DIGITAL

NAME

Module 16 Solving Rational Equations
Lesson 2 Solving Problems Using Direct
Variation

independent
practice

Does *y* vary directly as *x*? If so, find the constant of variation and write the direct variation function.

1.

x	y
–3	18
5	–30
9	–54

yes; $k = -6$; $\frac{y}{x} = -6$

2.

x	y
–3	–2
–9	–6
18	12

yes; $k = \frac{2}{3}$; $\frac{y}{x} = \frac{2}{3}$

3.

x	y
18	24
24	32
48	60

no

4.

x	y
–3	12
$\frac{1}{2}$	–2
2	–8

yes; $k = -4$; $\frac{y}{x} = -4$

5.

x	y
0	0
2	$\frac{1}{3}$
12	–2

no

6.

x	y
2	14
3	21
5	35

yes; $k = 7$; $\frac{y}{x} = 7$

Solve.

7. The variable *y* varies directly as *x*: *y* is 12 when *x* is 4. Find *x* when *y* is 18.

$x = 6$

8. The variable *y* varies directly as *x*: *y* is –3 when *x* is 5. Find *y* when *x* is –15.

$y = 9$

9. The variable *y* varies directly as *x*: *y* is 10 when *x* is 12. Find *y* when *x* is 9.

$y = \frac{15}{2}$

10. The variable *y* varies directly as *x*: *y* is –2 when *x* is –4. Find *x* when *y* is 5.

$x = 10$

11. The variable *y* varies directly as *x*: *y* is 3.2 when *x* is 4.6. Find *x* when *y* is 1.6.

$x = 2.3$

12. The variable *y* varies directly as *x*: *y* is 3 when *x* is $-\frac{3}{4}$. Find *y* when *x* is 2.

$y = -8$

Solve using direct variation.

13. Jin Li earns $44 for eight hours work. How much will she earn for 30 hours work?

$165

14. On a map, the distance from Cesky Krumlov to Karlovy Vary is three inches. One inch represents 50 miles. What is the actual distance between these two Hungarian cities?

150 miles

15. Richard is taking a trip to Vancouver Canada. He exchanged 15 American dollars for 22.50 Canadian dollars. How many Canadian dollars will he get for 27 American dollars?

$40.50

16. If Mia receives $72.20 for $1,805.00 in sales, how much must her sales be in order to receive $150 in commission?

$3,750

17. Colin pays $7.50 for 50 pounds of rabbit feed. How much rabbit feed can he get for $1.50?

10 pounds

18. Merideth's heart beats 63 times in 45 seconds. How many times will her heart beat in one hour?

5,040 beats

Journal

1. Does the equation $y = kx$, where $k \neq 0$, represent a direct variation function? Explain.
2. Dwight says that the perimeter of a square varies directly as the length of a side of the square. Is he correct? Explain.
3. How can anyone tell if a line is the graph of a direct variation function?
4. Miguel earns $5.75 an hour mowing lawns. Explain how Miguel can use direct variation to find his pay for the week. What is the constant of variation in this situation?
5. Find the direct variation function whose graph passes through the point (2, 3).

Cumulative Review

Simplify each rational expression. Assume that the domains of the rational expressions contain no value for which any denominator is zero.

1. $\dfrac{3x}{6x + 9}$ $\dfrac{x}{2x + 3}$

2. $\dfrac{4x^2 + 4x - 3}{8x^2 - 2x - 1}$ $\dfrac{2x + 3}{4x + 1}$

3. $\dfrac{c^2 + 3c - 28}{c^2 - c - 12}$ $\dfrac{c + 7}{c + 3}$

4. $\dfrac{m^2 - 9}{(m + 3)^2}$ $\dfrac{m - 3}{m + 3}$

Solve each rational equation.

5. $\dfrac{1}{x} + \dfrac{2}{3} = \dfrac{3}{x}$ $x = 3$

6. $\dfrac{3}{4x} = \dfrac{4}{9}$ $x = \dfrac{27}{16}$

7. $\dfrac{5}{3} + \dfrac{4}{2x} = \dfrac{8}{3}$ $x = 2$

Calculator Problem

Use a graphing calculator to determine if $y = 3x$ is a direct variation.

1. Press [Y=]. Enter the function $y = 3x$ into **Y_1**. See Figure 1.
2. Press [GRAPH]. See Figure 2. (You may want to set your window dimension like those in Figure 3.)
3. The graph of a direct variation function is a non-vertical and non-horizontal line through the origin like the one in Figure 2. Determine the constant of variation.
4. Press [2nd][WINDOW]. Set values to those of Figure 4.
5. Press [2nd][GRAPH]. See Figure 5. The x values of the function appear in the first column of the table, and the y values appear in the second column of the table.
6. Press [Y=] and place the cursor to the right of **Y_2**. Press [VARS]. Use the right arrow key to select **Y–VARS**. Select **1: Function...** and then, select **1: Y_1**. Press [ENTER], [÷], then, [ALFA][STO→]. See Figure 6. This function divides every y value with its corresponding x value. In other words, if there is a constant of variation, $\frac{y}{x}$ is a constant value.
7. Press [2nd][GRAPH]. See Figure 7. The values in the third column are all 3 except the value corresponding to the coordinate (0, 0). This is because $\frac{0}{0}$ is undefined.
8. Press [GRAPH]. See Figure 8. The graph now shows a horizontal line at $y = 3$. This is a *graphical representation* of the constant of variation $k = 3$.
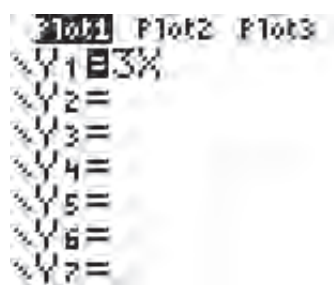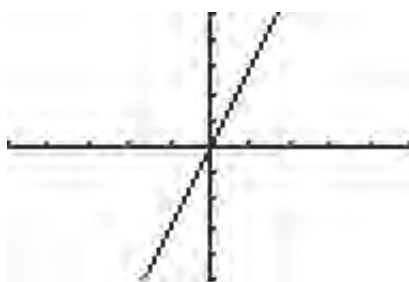

Figure 1

Figure 2

Figure 3

Figure 4
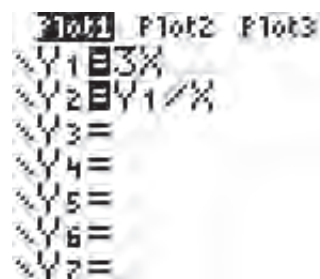
Figure 5

Figure 6

monotype composition
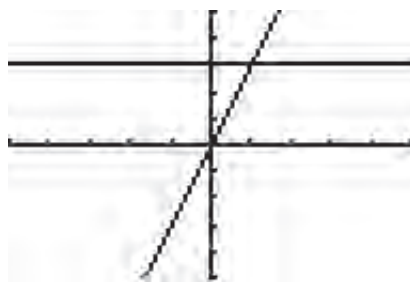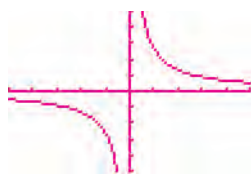410–467–3300

Figure 7

Figure 8

Graph and determine if the following functions are direct variations.

1. $y = \dfrac{8}{3x}$

not a direct variation

2. $y = 2.5x$

direct variation

3. $y = \dfrac{1}{2}x$

direct variation

4. $y = 5x - 2$

not a direct variation

Possible Journal Answers

1. Yes, by the Multiplication Property of Equality, $\dfrac{y}{x} = k$ becomes $x\left(\dfrac{y}{x}\right) = xk$. This is the same as $y = kx$.
2. The perimeter of a square is found by the equation $P = 4s$, where s is the length of one side of the square. This equation can be written as $\dfrac{P}{s} = 4$, where 4 is the constant of variation. The variable P varies directly as s.
3. The graph of a direct variation is a line that passes through the origin, which is neither vertical nor horizontal.
4. Miguel's pay, p, is \$5.75 times the number of hours, h, he works. This can be written as $p = 5.75h$ or $\dfrac{p}{h} = 5.75$. Miguel's pay varies directly as the number of hours he works; \$5.75 is the constant of variation.
5. When x is 2, y is 3. The constant of variation is $\dfrac{3}{2}$. The direct variation function is $\dfrac{y}{x} = \dfrac{3}{2}$.

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