Accelerated Math Notes
Proportional and Nonproportional Relationships
(Section 5-5)

Two quantities are **proportional** if they have a constant ratio or unit rate.
If they do not have a constant ratio or unit rate, they are **nonproportional**.
The constant ratio is called the **constant of proportionality**.

How can we show that two objects are **proportional**?

* Make a chart to show different possibilities
* Show the simplified ratios for each situation
  "y is proportional to x" means the ratio is $\frac{y}{x}$
* Decide if they are always the same or not
* The constant of proportionality is $\frac{y}{x}$ and can be written as a fraction in simplest form or as a decimal number

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Uptown Tickets charges $7 per baseball game ticket plus a $3 processing fee per order. Is the cost of an order proportional to the number of tickets ordered? Show your reasoning. If it is proportional, find the constant of proportionality.

y Cost ($)	10	17	24	31		
x Tickets (# ordered)	1	2	3	4		

$\frac{y}{x}$ $\frac{10}{1}$ $\frac{17}{2}=8.5$ 8 $\frac{31}{4}=7.75$

It is not proportional because the ratio of cost to tickets is not the same

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Is the amount of sugar used proportional to the amount of mix used to make this fruit punch? Show proof. If so, find the constant of proportionality.

Fruit Punch Recipe

y Cups of Sugar	$\frac{1}{2}$	1	$1\frac{1}{2}$	2
x Envelopes of Mix	1	2	3	4

$\frac{y}{x}$ $\frac{\frac{1}{2}}{1}=\left(\frac{1}{2}\right)$ $\left(\frac{1}{2}\right)$ $\frac{1\frac{1}{2}}{3}=\frac{1\frac{1}{2}\div3}{\frac{3}{2}\cdot\frac{1}{3}}=\left(\frac{1}{2}\right)$ $\frac{2}{4}=\left(\frac{1}{2}\right)$

It is proportional
$\frac{1}{2}$ is the constant of proportionality
$y = Kx$
$y = \frac{1}{2}x$

Proportional relationships can be described using equations of the form $y = kx$, where k is the constant ratio or constant of proportionality.
   The **constant of proportionality** is also called the **unit rate**. $\longrightarrow$ $5.75/day$

Nina charges $34.50 for 6 days of pet sitting. Find the constant of proportionality. Then write an equation relating the cost of pet sitting to the number of days.

$\frac{y}{x}$ $\frac{cost}{\# days}$ $\frac{34.50}{6} = 5.75$

$\frac{y}{x} = k = 5.75$

$y = kx$
$y = 5.75x$

Use your equation to find the cost of pet sitting for 4 days.

Panel 1 (top-left)

Some relationships that are proportional

* A circle's circumference is proportional to its diameter.

$$\frac{y}{x} \quad \frac{Circumf}{diameter} = k$$
$$= \pi$$
$$\boxed{C = \pi d}$$

y is proportional to x means
$\boxed{y = kx}$
where k = constant of proportionality

* A square's perimeter is proportional to its side length.

$$\frac{perimeter}{side} = k \qquad \boxed{P = 4S}$$

* The number of meters is proportional to its equivalent number of centimeters.

$$(m) \quad \frac{\# \ of \ meters}{\# \ of \ cm} \ (c) \qquad \frac{3}{300} = \frac{1}{100} \qquad m = \boxed{} c$$
$$\underset{k}{\uparrow} \qquad m = \frac{1}{100} c$$

Panel 2 (top-right)

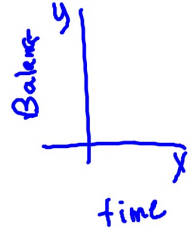Proportional or Not ? If so, find constant of proportionality and the equation that represents it in the form y = kx.

At the beginning of the year, Megan had $200 in the bank. Each week she deposits another $50. Is her bank account balance proportional to the number of weeks of deposits? Prove it.

X Time (# of weeks)	0	1	2	3		
y Balance in account	200	250	300	350		

$$\frac{y}{x} \quad \frac{Balance \ in \ account}{\# \ of \ weeks} \qquad \frac{200}{0} \qquad \frac{250}{1} \qquad \frac{300}{2}$$
$$\text{undefined} \qquad 250 \qquad 150$$

No, not proportional
Bal to # of weeks ratio not constant

Panel 3 (bottom-left)

Proportional or Not ? If so, find constant of proportionality and the equation that represents it in the form ⟨y = kx.⟩

*A store is having a sale where all clothes are 20% off the regular price. Is the sale price proportional to the regular price?

$$\frac{s}{r} \quad \frac{sale \ price}{reg \ price} \qquad \frac{80}{100} \qquad \frac{40}{50}$$
$$.8 \qquad .8$$

$$\boxed{S = \frac{4}{5} r} \ or$$
$$\boxed{S = 0.8 r}$$

Let s = sale price
Let r = regular price

*A store is having a sale where all clothes are 20% off the regular price. Is the regular price proportional to the sale price?

$$\frac{r}{s} \quad \frac{reg}{sale} = \qquad \frac{100}{80} \qquad \frac{50}{40}$$
$$\frac{5}{4} \qquad \frac{5}{4}$$

$$\boxed{r = \frac{5}{4} S} \ \boxed{or}$$
$$\boxed{r = 1.25 S}$$

Panel 4 (bottom-right)

Determine if the length of an edge of a cube is proportional to its volume.

y length	1	2	3			
x Volume	1	8	27			

$$1 \qquad \frac{1}{4} \qquad \frac{1}{9} \qquad \text{Not proportional}$$

Determine if the length of a side of a square is proportional to its perimeter.

S length side	1	2	3			
P Per.	4	8	12			

$$\frac{1}{4} \qquad \frac{1}{4} \qquad \frac{1}{4} \qquad \text{yes}$$

$$\boxed{S = \frac{1}{4} P}$$