

Lesson 7-1

Objective- To use ratios and proportions.
 Ratio - A comparison of two whole numbers in the same units.

5 girls to 7 boys

4 Possible Ways to Write a Ratio

$\frac{5}{7}$ 5:7 5 to 7

sometimes . . .

5 out of 12
 as in 5 girls out of 12 students

Slope of a Line

Slope - The ratio of vertical change to horizontal change of a line indicating how steep it is.

Slope = $\frac{\text{vertical change}}{\text{horizontal change}}$

Slope = $\frac{\Delta y}{\Delta x}$

Slope = $\frac{\text{rise}}{\text{run}}$

Slope = $m = \frac{+3}{+2} = \frac{3}{2}$

$m = \frac{-6}{-4} = \frac{3}{2}$

A triangle has sides in a ratio of 3:4:6. If the perimeter is 91 cm, find the length of each side.

Let $3x = \text{short side} = 3(7) = 21$

$4x = \text{middle length} = 4(7) = 28$

$6x = \text{longest side} = 6(7) = 42$

$3x + 4x + 6x = 91$

$\frac{13x}{13} = \frac{91}{13}$

$x = 7$

Proportion - A statement of equality between two ratios.

$\frac{a}{b} = \frac{c}{d}$

$ad = bc$

Solve for x.

1) $\frac{3}{5} = \frac{x}{20}$

$\frac{60}{5} = \frac{5x}{5}$

$12 = x$

2) $\frac{x}{1} = \frac{9}{2}$

$\frac{2x}{2} = \frac{9}{2}$

$x = \frac{9}{2} = 4\frac{1}{2}$

Why does cross multiplying work?

$\left(\frac{y}{y}\right)\frac{m}{x} = \frac{n}{y}\left(\frac{x}{x}\right)$

$\frac{my}{xy} = \frac{nx}{xy}$

$my = nx$

$xy = xy$

The same outcome is reached by cross multiplying.

Solve the proportions below.

3) $\frac{3}{x+4} = \frac{5}{x}$

$3x = 5(x+4)$

$3x = 5x + 20$

$\frac{-5x}{-5x} = \frac{20}{-5x}$

$\frac{-2x}{-2} = \frac{20}{-2}$

$x = -10$

4) $\frac{a+2}{3} = \frac{2a+1}{5}$

$5(a+2) = 3(2a+1)$

$5a+10 = 6a+3$

$\frac{-5a}{-5a} = \frac{3-10}{-5a}$

$10 = a+3$

$\frac{-3}{-3} = \frac{3-10}{-3}$

$7 = a$

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Solve the proportions below.

5) $\frac{2x}{x+4} = \frac{3}{x-1}$
 $2x(x-1) = 3(x+4)$
 $2x^2 - 2x = 3x + 12$
 $\frac{-3x \quad -3x}{2x^2 - 5x = 12}$
 $\frac{-12 \quad -12}{2x^2 - 5x - 12 = 0}$
 $1 \cdot 2 (2x + 3)(1x - 4) \begin{matrix} 1 \cdot 12 \\ 2 \cdot 6 \\ 3 \cdot 4 \\ 4 \cdot 6 \end{matrix}$
 $x = -\frac{3}{2}$ or $x = 4$

6) $\frac{a+1}{3} = \frac{7}{a-3}$
 $(a+1)(a-3) = 21$
 $a^2 - 2a - 3 = 21$
 $\frac{-21 \quad -21}{a^2 - 2a - 24 = 0}$
 $(a+4)(a-6) = 0$
 $a = -4, 6$

Find the ratio of a:b.

1) $5a = 7b$
 $\frac{5a}{5} = \frac{7b}{5}$
 $\frac{1}{b} \cdot a = \frac{7}{5} b \cdot \frac{1}{b}$
 $\frac{a}{b} = \frac{7}{5}$

2) $\frac{7}{b} = \frac{6}{a}$
 $\frac{7a}{7} = \frac{6b}{7}$
 $\frac{1}{b} \cdot a = \frac{6}{7} b \cdot \frac{1}{b}$
 $\frac{a}{b} = \frac{6}{7}$

Correct Proportions

$\frac{x}{25} = \frac{6}{5}$ $\frac{x}{6} = \frac{25}{5}$ $\frac{6}{5} = \frac{x}{25}$ $\frac{6}{x} = \frac{5}{25}$

Incorrect Proportions

$\frac{x}{6} = \frac{5}{25}$ $\frac{x}{5} = \frac{6}{25}$ $\frac{5}{6} = \frac{x}{25}$ $\frac{5}{x} = \frac{6}{25}$

Proportions are similar to analogies.

$\left(\frac{\text{Racket}}{\text{Tennis}} = \frac{x}{\text{Baseball}} \right)$ $\left(\frac{\text{Walk}}{\text{Run}} = \frac{\text{Talk}}{x} \right)$
 $x = \text{Bat}$ $x = \text{Shout}$

$\left(\frac{\text{Milk}}{\text{Ice Cream}} = \frac{\text{Bread}}{x} \right)$
 $x \neq \text{Flour}$
 $x = \text{Sandwich}$

If it takes 6 cups of flour to make 54 cookies, how many cookies can be made with 10 cups?

Let x = the number of cookies

$\frac{\text{cups}}{\text{cookies}} = \frac{6}{54} = \frac{10}{x}$
 $\frac{6x}{6} = \frac{540}{6}$
 $x = 90$ cookies

A printer can print 91 books in 7 hours. How many books can it print in 12 hours?

Let x = the number of books

$\frac{\text{books}}{\text{hours}} = \frac{91}{7} = \frac{x}{12}$
 $91(12) = 7x$
 $\frac{1092}{7} = \frac{7x}{7}$
 $156 = x$
 $x = 156$ books

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Tricky Problems

Tristan reads 40 pages of a 200 page book in 3 hours.
How long will it take him to finish the book?

Let $x = \#$ of hours

$$\frac{\text{pages}}{\text{hours}} \quad \frac{40}{3} = \frac{200}{x}$$

Wrong!

$$\frac{40}{3} = \frac{200 - 40}{x}$$

$$\frac{40}{3} = \frac{160}{x}$$

$$\frac{40x}{40} = \frac{480}{40}$$

$$x = 12 \text{ hours}$$

Tricky Problems

Austin drives 240 miles of a 1200 mile trip in 4 hours.
How long will it take him to finish the journey if he continues at this same rate?

Let $x = \#$ of hours

$$\frac{\text{miles}}{\text{hours}} \quad \frac{240}{4} = \frac{1200}{x}$$

Wrong!

$$\frac{240}{4} = \frac{1200 - 240}{x}$$

$$\frac{240}{4} = \frac{960}{x}$$

$$\frac{240x}{240} = \frac{3840}{240}$$

$$x = 16 \text{ hours}$$