Name: Answer Key Date:

11.6 Notes

Direct Variation	Inverse Variation
$y = kx$ $k \neq 0$ $k = \frac{y}{x}$	$y = \frac{k}{x}$ $k \neq 0$ $k = xy$

What does every equation need?

Constant of variation (k), y, and x

Example 1: Writing an Equation

Suppose y varies inversely with x, and y = 8 when x = 3. What is the equation for the inverse variation?

$y = \frac{k}{x}$
$8 = \frac{k}{3}$
$k = 24$

$y = \frac{24}{x}$

1. Suppose y varies inversely with x, and y = 12 when x = 6. What is the equation for the inverse variation?

$y = \frac{k}{x}$
$12 = \frac{k}{6}$
$k = 72$

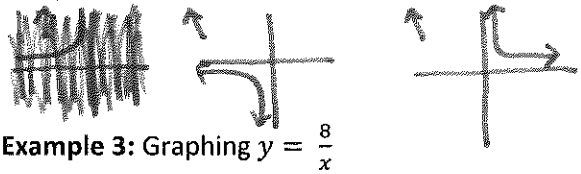
$y = \frac{72}{x}$

Example 2: What is happening graphically?

Use the equation to fill out the table: $y = \frac{18}{x}$ $x \neq 0$

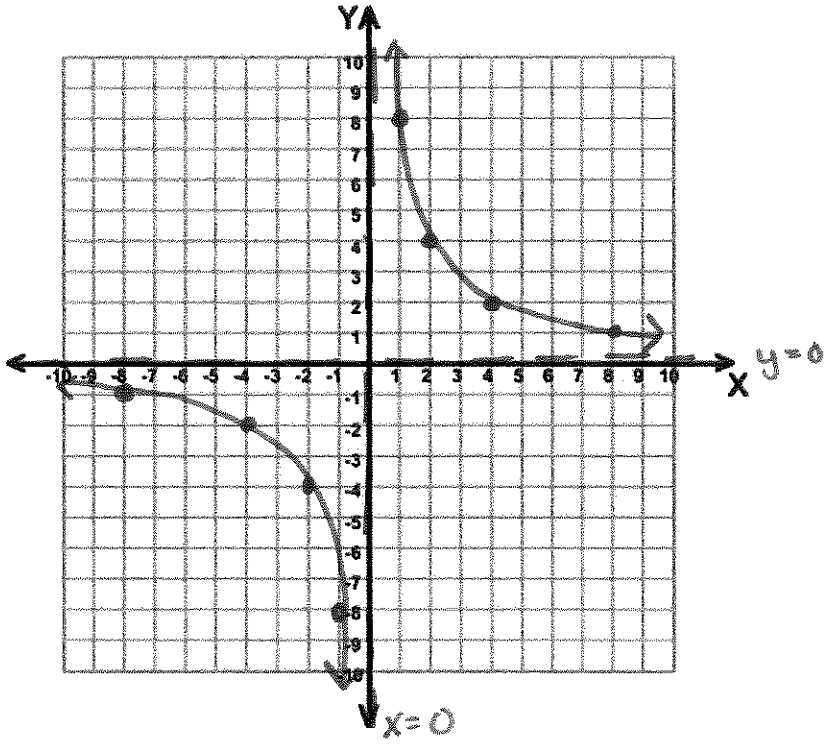
x	y	x	y
-1	-18	1	18
-2	-9	2	9
-3	-6	3	6
-6	-3	6	3
-9	-2	9	2

asymptotes: $x = 0$, $y = 0$



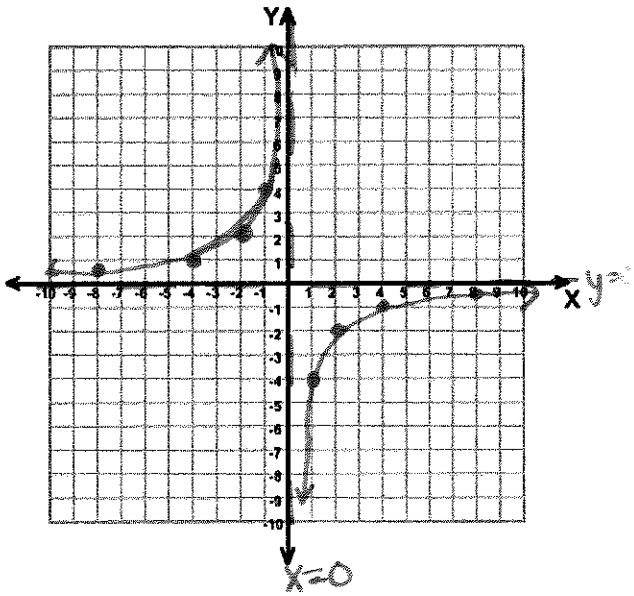
Example 3: Graphing $y = \frac{8}{x}$

x	y
-8	-1
-4	-2
-2	-4
-1	-8
1	8
2	4
4	2
8	1

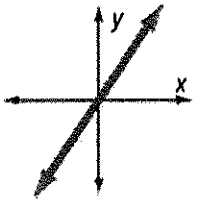


3. Graphing $y = \frac{-4}{x}$

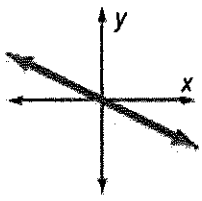
x	y
-8	1/2
-4	1
-2	2
-1	4
1	-4
2	-2
4	-1
8	-1/2



Direct Variation



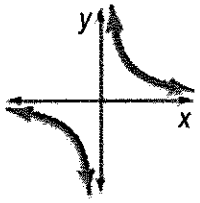
$y = kx, k > 0$ positive



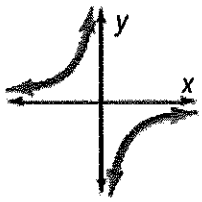
$y = kx, k < 0$ negative

y varies directly with x.
y is directly proportional to x.
The ratio $\frac{y}{x}$ is constant.

Inverse Variation



$y = \frac{k}{x}, k > 0$ positive

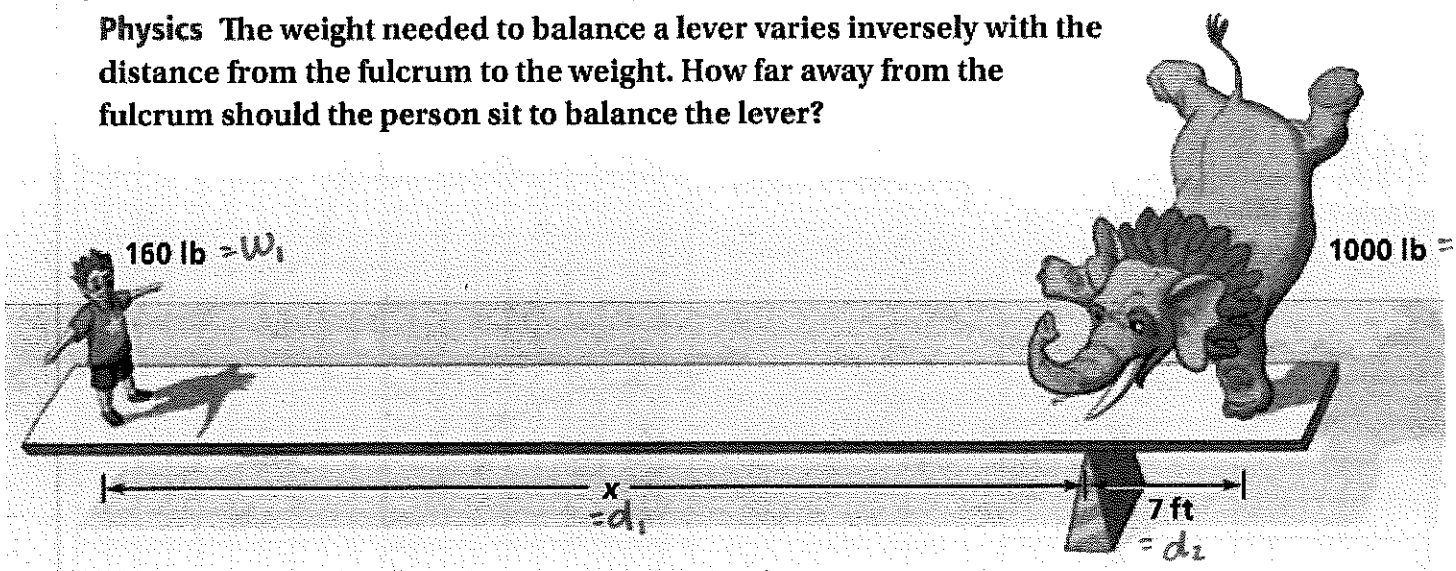


$y = \frac{k}{x}, k < 0$ negative

y varies inversely with x.
y is inversely proportional to x.
The product xy is constant.

Example 4: Word Problem $w_1 \cdot d_1 = w_2 \cdot d_2$

Physics **The weight needed to balance a lever varies inversely with the distance from the fulcrum to the weight. How far away from the fulcrum should the person sit to balance the lever?**



$160x = 1000(7)$

$\frac{160x}{160} = \frac{7000}{160} \Rightarrow x = 43.75$ ft

w_1 d_1 w_2 d_2

4. A 1,000lb elephant is 15 feet from a fulcrum and the trainer weighing 175 lbs is balanced across. How far away from the fulcrum should the trainer stand?

$1000(15) = 175\,d_2$

$\frac{15{,}000}{175} = \frac{175\,d_2}{175}$

$d_2 = \boxed{85.7 \text{ ft}}$

Example 5: Writing Equations

Do the data in each table represent a *direct variation* or an *inverse variation*? For each table, write an equation to model the data.

x	y
3	−15
4	−20
5	−25

$\frac{y}{x} = -5$

$\boxed{y = -5x \text{ Direct}}$

x	y
2	9
4	4.5
6	3

$xy = 18$

$\boxed{y = \frac{18}{x} \text{ inverse}}$

① $xy = -45$

$xy = -60$

$xy = -100$

X

② $\frac{y}{x} = -5$

$\frac{y}{x} = -5$

$\frac{y}{x} = -5$ ✓

① $xy = 18$

$xy = 18$

$xy = 18$ ✓

5. Do the data in each table represent a *direct variation* or an *inverse variation*? For each table, write an equation to model the data.

a.

x	y
4	−12
6	−18
8	−24

$\frac{y}{x} = -3$

$\boxed{y = -3x \text{ Direct}}$

$\frac{y}{x} = -3$

$\frac{y}{x} = -3$ ✓

$\frac{y}{x} = -3$

b.

x	y
4	−12
6	−8
8	−6

$xy = -48$

$\boxed{y = \frac{-48}{x} \text{ inverse}}$

$xy = -48$

$xy = -48$

$xy = -48$ ✓

Strategies + Patterns to Look For	
If $\|x\| \uparrow$ and $\|y\| \downarrow$ or $\|x\| \downarrow$ and $\|y\| \uparrow$ then inverse therefore $y = \frac{k}{x}$ $[xy = k]$	If $\|x\| \downarrow$ and $\|y\| \downarrow$ or $\|x\| \uparrow$ and $\|y\| \uparrow$ then direct therefore $y = kx$ $\left[\frac{y}{x} = k\right]$

Example 6:

Does each situation represent a *direct variation* or an *inverse variation*? Explain your reasoning.

A Boating **The cost of a $120 boat rental is split among several friends.**

Changes: # of friends

friends ↑ price ↓ [inverse variation]

B Entertainment **You download several movies for $14.99 each.**

Changes: # of movies

movies ↑ price ↑ [direct variation]

6. Does each situation represent a *direct variation* or an *inverse variation*? Explain your reasoning.

a. You buy sweaters in a clothing store for $35 each.

Changes: # of sweaters

sweaters ↑ price ↑ [direct variation]

b. You walk 5 mi each day. Your speed and time spent walking vary each day.

Changes: both (pick one) ⇒ you control speed

speed ↑ time ↓ [inverse variation]