

Ratios and Proportions

Warm-up:

The table gives the wins and losses of a baseball team. In which year(s) did the team have the best record? Explain.

Year	Wins	Losses
1890	60	24
1930	110	44
1970	110	52
2010	108	54

Ratios and Proportions

Objective To write ratios and solve proportions

Ratios and Proportions

Problem 1 Writing a Ratio

Bonsai Trees The bonsai bald cypress tree shown here is a small version of a full-size tree. In Longwood, Florida, a bald cypress tree called the Senator stands 118 ft tall. What is the ratio of the height of the bonsai to the height of the Senator?



$$118 \times 12 = 1416 \text{ in.}$$

$$15 : 1416 \quad \frac{15}{1416} = \frac{5}{472}$$

Problem 2 Dividing a Quantity Into a Given Ratio

Fundraising Members of the school band are buying pots of tulips and pots of daffodils to sell at their fundraiser. They plan to buy 120 pots of flowers. The ratio $\frac{\text{number of tulip pots}}{\text{number of daffodil pots}}$ will be $\frac{2}{3}$. How many pots of each type of flower should they buy?

$$\begin{array}{l} \text{tulip} \quad 2x \\ \hline \text{daffodil} \quad 3x \end{array} \quad \begin{array}{l} 2x + 3x = 120 \\ 5x = 120 \\ x = 24 \end{array}$$
$$\begin{array}{l} 2x = 48 \text{ tulip} \\ 3x = 72 \text{ daffodil} \\ \hline 120 \text{ total} \end{array}$$

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Problem 2 : part 2

The measures of two supplementary angles are in the ratio 1 : 4.
What are the measures of the angles?

$$1x : 4x$$

$$x + 4x = 180$$

$$5x = 180$$

$$x = 36$$

$$\begin{array}{c} 36^\circ \\ 144^\circ \end{array}$$

Solving a Proportion

Algebra What is the solution of each proportion?

$$\text{A } \frac{6}{x} = \frac{5}{4}$$

$$5x = 24$$

$$x = \frac{24}{5} \text{ or } 4.8$$

$$\text{B } \frac{y+4}{9} = \frac{y}{3}$$

$$3(y+4) = 9y$$

$$3y + 12 = 9y$$

$$12 = 6y$$

$$y = 2$$

What is the solution to the proportion $\frac{9}{2} = \frac{a}{14}$?

$$2a = 126$$

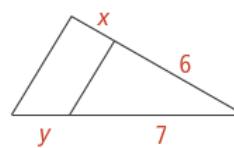
$$a = 63$$

Ratios and Proportions

Writing Equivalent Proportions

In the diagram $\frac{x}{6} = \frac{y}{7}$, what ratio completes the equivalent proportion $\frac{x}{y} = \frac{\square}{\square}$? Justify your answer.

$$\frac{6}{7}$$



Reteach Worksheet

Ratios and Proportions

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Reteaching

Ratios and Proportions

Problem

About 15 of every 1000 light bulbs assembled at the Brite Lite Company are defective. If the Brite Lite Company assembles approximately 13,000 light bulbs each day, about how many are defective?

Set up a proportion to solve the problem. Let x represent the number of defective light bulbs per day.

$$\frac{15}{1000} = \frac{x}{13,000}$$

$$15(13,000) = 1000x \quad \text{Cross Products Property}$$

$$195,000 = 1000x \quad \text{Simplify.}$$

$$\frac{195,000}{1000} = x \quad \text{Divide each side by 1000.}$$

$$195 = x \quad \text{Solve for the variable.}$$

About 195 of the 13,000 light bulbs assembled each day are defective.

Exercises

Use a proportion to solve each problem.

- About 45 of every 300 apples picked at the Newbury Apple Orchard are rotten. If 3560 apples were picked one week, about how many apples were rotten?
- A grocer orders 800 gal of milk each week. He throws out about 64 gal of spoiled milk each week. Of the 9600 gal of milk he ordered over three months, about how many gallons of spoiled milk were thrown out?
- Seven of every 20 employees at V & B Bank Company are between the ages of 20 and 30. If there are 13,220 employees at V & B Bank Company, how many are between the ages of 20 and 30?
- About 56 of every 700 picture frames put together on an assembly line have broken pieces of glass. If 60,000 picture frames are assembled each month, about how many will have broken pieces of glass?

Algebra Solve each proportion.

$$5. \frac{300}{1600} = \frac{x}{4800} \quad 6. \frac{40}{140} = \frac{700}{x} \quad 7. \frac{x}{2000} = \frac{17}{400}$$

$$8. \frac{35}{x} = \frac{150}{2400} \quad 9. \frac{x}{1040} = \frac{290}{5200} \quad 10. \frac{x}{42,000} = \frac{87}{500}$$

$$11. \frac{x}{380} = \frac{180}{5700} \quad 12. \frac{1200}{90,000} = \frac{270}{x} \quad 13. \frac{325}{x} = \frac{7306}{56,200}$$

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Reteaching (continued)

Ratios and Proportions

In a proportion, the products of terms that are diagonally across the equal sign from each other are the same. This is called the *Cross Products Property* because the products cross at the equal sign.

$$\begin{array}{c} a \quad c \\ \diagdown \quad \diagup \\ = \\ \diagup \quad \diagdown \\ b \quad d \end{array} \begin{array}{l} \longrightarrow b \times c \\ \longrightarrow a \times d \end{array} \quad b \times c = a \times d$$

Proportions have other properties:

- Property (1) $\frac{a}{b} = \frac{c}{d}$ is equivalent to $\frac{b}{a} = \frac{d}{c}$. Use reciprocals of the ratios.
- Property (2) $\frac{a}{b} = \frac{c}{d}$ is equivalent to $\frac{a}{c} = \frac{b}{d}$. Switch b and c in the proportion.
- Property (3) $\frac{a}{b} = \frac{c}{d}$ is equivalent to $\frac{a+b}{b} = \frac{c+d}{d}$. Add the denominator to the numerator.

Problem

How can you use the Cross Products Property to verify Property (3)?

$$\frac{a}{b} = \frac{c}{d} \text{ is equivalent to } ad = bc.$$

$$\frac{a+b}{b} = \frac{c+d}{d} \text{ is equivalent to } (a+b)d = b(c+d). \quad \text{Cross Products Property}$$

$$ad + bd = bc + bd \quad \text{Distributive Property}$$

$$ad = bc \quad \text{Subtraction Property of Equality}$$

So, $\frac{a}{b} = \frac{c}{d}$ is equivalent to $\frac{a+b}{b} = \frac{c+d}{d}$.

Exercises

Use the proportion $\frac{x}{10} = \frac{2}{5}$. Complete each statement. Justify your answer.

$$14. \frac{x}{2} = \frac{\square}{\square} \quad 15. \frac{10}{x} = \frac{\square}{\square} \quad 16. \frac{x+10}{10} = \frac{\square}{\square}$$

17. The ratio of width to length of a rectangle is 7 : 10. The width of the rectangle is 91 cm. Write and solve a proportion to find the length.

18. The ratio of the two acute angles in a right triangle is 5 : 13. What is the measure of each angle in the right triangle?

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