

*Standard 7.RP.2 (M)***Proportional Relationships**

A **proportion** is an equation that shows two ratios are equivalent. The equation below shows two equivalent ratios.

$$\frac{1}{3} = \frac{3}{9}$$

In a **proportional relationship**, two quantities vary directly with one another. The constant in a proportional relationship is called the **constant of proportionality**. The constant of proportionality is the same value as the unit rate. In math equations, it is often represented by the variable k .

A proportional relationship, or **direct variation**, is a mathematical relationship between two variables that can be expressed by an equation in which one variable equals a constant (k) times the other variable. The equation below represents a proportional relationship, or direct variation.

$$y = kx$$

We can use an input-output table or a graph to determine if two quantities are in a proportional relationship.

Proportional Relationships in Tables

The table below shows the relationship between two quantities: the number of DVDs purchased and the total cost for the DVDs.

DVD Prices

Number of DVDs	Total Cost
1	\$4
3	\$12
5	\$20
9	\$36

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Talk About It

- How is the total cost of the DVDs determined?
- Do all the rows in the table follow this pattern? How do you know?

Each number in the first column multiplied by 4 equals the corresponding number in the second column. The constant of proportionality is 4.

Think About It–1: If 4 is the constant of proportionality, what is the unit rate?

Since every row in the table has the same unit rate, or constant of proportionality, the number of DVDs bought and the total cost have a proportional relationship.

Let's look at another example.

Seed Prices

Pounds of Seeds (x)	Total Cost (y)
$\frac{1}{2}$	\$1.75
1	\$3.50
$2\frac{1}{2}$	\$8.75
$3\frac{1}{2}$	\$12.25

Think About It–2: Do the two quantities in the table have a proportional relationship? You can determine this by finding the constant of proportionality. What constant, k , times the x values equals the y values ($y = kx$)?

OR

Do the y values divided by the x values all equal the same number, $k = \frac{y}{x}$?

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Hint: Change the decimal numbers to fractions before solving.

$$\frac{1\frac{3}{4}}{\frac{1}{2}} = \frac{3\frac{1}{2}}{1} = \frac{8\frac{3}{4}}{2\frac{1}{2}} = \frac{12\frac{1}{4}}{3\frac{1}{2}}$$

Remember: The two quantities have the same constant of proportionality if all the ratios are equivalent.

On Your Own

- Does each row have the same constant, k ? _____

If yes, what is the value of k ? _____

- Do the number of pounds of seeds and the total cost have a proportional relationship?

_____ How do you know? _____

- What is unit rate for the values in the table? _____ What does the unit rate mean? _____

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The Table Test

Directions: Determine whether the two quantities in each table below have a proportional relationship. Write YES or NO on each answer line. If the quantities have a proportional relationship, write the constant of proportionality (k) on the correct line.

1.

Number of Peaches	Total Cost
1	\$6
4	\$24
6	\$36
10	\$60

Answer: _____

 $k =$ _____

3.

Ounces of Oil	Total Cost
3	\$3.50
$4\frac{1}{2}$	\$0.90
$5\frac{1}{4}$	\$1.05
$6\frac{3}{4}$	\$1.35

Answer: _____

 $k =$ _____

2.

Number of Bananas	Total Cost
2	\$5
3	\$7.50
7	\$17.50
8	\$20

Answer: _____

 $k =$ _____

4.

Pounds of Flour	Total Cost
$1\frac{1}{2}$	\$2.25
$3\frac{1}{2}$	\$5.25
5	\$7.50
$7\frac{1}{2}$	\$11.25

Answer: _____

 $k =$ _____

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5.

Pounds of Beans	Total Cost
$1\frac{3}{4}$	\$5.25
4	\$12
$5\frac{1}{4}$	\$15.75
$9\frac{3}{4}$	\$29.25

Answer: _____

 $k =$ _____

7.

Number of Cards	Total Cost
2	\$3.50
6	\$10.50
9	\$15.75
12	\$21

Answer: _____

 $k =$ _____

6.

Number of Berries	Total Cost
14	\$1.40
24	\$2.40
64	\$4.60
74	\$7.40

Answer: _____

 $k =$ _____

8.

Ounces of Cotton	Total Cost
$\frac{1}{2}$	\$0.25
1	\$0.75
$3\frac{1}{2}$	\$1.70
5	\$2.50

Answer: _____

 $k =$ _____

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9.

Pounds of Rocks	Total Cost
$4\frac{1}{2}$	\$24.75
$10\frac{1}{2}$	\$57.75
$16\frac{1}{2}$	\$90.75
$18\frac{1}{2}$	\$101.75

Answer: _____

$k =$ _____

11.

Number of Shirts	Total Cost
6	\$13.20
18	\$39.60
30	\$66
42	\$94.20

Answer: _____

$k =$ _____

10.

Cups of Sugar	Total Cost
$\frac{1}{4}$	\$0.50
$\frac{1}{2}$	\$1
$\frac{3}{4}$	\$1.50
1	\$2

Answer: _____

$k =$ _____

12.

Pounds of Potatoes	Total Cost
3	\$14.25
9	\$42.25
12	\$57
15	\$71.25

Answer: _____

$k =$ _____