Write and Solve Proportions by Using Cross-Products

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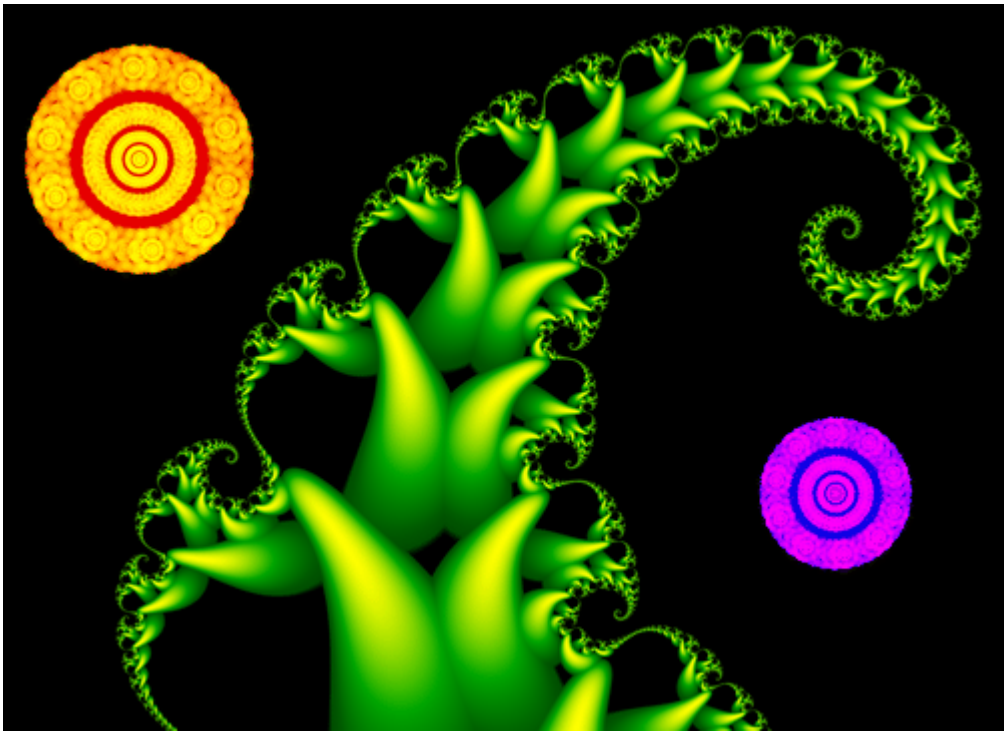


[Figure 1]

Sandra is doing a survey to discover students' favorite type of movie. She asks 20 students and 7 say that science fiction is their favorite genre. At this rate, if Sandra asks all 460 students in the school, how many will choose science fiction as their favorite type of movie?

In this concept, you will learn to write and solve proportions by using cross-products and algebra.

Cross Products

A proportion is created when two ratios are equal. Sometimes, you will know three parts of a proportion and there will be one missing part. When this happens, you will need to solve a proportion.

A way of solving a proportion is called **cross-multiplying**, and this involves algebra. The rule for cross multiplying is:

If $\frac{a}{b} = \frac{c}{d}$, then $ad = bc$.

This is also called "the product of the means is equal to the product of the extremes." The values in the 'b' and 'c' positions are called the **means**, and the values in the 'a' and 'd' positions are called the **extremes**.

Let's look at an example.

Solve for x.

$$\frac{x}{5} = \frac{9}{10}$$

First, cross multiply.

$$\begin{aligned} \frac{x}{5} &= \frac{9}{10} \\ 10x &= 9 \times 5 \\ 10x &= 45 \end{aligned}$$

Next, solve for x by dividing both sides by 10.

$$\begin{aligned} 10x &= 45 \\ \frac{10x}{10} &= \frac{45}{10} \\ x &= 4.5 \end{aligned}$$

The answer is 4.5.

Here is another example.

Solve for x.

$$\frac{4}{5} = \frac{16}{x}$$

First, cross multiply.

$$\begin{aligned} \frac{4}{5} &= \frac{16}{x} \\ 4x &= 5 \times 16 \\ 4x &= 80 \end{aligned}$$

Next, solve for x by dividing both sides by 4.

$$\begin{aligned} 4x &= 80 \\ \frac{4x}{4} &= \frac{80}{4} \\ x &= 20 \end{aligned}$$

The answer is 20.

Examples

Example 1

Earlier, you were given a problem about Sandra's science fiction study.

Sandra wants to figure out how many of the 460 students will choose science fiction, given that 7 out of 20 students already selected science fiction as their favorite movie genre.

First, write your proportion.

$$\frac{7}{20} = \frac{x}{460}$$

Next, cross multiply.

$$\begin{aligned} \frac{7}{20} &= \frac{x}{460} \\ 20x &= 7 \times 460 \\ 20x &= 3220 \end{aligned}$$

Then, solve for x by dividing both sides by 20.

$$\begin{aligned} 20x &= 3220 \\ \frac{20x}{20} &= \frac{3220}{20} \\ x &= 161 \end{aligned}$$

The answer is 161.

Sandra, using the ratio of $7:20$ would find 161 of the 46- students choose science fiction as their favorite type of movie.

Example 2

The ratio of apples to bananas at a store is 3 to 8. If there are 90 apples, how many bananas are there?

First, write your proportion.

$$\frac{3}{8} = \frac{90}{x}$$

Next, cross multiply.

$$\begin{aligned} \tfrac{3}{8} &= \tfrac{90}{x} \\ 3x &= 8 \times 90 \\ 3x &= 720 \end{aligned}$$

Then, solve for x by dividing both sides by 3.

$$\begin{aligned} 3x &= 720 \\ \tfrac{3x}{3} &= \tfrac{720}{3} \\ x &= 240 \end{aligned}$$

The answer is 240.

There were 240 bananas.

Example 3

Solve for x.

$$\frac{x}{9} = \frac{18}{27}$$

First, cross multiply.

$$\begin{aligned} \tfrac{x}{9} &= \tfrac{18}{27} \\ 27x &= 9 \times 18 \\ 27x &= 162 \end{aligned}$$

Next, solve for x by dividing both sides by 27.

$$\begin{aligned} 27x &= 162 \\ \frac{27x}{27} &= \frac{162}{27} \\ x &= 6 \end{aligned}$$

The answer is 6.

Example 4

Solve for y.

$$\frac{3}{7} = \frac{33}{y}$$

First, cross multiply.

$$\begin{aligned} \frac{3}{7} &= \frac{33}{y} \\ 3y &= 7 \times 33 \\ 3y &= 231 \end{aligned}$$

Next, solve for y by dividing both sides by 3.

$$\begin{aligned} 3y &= 231 \\ \frac{3y}{3} &= \frac{231}{3} \\ y &= 77 \end{aligned}$$

The answer is 77.

Example 5

Solve for x.

$$\frac{x}{2} = \frac{49.5}{99}$$

First, cross multiply.

$$\begin{aligned} \frac{x}{2} &= \frac{49.5}{99} \\ 99x &= 2 \times 49.5 \\ 99x &= 99 \end{aligned}$$

Next, solve for x by dividing both sides by 99.

$$\begin{aligned} 99x &= 99 \\ \frac{99x}{99} &= \frac{99}{99} \\ x &= 1 \end{aligned}$$

The answer is 1.

Review

Solve each proportion by using cross–multiplying with algebra. You may round to the nearest tenth when necessary.

1. $\frac{3}{5} = \frac{y}{2.5}$
2. $\frac{6}{7} = \frac{2.5}{y}$
3. $\frac{4}{5} = \frac{2}{x}$
4. $\frac{9}{11} = \frac{14}{x}$
5. $\frac{2}{3} = \frac{5}{y}$
6. $\frac{12}{3} = \frac{4}{y}$
7. $\frac{22}{40} = \frac{11}{x}$
8. $\frac{60}{x} = \frac{5}{10}$
9. $\frac{12}{50} = \frac{3}{y}$

10. $\frac{42}{36} = \frac{7}{y}$

11. $\frac{56}{63} = \frac{x}{9}$

12. $\frac{120}{130} = \frac{1.2}{y}$

Solve each problem.

13. The ratio of fiction to nonfiction books at a library is 5 to 3. If there are 480 nonfiction books, find f, the number of fiction books.

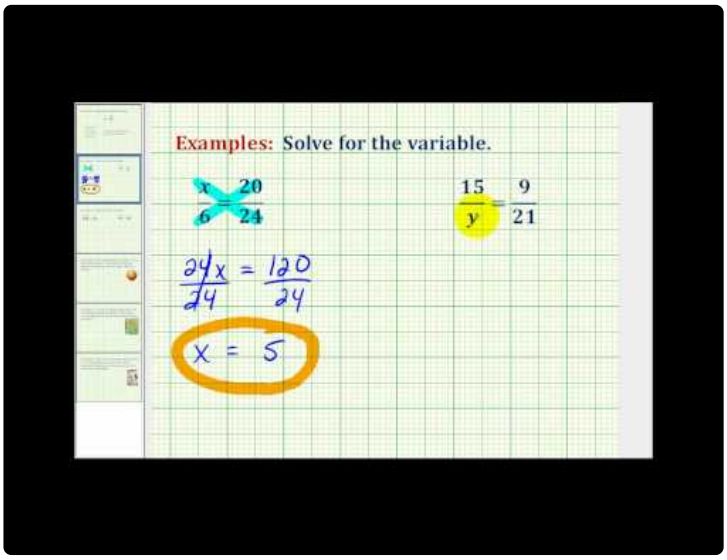
14. The ratio of cherry trees to apple trees at an orchard is 4 to 9. If there are 184 cherry trees, find a, the number of apple trees.

15. The ratio of cars to SUVs in a parking lot is 10 to 7. If there are 84 SUVs, find c, the number of cars in the lot.

Review (Answers)

To see the review answers, return to the Table of Contents and select 'Other Versions' or 'Resources'.

Resources



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