

3-2 Transforming Equations: Multiplication and Division

Objective: To solve equations using multiplication or division.

Properties

Multiplication Property of Equality If equal numbers are multiplied by the same number, the products are equal.

Division Property of Equality If equal numbers are divided by the same *nonzero* number, the quotients are equal.

Transformations

By multiplication You can multiply each side of an equation by the same *nonzero* real number.

By division You can divide each side of an equation by the same *nonzero* real number.

CAUTION 1 When you transform an equation, never multiply or divide by zero.

CAUTION 2 When you multiply or divide by a negative number, be careful with the sign of your answer.

Example 1 Solve $4x = 128$.

Solution

$$\frac{4x}{4} = \frac{128}{4}$$

$$x = 32$$

{ To get x alone on one side, divide each side by 4 (or multiply by $\frac{1}{4}$, the reciprocal of 4).

Check: $4x = 128$

$$4(32) \stackrel{?}{=} 128$$

$$128 = 128 \checkmark$$

The solution set is $\{32\}$.

Solve.

1. $7m = 140$

2. $12n = 240$

3. $-8x = 96$

4. $-11f = -143$

5. $-720 = -24g$

6. $330 = -15u$

7. $108 = -9x$

8. $45k = -270$

9. $26n = -520$

Example 2 Solve $12 = -\frac{3}{4}n$.

Solution

$$-\frac{4}{3}(12) = -\frac{4}{3}\left(-\frac{3}{4}n\right)$$

$$-16 = n$$

{ To get n alone on one side, multiply each side by $-\frac{4}{3}$, the reciprocal of $-\frac{3}{4}$.

Check: $12 = -\frac{3}{4}n$

$$12 \stackrel{?}{=} -\frac{3}{4}(-16)$$

$$12 = 12 \checkmark$$

The solution set is $\{-16\}$.

3-2 Transforming Equations: Multiplication and Division (continued)

Solve.

10. $\frac{2}{3}m = 6$

11. $\frac{3}{5}y = -15$

12. $-\frac{5}{8}x = 40$

13. $-\frac{4}{5}y = -20$

14. $\frac{2}{5}d = -40$

15. $\frac{3}{4}g = -24$

16. $\frac{7}{8}y = -56$

17. $-\frac{7}{10}e = 140$

18. $-\frac{2}{7}n = -28$

Example 3 Solve: a. $\frac{x}{2} = -6$

b. $\frac{1}{2}n = 3\frac{1}{2}$

Solution

$$2\left(\frac{x}{2}\right) = 2(-6)$$

$$x = -12$$

Check: $\frac{x}{2} = -6$

$$\frac{-12}{2} \stackrel{?}{=} -6$$

$$-6 = -6 \checkmark$$

The solution set is $\{-12\}$.

$$\frac{1}{2}n = \frac{7}{2}$$

$$2\left(\frac{1}{2}\right)n = 2\left(\frac{7}{2}\right)$$

$$n = 7$$

Check: $\frac{1}{2}n = 3\frac{1}{2}$

$$\frac{1}{2}(7) \stackrel{?}{=} 3\frac{1}{2}$$

$$\frac{7}{2} = 3\frac{1}{2} \checkmark$$

The solution set is $\{7\}$.

Solve.

19. $\frac{c}{6} = -24$

20. $\frac{y}{5} = -25$

21. $-\frac{u}{12} = 12$

22. $-\frac{x}{3} = 15$

23. $-28 = \frac{c}{7}$

24. $-\frac{1}{4}x = 2\frac{1}{4}$

25. $\frac{1}{5}f = 3\frac{1}{5}$

26. $\frac{1}{2}b = 2\frac{1}{2}$

27. $-\frac{1}{3}y = 3\frac{2}{3}$

Mixed Review ExercisesEvaluate if $a = -2$, $b = 3$, and $c = -6$.

1. $6b - 2a$

2. $(2b - 5c)a$

3. $|c| + |a| - b$

4. $|b| - |a + c|$

5. $\frac{-(7ab)}{c}$

6. $\frac{8+a}{c}$

Simplify.

7. $6a + 5 + 7a$

8. $7n - 6 + 6$

9. $9p - p + 3$

10. $-3(m + 4)$

11. $(x + 5)6$

12. $2(3y - 4)$