PROPORTIONALITY

A WHAT IS PROPORTIONALITY?

Discover: Imagine you are buying cookies. Each cookie costs \$2. The number of cookies is x and the total cost is y. We have:

1 cookie costs	$2=2\times1$
2 cookies cost	$4 = 2 \times 2$
3 cookies cost	$6=2\times3$
4 cookies cost	$8 = 2 \times 4$
x cookies cost	$y = 2 \times x$

x: number of cookies	1	2	3	4	x	
y: total cost	2	4	6	8	$2 \times x$	

• Ratio definition: No matter how many cookies you buy, the ratio $\frac{y}{x}$ is always the same and equal to the price of one cookie:

$$\frac{8}{4} = \frac{6}{3} = \frac{4}{2} = \frac{y}{x} = 2.$$

• Linearity definition: The total cost can also be expressed with a formula (a linear function):

$$y = 2 \times x$$
.

Definition **Proportional** -

Two variables x and y are proportional if the ratio $\frac{y}{x}$ is constant, equal to a value k called the coefficient of proportionality:

$$\frac{y}{x} = k$$
.

Equivalently, y is proportional to x if, for the same constant k,

$$y = k \times x$$
.

Ex: Does this table represent a proportional relationship?

\boldsymbol{x}	1	2	3
y	15	30	45

Answer: Yes. The table represents a proportional relationship because each ratio is equal:

$$\frac{15}{1} = \frac{30}{2} = \frac{45}{3} = 15.$$

B CALCULATING A FOURTH PROPORTIONAL

Method Calculating a Fourth Proportional -

If 4 tickets cost \$28, how much do 6 tickets cost if each ticket costs the same?

• Method 1: Using the Coefficient of Proportionality Find the unit price (price for 1 ticket):

Unit price
$$=\frac{28}{4}=7$$
.

Now multiply by 6 for 6 tickets:

Total for 6 tickets = $7 \times 6 = 42$.

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• Method 2: Proportion Equation

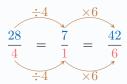
$$\frac{28}{4} = \frac{x}{6}$$

$$4 \times x = 28 \times 6 \quad \text{(cross-multiplication)}$$

$$x = \frac{28 \times 6}{4}$$

$$x = 42$$

• Method 3: Unit Rate with Equivalent Ratios



• Method 4: Cross-multiplication (Product in Cross)

Number of Tickets	<u>4</u> ÷	× 6
Price	28	$6 \times 28 \div 4 = 42$

So, 6 tickets cost 42 dollars.