Proportions

Definition of a Proportion

A proportion is an equation showing that two ratios or rates are equal.

An example of a proportion:

$$\frac{3}{4} = \frac{6}{8}$$

We read it: "$three\ is\ to\ four\ as\ six\ is\ to\ eight.$"

If in a proportion one of the numbers is unknown, then we can solve the proportion and find the unknown number.

Here is an example of a proportion with an unknown number x:

$$\frac{x}{4} = \frac{3}{12}$$

The Cross Multiplication

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

Examples of Solving Proportions

Example:	Explanation:
Solve the proportion: $\frac{x}{4} = \frac{3}{12}$	
$x \cdot 12 = 4 \cdot 3$	Use cross-multiplying to multiply x and 12, then 4 and 3.
$12x = 12$	Divide both sides by 12.
$\frac{12x}{12} = \frac{12}{12}$	
$x = 1$	

Solve the proportion: $$\frac{x}{7} = \frac{3}{25}$$ $$x \cdot 25 = 7 \cdot 3$$ $$25x = 21$$ $$\frac{25x}{25} = \frac{21}{25}$$ $$x = \frac{21}{25}$$	Use cross-multiplying to multiply x and 25, then 7 and 3. Divide both sides by 25.
Solve the proportion: $$\frac{x+2}{3} = \frac{4}{5}$$ $$(x+2) \cdot 5 = 3 \cdot 4$$ $$5x + 10 = 12$$ $$-10 \quad -10$$ $$5x = 2$$ $$\frac{5x}{5} = \frac{2}{5}$$ $$x = \frac{2}{5}$$	Use cross-multiplying to multiply $x+2$ and 5, then 3 and 4. Have $x+2$ in parentheses when multiplying. Use distributive property to remove the parentheses: $(x+2) \cdot 5 = 5x + 10$ Divide both sides by 5.

Examples of Word Problems that Involve Proportions

Example:	Explanation:
Six cans cost $\$18$. How much will ten cans cost? Solution Let x represent the cost for 10 cans. 6 cans are to $\$18$ as 10 cans are to $\$x$. $\frac{6}{18} = \frac{10}{x}$ $6 \cdot x = 18 \cdot 10$ $6x = 180$ $\frac{6x}{6} = \frac{180}{6}$ $x = 30$ So, ten cans will cost $\$30$.	In this proportion, we will write the number of cans in the numerators, and the cost in the denominators. Use cross-multiplying to multiply 6 and x, then 18 and 10. Divide both sides by 6.
A wall, 12 feet long, contains 420 bricks. How many bricks will a 20 feet brick wall contain? Solution Let x represent the number of bricks of the 20 feet wall. 12 feet is to 420 bricks as 20 feet is to x bricks. $\frac{12}{420} = \frac{20}{x}$ $12 \cdot x = 420 \cdot 20$ $12x = 8{,}400$ $\frac{12x}{12} = \frac{8{,}400}{12}$ $x = 700$ So, the 20 feet brick wall contains 700 bricks.	In this proportion, we will write the number of feet in the numerators, and the number of bricks in the denominators. Use cross-multiplying to multiply 12 and x, then 420 and 20. Divide both sides by 12.