10

4. $\frac{5}{6}$

5. -3

6. -24

7. $-\frac{15}{2}$

8. $\frac{1}{2}$

9. -1

10. -11