

✓ = direct variation function

### 3-6 Notes: Proportional and Non-proportional Relationships

**Proportional Relationships** If the relationship between the domain and range of a relation is linear, the relationship can be described by a linear equation. If the equation passes through  $(0, 0)$  and is of the form  $y = kx$ , then the relationship is proportional.

**Example: COMPACT DISCS** Suppose you purchased a number of packages of blank compact discs. If each package contains 3 compact discs, you could make a chart to show the relationship between the number of packages of compact discs and the number of discs purchased. Use  $x$  for the number of packages and  $y$  for the number of compact discs.

$x$	#pkgs	1	2	3
$y$	#cds	3	6	9

known

$y$  value = 0  
when  $x = 0$   
based on  
the pattern  
so passes through  
 $(0, 0)$  ✓

Slope = 3

$$y = 3x$$

#### Exercises

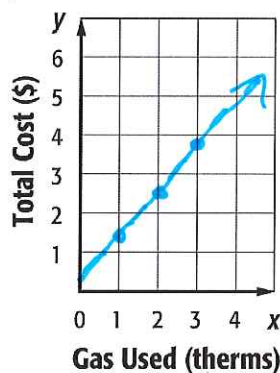
1. **NATURAL GAS** Natural gas use is often measured in "therms." The total amount a gas company will charge for natural gas use is based on how much natural gas a household uses. The table shows the relationship between natural gas use and the total cost.

Gas Used (therms)	1	2	3	4
Total Cost (\$)	\$1.30	\$2.60	\$3.90	\$5.20

- a. Graph the data. What can you deduce from the pattern about the relationship between the number of therms used and the total cost?

based on pattern  
 $y = 0$  when  $x = 0$   
so passes through  $(0, 0)$

Cost = \$1.30  
per therm  
used



- b. Write an equation to describe this relationship.

$$y = \$1.3x$$

- c. Use this equation to predict how much it will cost if a household uses 40 therms.

$$\begin{aligned} y &= 1.3x \\ y &= 1.3(40) \\ y &= 52 \end{aligned}$$

$x = \text{therms}$   
 $y = \text{total cost}$

Cost for 40 therms  
= \$52

★ **Non-proportional Relationships** If the ratio of the value of  $x$  to the value of  $y$  is different for select ordered pairs on the line, the equation is non-proportional.

example:  $y = 2x + 3$

x	0	1	3
y	3	5	7

= non-proportional

$$\frac{x}{y} = \frac{0}{3}, \frac{1}{5}, \frac{3}{7}$$

### Examples

Write an equation in function notation for the relation shown in the table. Then complete the table.

1.

x	-1	0	1	2	3	4
y	-2	2	6	10	14	18

+4  
+4

y intercept

$$y = mx + b$$

$$y = 4x + 2$$

slope:

$$\frac{6-2}{1-0} = 4$$

2.

x	-2	-1	0	1	2	3
y	10	7	4	1	-2	-5

-3

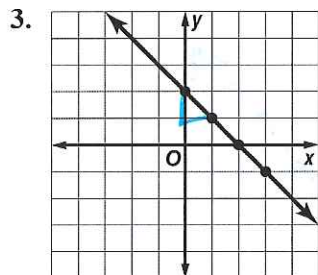
y intercept

$$\text{slope} = \frac{7-10}{-1-(-2)} = \frac{-3}{1} = -3$$

$$y = mx + b$$

$$y = -3x + 4$$

Write an equation in function notation for each relation.



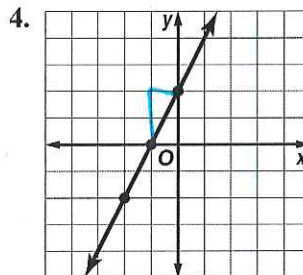
$$m = -1$$

$$\text{slope} = -1$$

$$\text{y intercept} = 2$$

$$y = mx + b$$

$$y = -x + 2$$



$$m = 2$$

$$\text{slope} = 2$$

$$\text{y intercept} = 2$$

$$y = mx + b$$

$$y = 2x + 2$$