Name_____ Algebra Variation – Study Guide and Homework

Four Steps to Solve a Variation Problem

1. Write the general variation formula for the problem.
2. Use the formula to find the constant of variation, k.
3. Rewrite the formula, including the value of k.
4. Answer the question.

There are three types of variations – direct, inverse, and joint.

Type #1: Direct Variation: y = kx *k is the constant of variation*

How you might see it phrased:
"y varies directly as x" *Note: sometimes the word 'with' is used instead of 'as.'*
"y is directly proportional to x"

Example: y varies directly as x.

a. Suppose x = 3 when y = 60. Find k.

b. Write an equation that relates x and y.

c. Find y when x = 7.

For 1 – 5: y varies directly as x.

a. Use the given values to find k. Write an equation relating x and y.

b. Find *y* when x = 3.

1. $x = 2, y = 6$

2. $x = -3, y = 24$

3. $x = 8, y = 40$

4. $x = -4, y = 52$

5. $x = 8, y = 2$

6. The number of pages *p* a student can read varies directly with the amount of time *t* in minutes spent reading. The student can read 60 pages in 30 minutes. Write an equation that relates *p* and *t*. Predict the number of pages the student can read if 45 minutes is spent reading.

7. The cost *c* of going to the movies varies directly with the number *n* of people attending. A group of four paid $14 to go to the movies on Friday. Write an equation that relates *c* and *n*. How much would it cost for 7 people to go to the movies?

Type #2: Inverse Variation: $y = \frac{k}{x}$ *k is the constant of variation* **Refer to section 8.1 of your textbook.**

How you might see it phrased:
"y varies inversely as x"
"y is inversely proportional to x"

Example: y varies inversely with x.

a. Suppose y = 50 when x = 10. Find k.

b. Write an equation that relates x and y.

c. Find y when x = 25.

For 8 – 13:

a. Use the given values to find k. Write an equation relating x and y.

b. Find *y* when x = 2.

8. $x = 3, y = 2$

9. $x = 3, y = 5$

10. $x = 6, y = -2$

11. $x = 4, y = 4$

12. $x = 9$, y $= \frac{1}{3}$

13. $, y = 12$, x $= \frac{1}{2}$

14. Boyle's Law states that for a constant temperature, the pressure *p* of a gas varies inversely with its volume *V*. A sample of oxygen gas has a volume of 50.25 cubic milliliters at a pressure of 20.6 atmospheres.

a. Find the constant of variation *k*.

b. Write an equation that relates *p* and *V*.

c. Find the volume of the oxygen gas if the pressure changes to 15.2 atmospheres.

15. The monthly demand *d* for one of a company's products varies inversely with the price *p* of the product. When the price is $8.25, the demand is 5300 units.

a. Find the constant of variation *k*.

b. Write an equation that relates *d* and *p*.

c. Find the demand if the price is $5.50.

Type #3: Joint Variation: $y = kxz$ *k is the constant of variation* **Refer to the bottom of page 553 of your textbook.**

[When one quantity (y) varies directly with multiple quantities (x and z.)]

How you might see it phrased: "y varies jointly as x and z"

Example: y varies jointly as x and z.

a. Suppose y = 600 when x = 2 and z = 10. Find k.

b. Write an equation that relates y, x, and z.

c. Find y when x = 8 and z = 5.

For 16 – 21: The variable *z* varies jointly as *x* and *y*.

a. Use the given values to write an equation relating *x*, *y*, and *z*.

b. Then find *z* when *x*= 2 and *y*= 5.

16. $x = 2, y = 1, z = 8$

17. $x = 3, y = 4, z = 24$

18. $x = 6$, y = 3, $z = 9$

The variable *z* varies jointly as *x* and *y*. Use the given values to write an equation relating *x, y,* and *z*. Then find z when *x* = 4 and *y* = 7.

19. $x = 3, y = 5, z = 30$

20. $x = 6, y = \frac{1}{2}$, $z = 24$

21. $x = \frac{3}{2}$, $y = 18, z = 9$

Type 4: Combined Variation: Combining any of the three types of variation listed above within a single problem.

Example: y varies directly as x and the square of z and inversely with h.

Suppose y = 150 when x = 3, z = 5, and h = 10. Write an equation with k. Find k and write the new equation with the k value. Find y when x = 5, z = 4, and h = 2.

Follow the 4-step process outlined at the beginning of this packet to solve 22 – 26.

22. y varies directly as x and inversely as z. If y = 5 when x = 3 and z = 4, find y when x = 6 and z = 8.

23. y varies directly as $\sqrt{x}$ and inversely as z. If y = 12 when x = 2 and z = 7, find y when x = 3 and z = 9.

24. A varies jointly as b and h. If A = 16 when b = 2 and h = 8, find A when b = 8 and h = 16.

25. y varies jointly as x and $\sqrt{z}$. If y = 6 when x = 3 and z = 9, find y when x = 4 and z = 36.

26. x varies directly as y^3 and inversely as $\sqrt{z}$. If x = 7 when y = 2 and z = 4, find x when y = 3 and z = 9.

27. The number of school hot lunches sold varies directly with the number of students in school, and inversely with the number of nearby fast-food restaurants.

500 hot lunches were sold when there were 1000 students in school and 4 nearby fast-food restaurants.

Find k, write an equation, and find the number of hot lunches that would sell if there were 600 students in school and 2 nearby fast-food restaurants.

28. Jack is a truck driver. The amount he earns varies directly with the number of hours he drives and inversely with the number of snowy days. If he earned $2500 driving 40 hours with 2 snowy days, find the constant of variation. Then find his earnings for driving 55 hours if there are 6 snowy days.

29. The number of rabbits varies directly as the number of moles, and inversely as the number of foxes. Suppose there were 200 rabbits when there were 1500 moles and 4 foxes. Find k, write an equation, and find the number of rabbits when there are 200 moles and 2 foxes.