PG 81

Lesson 9
Direct Variation

What You'll Learn

Scan the text on the following two pages. Write the definitions of direct variation and constant of proportionality.

- direct variation ______________________________
- constant of proportionality ______________________________

Essential Question

HOW can you show that two objects are proportional?

Vocabulary

direct variation
constant of variation
constant of proportionality

Common Core State Standards

Content Standards
7.RP.2, 7.RP.2a, 7.RP.2b

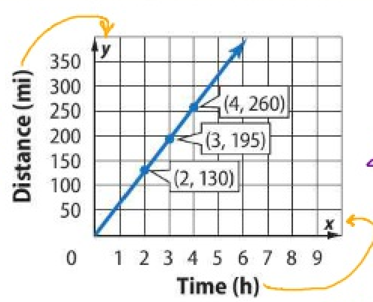
Mathematical Practices
1, 2, 3, 4

Real-World Link

Speed The distance *y* a car travels after *x* hours can be represented by $y = 65x$. The table and graph also represent the situation.

Time (hours) X	Distance (miles) Y
2	130
3	195
4	260

>65
>65



← SLOPE

$\frac{195}{3} = \frac{65}{1}$ $\frac{130}{2} = \frac{65}{1}$ UNIT RATE

$\frac{260}{4} = \frac{65}{1}$

1. Fill in the blanks to find the constant ratio.

$$\frac{\text{distance traveled}}{\text{driving time}} = \frac{130}{2} = \frac{195}{\boxed{3}} = \frac{\boxed{260}}{4}$$

The constant ratio is $\boxed{65}$ miles per hour.

2. The constant rate of change, or slope, of the line is $\frac{\text{change in miles}}{\text{change in time}}$, which is equal to $\frac{195-130}{3-2}$ or $\boxed{65}$ miles per hour.

3. Write a sentence that compares the constant rate of change and the constant ratio.

____

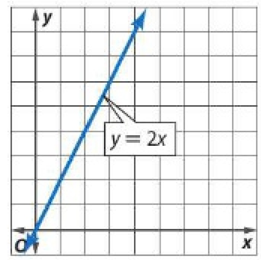
Page 2

Key Concept — Direct Variation

Words A linear relationship is a direct variation when the ratio of y to x is a constant, k. We say y varies directly with x.

Symbols $\frac{y}{x} = k$ or $y = kx$, where $k \neq 0$

Model



Example $y = 3x$

Work Zone

$y = 130$ $\frac{130}{2} = 65$
$x = 2$
$K = 65$

$y = 195$ $\frac{195}{3} = 65$
$x = 3$
$K = 65$

$y = 260$ $\frac{260}{4} = 65$
$x = 4$
$K = 65$

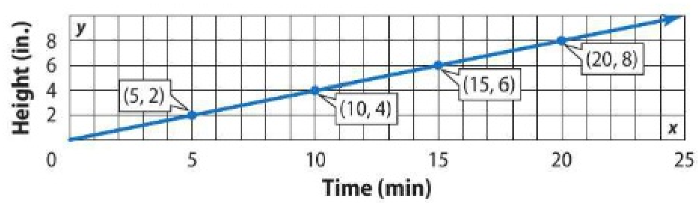
When two variable quantities have a constant ratio, their relationship is called a **direct variation**. The constant ratio is called the **constant of variation**. The constant of variation is also known as the **constant of proportionality**.

In a direct variation equation, the constant rate of change, or slope, is assigned a special variable, k.

Real World Example

Tutor

1. The height of the water as a pool is being filled is shown in the graph. Determine the rate in inches per minute.



TIME (X)	HEIGHT (Y)
5	2
10	4
15	6
20	8

Since the graph of the data forms a line, the rate of change is constant. Use the graph to find the constant of proportionality.

$\frac{Y}{X}$ $\frac{\text{height}}{\text{time}} \rightarrow \frac{2}{5}$ or $\frac{0.4}{1}$ $\frac{4}{10}$ or $\frac{0.4}{1}$ $\frac{6}{15}$ or $\frac{0.4}{1}$ $\frac{8}{20}$ or $\frac{0.4}{1}$

$K = 0.4$

The pool fills at a rate of 0.4 inch every minute.

CONSTANT

DIRECT VARIATION

Direct Variation

When a relationship varies directly, the graph of the function will always go through the origin, (0, 0). Also, the unit rate r is located at (1, r).

Got It? Do this problem to find out.

a. Two minutes after a diver enters the water, he has descended 52 feet. After 5 minutes, he has descended 130 feet. At what rate is the scuba diver descending?

$\frac{Y}{X} = K$ (CONSTANT)

TIME (X)	2	5
DEPTH (Y)	52	130

$\frac{52}{2} = 26$ $\frac{130}{5} = 26$

Show your work.

DIVING 26 ft PER MINUTE

a. ________