Lesson Title 7.1 Direct, Inverse, & Joint Variation NOTES **Alg 2** **Date** _____

OBJECTIVE 1: Terminology

- **Direct variation** (review from Alg 1) is the relationship between two variables x and y
  - Equation for direct variation is y = kx and k cannot be 0
  - The phrase is "y varies directly as x"
  - Linear data
- "k" is always the unknown constant
- **Inverse variation** (new in Algebra 2) is the relationship between two variables x and y
  - Equation for inverse variation is $y = \frac{k}{x}$ and x cannot be 0
  - The phrase is "y varies inversely as x"
  - Nonlinear data
- **Joint Variation** (new in Algebra 2) is the relationship between three variables x, y, & z
  - Equation for joint variation is y = kxz and k cannot be 0
  - The phrase is "y varies jointly as x and z"
  - Nonlinear data

OBJECTIVE 2: Graphing & Writing Direct & Inverse Variation Equations

STEPS:

1. Plug x and y into the equation, either direct or inverse, depending on the phrase
2. Solve for "k", the constant of variation.
3. Rewrite the formula with only the k value replaced
4. Graph the equation created in Step 3
5. Use the equation created in Step 3 to solve for new values to predict.

TASK 2: Apply the same steps to this real-world scenario.

The cost of an item in euros e **varies directly** as the cost of the item in dollars d, and e = 3.85 euros when d = $5.00.

Find d when e = 10.00 euros.

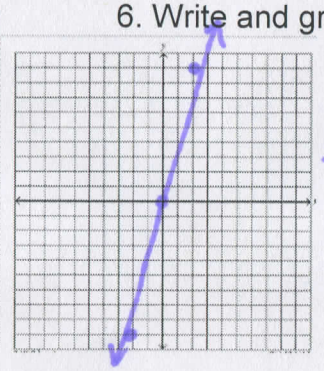
$y = kx$ $\quad \frac{3.85}{5} = \frac{k(5)}{5}$ $\quad K = 0.77$

$e = kd$

$e = (0.77)d$

$\frac{10}{0.77} = \frac{0.77d}{0.77}$ $\quad d = \$12.99$

TASK 1: Given y **varies directly** as x, and y = 27 when x = 6. Write and graph the direct variation function.



$y = kx$

$\frac{27}{6} = \frac{k(6)}{6}$

$k = 4.5$

$y = \frac{9}{2}x$

TASK 3: Using the steps from above.
Given that y **varies inversely** as x, and y = 4 when x = 5.
Write the inverse variation function and find y when $x = \frac{2}{3}$.

$y = \frac{20}{x}$

$4 = \frac{k}{5}$

$k = 20$

$y = \frac{20}{\frac{2}{3}} = \frac{\frac{20}{1}}{\frac{2}{3}} = \frac{20}{1} \cdot \frac{3}{2} = \frac{60}{2} = 30$

TASK 4: Using the steps from above.
The time, *t*, needed to complete a certain race **varies inversely** as the runner's average speed, *s*. If a runner with an average speed of 8.82 mi/h completes the race in 2.97 h, what is the average speed of a runner who completes the race in 3.5 h?

$t = \frac{k}{s}$ $2.97 = \frac{k}{8.82}$ $k \approx 26.195$ $\frac{3.5}{1} = \frac{26.195}{s}$ $s \approx 7.484 \text{ mi/h}$

OBJECTIVE 3: Determining the Type of Variation from Data

Plug the data provided into the direct and inverse variation equations to see if they are true statement. If true, then that is the variation. If false, try the next or know that it is neither type of variation.

TASK 5: Determine whether each data set represents a direct variation, an inverse variation, or neither.

A. indirect

X	Y
6.5	8
13	4
104	0.5

$8 = \frac{k}{6.5}$ $k = 52$

$4 = \frac{k}{13}$ $k = 52$

$0.5 = \frac{k}{104}$ $k = 52$ (A)

B. direct

X	Y
5	30
8	48
12	72

$30 = k(5)$ $k = 6$

$48 = k(8)$ $k = 6$

$72 = k(12)$ $k = 6$ (B)

C. neither

X	Y
3	5
6	14
8	21

$5 = k(3)$ $\frac{5}{3}$ X

$14 = k(6)$ $\frac{7}{3}$

$k = 15$ $k = 84$ X (C)

Still need help with: