7-2 Proportions

Objective: To solve problems using proportions.

Vocabulary

Proportion An equation that states two ratios are equal is called a proportion.

For example, $2:5 = 4:10$, or $\dfrac{2}{5} = \dfrac{4}{10}$.

(Both can be read as "2 is to 5 as 4 is to 10.")

Means and extremes In the proportion, $a:b = c:d$, b and c are called the means, and a and d are called the extremes. If $\dfrac{a}{b} = \dfrac{c}{d}$, then $ad = bc$.

(The product of the means equals the product of the extremes.)

Example 1   Solve: **a.** $\dfrac{2}{x} = \dfrac{6}{4}$ **b.** $\dfrac{3}{8} = \dfrac{-6}{4a}$ **c.** $\dfrac{2}{n} = 6$

Solution   **a.** $\dfrac{2}{x} = \dfrac{6}{4}$ You can "cross-multiply" to solve a proportion.

$2 \cdot 4 = x \cdot 6$ To do this, multiply the means and the extremes.

$8 = 6x$ Then simplify.

$\dfrac{8}{6} = x$

$\dfrac{4}{3} = x$

The solution set is $\left\{\dfrac{4}{3}\right\}$.

b. $\dfrac{3}{8} = \dfrac{-6}{4a}$ **c.** $\dfrac{2}{n} = \dfrac{6}{1}$

$3 \cdot 4a = 8(-6)$ Cross-multiply. $2 \cdot 1 = 6 \cdot n$ Cross-multiply.

$12a = -48$ Simplify. $2 = 6n$ Simplify.

$a = -4$ $\dfrac{1}{3} = n$

The solution set is $\{-4\}$.   The solution set is $\left\{\dfrac{1}{3}\right\}$.

Solve.

1. $\dfrac{x}{30} = \dfrac{3}{5}$ **2.** $\dfrac{x}{24} = \dfrac{5}{6}$ **3.** $\dfrac{5}{2} = \dfrac{30}{x}$ **4.** $\dfrac{3}{4} = \dfrac{x}{8}$ **5.** $\dfrac{x}{16} = \dfrac{6}{8}$

6. $\dfrac{2}{3} = \dfrac{4}{x}$ **7.** $\dfrac{3}{4} = \dfrac{x}{32}$ **8.** $\dfrac{x}{12} = \dfrac{54}{36}$ **9.** $\dfrac{9}{2x} = \dfrac{6}{4}$ **10.** $\dfrac{4}{3n} = 2$

11. $\dfrac{3}{x} = 4$ **12.** $-8 = \dfrac{4b}{5}$ **13.** $\dfrac{10}{3k} = \dfrac{2}{5}$ **14.** $\dfrac{12t}{-7} = \dfrac{60}{14}$

15. $\dfrac{3x}{7} = -6$ **16.** $\dfrac{4r}{3} = -12$ **17.** $-2 = \dfrac{2x}{5}$ **18.** $\dfrac{91}{x} = \dfrac{7}{3}$

19. $\dfrac{7x}{45} = \dfrac{21}{9}$ **20.** $\dfrac{x}{60} = \dfrac{9}{5}$ **21.** $\dfrac{3}{2y} = \dfrac{9}{12}$ **22.** $\dfrac{14x}{35} = \dfrac{8}{5}$

Study Guide, ALGEBRA, Structure and Method, Book 1

7-2 Proportions (continued)

Example 2 Solve: **a.** $\dfrac{x-3}{8} = \dfrac{3}{4}$ **b.** $\dfrac{2x-1}{3} = \dfrac{4x-3}{5}$

Solution   **a.** $\dfrac{x-3}{8} = \dfrac{3}{4}$ **b.** $\dfrac{2x-1}{3} = \dfrac{4x-3}{5}$

$$4(x-3) = 3 \cdot 8$$
$$4x - 12 = 24$$
$$4x = 36$$
$$x = 9$$

$$5(2x-1) = 3(4x-3)$$
$$10x - 5 = 12x - 9$$
$$4 = 2x$$
$$2 = x$$

The solution set is $\{9\}$.   The solution set is $\{2\}$.

Solve.

23. $\dfrac{x-1}{6} = \dfrac{2}{3}$ **24.** $\dfrac{x-2}{8} = \dfrac{3}{4}$

25. $\dfrac{3+2n}{7} = 5$ **26.** $3 = \dfrac{2-5y}{4}$

27. $\dfrac{x+1}{6} = \dfrac{4}{3}$ **28.** $\dfrac{x-4}{6} = \dfrac{3}{2}$

29. $\dfrac{x-3}{8} = \dfrac{3}{4}$ **30.** $\dfrac{3x+4}{4} = \dfrac{5}{2}$

31. $\dfrac{2x-1}{7} = 5$ **32.** $\dfrac{2n-1}{5} = 9$

33. $\dfrac{x+6}{8} = \dfrac{x-6}{9}$ **34.** $\dfrac{x+2}{9} = \dfrac{x-2}{3}$

35. $\dfrac{x+3}{3} = \dfrac{4x-9}{5}$ **36.** $\dfrac{x-6}{4} = \dfrac{x-9}{2}$

37. $\dfrac{2y-1}{3} = \dfrac{4y-3}{7}$ **38.** $\dfrac{3x+4}{4} = \dfrac{2x+5}{5}$

39. $\dfrac{3x-2}{4} = \dfrac{x+4}{2}$ **40.** $\dfrac{5x-3}{9} = \dfrac{3x+3}{7}$

Mixed Review Exercises

Find the LCD for each group of fractions.

1. $\dfrac{1}{3xy^2}, \dfrac{2}{xy}$ **2.** $\dfrac{w+2}{2}, \dfrac{3w-1}{9}$ **3.** $\dfrac{2}{9}, \dfrac{7}{12}$

4. $\dfrac{1}{3}, \dfrac{1}{4}, \dfrac{5}{24}$ **5.** $\dfrac{2}{x-2}, \dfrac{4}{x+2}$ **6.** $\dfrac{x}{2y}, \dfrac{x-1}{3}$

Simplify.

7. $\dfrac{8}{2(x+1)} + \dfrac{2}{x+1}$ **8.** $\dfrac{3r}{4} + \dfrac{r-1}{12}$ **9.** $\dfrac{3a}{8} + \dfrac{2a+1}{4}$

10. $|-6.3| - |2.7|$ **11.** $|-2.7| + |1.2|$ **12.** $6 + 2 \cdot 7$