Write and Solve Proportions by Using Equivalent Rates

Brenda Meery

Jen Kershaw

To access the online version of this FlexBook
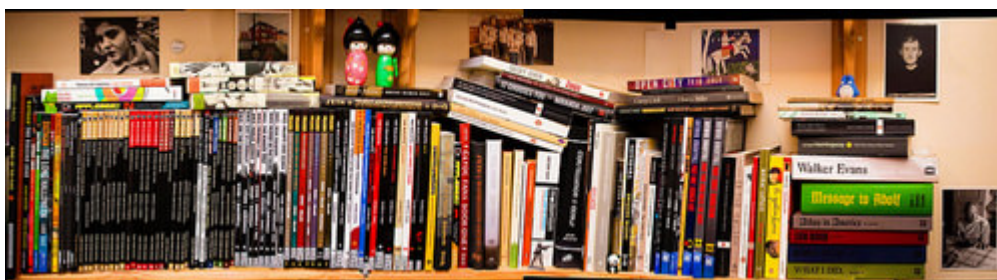click the link below:

AUTHORS
Brenda Meery
Jen Kershaw

4.3 Write and Solve Proportions by Using Equivalent Rates

FlexBooks 2.0 > VUB Math > Write and Solve Proportions by Using Equivalent Rates

Last Modified: Aug 23, 2023

[Figure 1]

Jamie is participating in her local county's reading challenge. She has to keep a log of all the books she reads, and how long it takes her to read each one. If Jamie can read 15 pages in 25 minutes, how many pages can she read in 65 minutes?

In this concept, you will learn to write and solve proportions by using equivalent rates.

Equivalent Rates

A **ratio** is a comparison between two quantities or numbers. Ratios can be written in fraction form, with a colon or by using the word "to". Sometimes, you will compare ratios. Sometimes one ratio will be greater than another, and other times they can be equal or equivalent. When you have two equal ratios, you have a proportion. A **proportion** is created when two ratios are equal, or we can say that two equal ratios form a proportion.

You can write a proportion when we know that two ratios are equivalent.

$$1:2 = 2:4$$

These two ratios are equivalent. You can say that the two ratios form a proportion.

Let's look at an example.

Do these two ratios, $\frac{3}{4}$ and $4:24$ form a proportion?

First, put the ratio $4:24$ into fraction form.

$$4 : 24 = \frac{4}{24}$$

Next, reduce the fraction.

$$\frac{4}{24} = \frac{1}{6}$$

Then, compare the two fractions.

$$\frac{1}{6} \neq \frac{3}{4}$$

The answer is $\frac{1}{6} \neq \frac{3}{4}$.

If the ratios are equivalent, they form a proportion. Since the ratios are not equivalent, the ratios do not form a proportion.

To write a proportion, set two equivalent fractions equal to each other, using the information in the problem.

Let's do another example.

If you know the ratio of girls to boys in a class is $2 : 3$, and you know there are 24 boys in the class, you can write a proportion in order to find the number of girls in the class.

First, write the ratio of the girls to boys.

$$\frac{\text{girls}}{\text{boys}} = \frac{2}{3}$$

Next, write the proportion statement knowing there are 24 boys in the class.

$$\frac{2}{3} = \frac{x}{24}$$

Then, cross multiply to solve for x.

$$
\begin{aligned}
\frac{2}{3} &= \frac{x}{24} \\
3x &= 2 \times 24 \\
3x &= 48 \\
x &= 19
\end{aligned}
$$

The answer is 19.

The class has 19 girls and 24 boys in the class.

Let's use equivalent rates to solve a proportion.

The ratio of teachers to students in a certain school is $2:25$. If there are 400 students in the eighth-grade class, how many teachers are there?

First, write the ratio of the teachers to students.

$$
\frac{\text{teacher}}{\text{students}} = \frac{2}{25}
$$

Next, write the proportion statement knowing there are 400 students in the 8th grade.

$$
\frac{2}{25} = \frac{x}{400}
$$

Then, cross multiply to solve for x.

$$
\begin{aligned}
\frac{2}{25} &= \frac{x}{400} \\
25x &= 2 \times 400 \\
25x &= 800 \\
x &= 32
\end{aligned}
$$

The answer is 32.

There are 32 8th grade teachers.

Examples

Example 1

Earlier, you were given a problem about Jamie's robust reading challenge.

Jamie reads 15 pages in 25 minutes and wants to know how many pages she can read in 65 minutes.

First, write a proportion to represent this problem.

$$\frac{15}{25} = \frac{x}{65}$$

Next, cross multiply.

$$
\begin{aligned}
\frac{15}{25} &= \frac{x}{65} \\
25x &= 15 \times 65 \\
25x &= 975
\end{aligned}
$$

Then, divide by 25 to solve for x.

$$
\begin{aligned}
25x &= 975 \\
\frac{25x}{25} &= \frac{975}{25} \\
x &= 39
\end{aligned}
$$

The answer is 39.

Therefore Jamie can read 39 pages in 65 minutes.

Example 2

Write a proportion to describe this situation. The proportion of red paper to white paper in a stack is 2 to 7. If there are 32 red pieces of paper, what proportion could be used to find the number of pieces of white paper?

First, write the ratio of the teachers to students.

$$\frac{\text{red paper}}{\text{white paper}} = \frac{2}{7}$$

Next, write the proportion statement knowing there are 32 pieces of red paper.

$$\frac{2}{7} = \frac{32}{x}$$

Then, cross multiply to solve for x.

$$
\begin{aligned}
\frac{2}{7} &= \frac{32}{x} \\
2x &= 7 \times 32 \\
2x &= 224 \\
x &= 112
\end{aligned}
$$

The answer is 112.

There are 112 white pieces of paper.

Example 3

Solve for x in the proportion $\dfrac{3}{4} = \dfrac{6}{x}$ by using equal ratios.

First, cross multiply.

$$
\begin{aligned}
\frac{3}{4} &= \frac{6}{x} \\
3x &= 4 \times 6 \\
3x &= 24
\end{aligned}
$$

Next, divide by 3 x.

$$
\begin{aligned}
3x &= 24 \\
\frac{3x}{3} &= \frac{24}{3} \\
x &= 8
\end{aligned}
$$

The answer is 8.

Therefore $\dfrac{3}{4} = \dfrac{6}{8}$.

Example 4

Solve for x in the proportion $\dfrac{9}{50} = \dfrac{x}{100}$ by using equal ratios.

First, cross multiply.

$$
\begin{aligned}
\frac{9}{50} &= \frac{x}{100} \\
50x &= 9 \times 100 \\
50x &= 900
\end{aligned}
$$

Next, divide by 50 to solve for x.

$$
\begin{aligned}
50x &= 900 \\
\frac{50x}{50} &= \frac{900}{50} \\
x &= 18
\end{aligned}
$$

The answer is 18.

Therefore $\dfrac{9}{50} = \dfrac{18}{100}$.

Example 5

Solve for x in the proportion $\dfrac{3.5}{7} = \dfrac{x}{35}$ by using equal ratios.

First, cross multiply.

$$
\begin{aligned}
\frac{3.5}{7} &= \frac{x}{35} \\
7x &= 3.5 \times 35 \\
7x &= 122.5
\end{aligned}
$$

Next, divide by 7 to solve for x .

$$
\begin{aligned}
7x &= 122.5 \\
\frac{7x}{7} &= \frac{122.5}{7} \\
x &= 17.5
\end{aligned}
$$

The answer is 17.5.

Therefore $\dfrac{3.5}{7} = \dfrac{175}{35}$.

Review

Solve each proportion using equal ratios.

1. $\dfrac{3}{4} = \dfrac{x}{12}$

2. $\dfrac{5}{6} = \dfrac{x}{12}$

3. $\dfrac{4}{7} = \dfrac{8}{y}$

4. $\dfrac{2}{3} = \dfrac{12}{y}$

5. $\dfrac{4}{5} = \dfrac{44}{y}$

6. $\dfrac{12}{13} = \dfrac{x}{26}$

7. $\dfrac{9}{10} = \dfrac{81}{y}$

8. $\dfrac{6}{7} = \dfrac{18}{y}$

9. $\dfrac{7}{8} = \dfrac{x}{56}$

10. $\dfrac{12}{14} = \dfrac{36}{x}$

11. $\dfrac{6}{4} = \dfrac{x}{12}$

12. $\dfrac{12}{14} = \dfrac{24}{x}$

13. $\dfrac{13}{14} = \dfrac{x}{42}$

14. $\dfrac{1.5}{4} = \dfrac{x}{8}$

15. $\dfrac{3.5}{4.5} = \dfrac{x}{9}$

16. $\dfrac{9}{14} = \dfrac{108}{x}$

Review (Answers)

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

Resources

https://flexbooks.ck12.org/flx/render/embeddedobject/167905

⊡ **Report Content Errors**

1.0 REFERENCES

Image	Attributions
	Credit: poppet with a camera **Source:** https://www.flickr.com/photos/infobunny/8317173091/in/photolist-dEXFN4-kQbuFv-d3CdXm-Fa6wm-dRpekF-adgypB-kqsPuW-rmMs8P-pcgzp-q4dz8r-FH44k-m8KMN9-pr7NcE-fkr4Fc-8jH4eb-adwcMk-6ozJcT-5JNnEK-8oUH34-hZyg6F-aSeEyH-eNamDx-bvRkiE-pZ7HeQ-qGUz4M-5zo8kf-ecXWbk-6Uccv-iDoy2h-rYdds5-dEpG5A-71UN8-kVKFpt-dYJWCE-nyXiHz-4G9TCp-rrTNKk-qGBeL2-dtVQXr-oMcgyR-dXDrCi-aSewJa-ewg4Zi-8MV6wS-fTfabp-3QLLZG-86KxQn-uFqXxL-bQGRCK-ey5CVs