3.6 Solve Proportions Using Cross Products

Goal • Solve proportions using cross products.

Your Notes

VOCABULARY

Cross product The product of the numerator of one ratio and the denominator of the other ratio

Scale drawing A two-dimensional drawing of an object in which the dimensions of the drawing are in proportion to the dimensions of the object

Scale model A three-dimensional model of an object in which the dimensions of the model are in proportion to the dimensions of the object

Scale A relationship between the drawing's or model's dimensions and the actual dimensions; This should be written as scale measure : actual measure.

CROSS PRODUCTS PROPERTY

Words The cross products of a proportion are equal.

Example $\frac{5}{6} = \frac{10}{12}$ $\quad 6 \cdot 10 = 60$, $\quad 5 \cdot 12 = 60$

Algebra If $\frac{a}{b} = \frac{c}{d}$ where $b \neq 0$ and $d \neq 0$, then $ad =$ bc.

Your Notes

Example 1 ***Solve a proportion using cross products***

Solve the proportion $\frac{5}{y} = \frac{15}{75}$.

Solution

$\frac{5}{y} = \frac{15}{75}$ — **Write original proportion.**

$5 \cdot 75 = y \cdot 15$ — **Cross products property**

$375 = 15y$ — **Simplify.**

$25 = y$ — **Divide each side by 15.**

The solution is 25.

Example 2 ***Write and solve a proportion***

Plant Food To feed your plants, you need to mix 3 tablespoons of plant food with 16 ounces of water. If it takes 80 ounces of water to feed all of your plants, how many tablespoons of plant food are needed?

Solution

Step 1 **Write** a proportion involving two ratios that compare the amount of plant food with the amount of water.

$\frac{3}{16} = \frac{x}{80}$ ← amount of plant food ← amount of water

Step 2 **Solve** the proportion.

$\frac{3}{16} = \frac{x}{80}$ — **Write proportion.**

$3 \cdot 80 = 16 \cdot x$ — **Cross product property**

$240 = 16x$ — **Simplify.**

$15 = x$ — **Divide each side by 16.**

You need 15 tablespoons of plant food for 80 ounces of water.

Your Notes

✔ ***Checkpoint*** **Solve the proportion. Check your solution.**

1. $\frac{5}{n} = \frac{25}{45}$

$n = 9$

2. $\frac{6}{b} = \frac{3}{b-2}$

$b = 4$

3. In Example 2, suppose it takes 120 ounces to feed all of the plants. How many tablespoons of plant food are needed?

22.5 tablespoons

Example 3 ***Use a scale model***

Scale Model An architect creates a scale model of a school. The school is 50 feet high. The ratio of the model to the actual school is 1 foot to 75 feet. Estimate the height of the model.

Solution

Write and solve a proportion to find the height h of the scale model.

$\frac{1}{75} = \frac{h}{50}$ ← height of model (feet)
← actual height (feet)

$1 \cdot 50 = 75 \cdot h$ **Cross products property**

$\frac{2}{3} = h$ **Simplify.**

The height of the scale model is $\frac{2}{3}$ foot, or 8 inches.

Homework

✔ ***Checkpoint*** **Complete the following exercise.**

4. In Example 3, suppose the ratio of the model to the actual school is 1 foot to 100 feet. Estimate the height of the model.

$\frac{1}{2}$ foot, or 6 in.