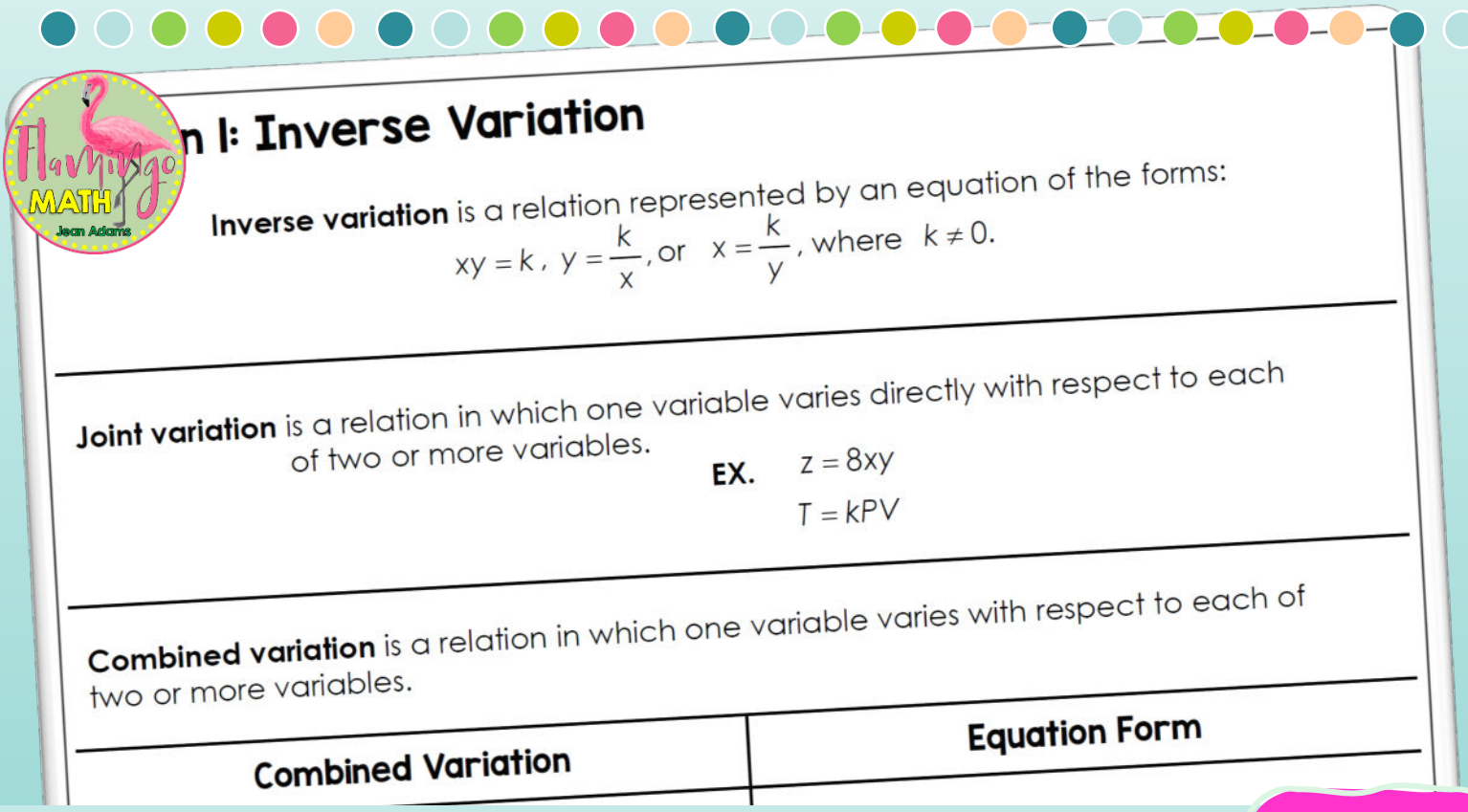
Algebra 2 Honors

Inverse Variation



n I: Inverse Variation

Inverse variation is a relation represented by an equation of the forms:

$xy = k$, $y = \frac{k}{x}$, or $x = \frac{k}{y}$, where $k \neq 0$.

Joint variation is a relation in which one variable varies directly with respect to each of two or more variables.

EX. $z = 8xy$

$T = kPV$

Combined variation is a relation in which one variable varies with respect to each of two or more variables.

Combined Variation	Equation Form

Completely Editable

8.1

Lesson 8.I: Inverse Variation

Inverse variation is a relation represented by an equation of the forms:

$$xy = k,\ y = \frac{k}{x},\text{ or }\ x = \frac{k}{y},\text{ where }\ k \neq 0.$$

Joint variation is a relation in which one variable varies directly with respect to each of two or more variables.

EX. $z = 8xy$

$T = kPV$

Combined variation is a relation in which one variable varies with respect to each of two or more variables.

Combined Variation	Equation Form
z varies jointly with x and y	
z varies jointly with x and y and inversely with w	
z varies directly with x and inversely with the product wy	

EX #1: Is the relationship between the variables a direct variation, an inverse variation, or neither? Write function models for the direct and inverse variations.

A.

x	y
0.2	8
0.5	20
1.0	40
1.5	60

B.

x	y
0.2	40
0.5	16
1.0	8.0
2.0	4.0

C.

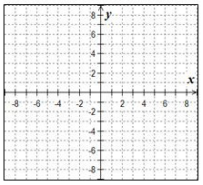
x	y
0.5	40
1.2	12
2.0	10
2.5	6.0

Determining an Inverse Variation

EX #2: Suppose x and y varies inversely, and $x = 2$ when $y = -3$

A. What function models the inverse variation?

B. What does the graph of the function look like?



C. What is y when $x = -5$?

Modeling an Inverse Variation

EX. #3: A recent hurricane left debris around the neighborhoods near your school. The table below shows the time *t* in minutes that it takes a group of *n* students to remove the debris from an average-sized yard.

Number of students (*n*)	1	3	5	14
Time in minutes (*t*)	225	75	45	16

A. What function models the time needed to clear the debris from an average-sized yard relative to the number of students who do the work?

B. How many students should there be to clear debris from an average-sized yard in at most 25 minutes?

Using Combined Variation

EX. #4: The number of bags of mulch you need to cover a planting area varies jointly with the area to be mulched *a* in square feet, and the depth of the mulch *d* in feet. If you need 10 bags to mulch 120 ft² to a depth of 3 in., how many bags

Putting It All Together

EX #5: Find the constant of variation for each variation, then write an equation that can be used to solve the missing value.

A. If z varies jointly with x and y, when $x = 3$, $y = 5$, and $z = 120$. Find x if $z = 35$ and $y = 7$.

B. If y varies inversely with the square of x, when $x = 3$, $y = \frac{7}{15}$. Find y if $x = 5$.

Applying Combined Variation

Gravitational potential energy *PE* is a measure of energy. *PE* varies directly with an object's mass *m* and its height *h* in meters above the ground. Physicists use *g* to represent the constant of variation, which is gravity.

$$PE = gmh$$

Use the gravitational constant of 9.8 m/s² and Joules for *PE*.

$$J = \frac{kg \cdot m^2}{s^2}$$

EX #5: How much potential energy would a 41-kg diver have standing on a 10-meter diving platform?

NOTES

Name _____ Date _____

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Inverse Variation Practice

Problems 1 – 4, is the relationship between the values in each table a direct variation, an inverse variation, or neither? Write equations to model the direct and inverse variations.

1.

x	−4	−2	1	2
y	−0.5	−1	2	1

2.

x	−5	3	7	13
y	−15	9	21	39

3.

x	6	1.2	0.6	0.3
y	5	10	30	40

4.

x	−2	1	4	10
y	2.5	−5	−1.25	−0.5

Problems 5 – 8, suppose that x and y vary inversely. Write a function that models each inverse variation.

5. $x = -3$ when $y = \frac{4}{9}$

6. $x = 2$ when $y = 1.25$

7. $x = -3$ when $y = 6$

8. $x = \frac{1}{5}$ when $y = 6$

Problems 9 – 12, describe the combined variation that is modeled by each formula below.

9. $A = \frac{1}{2}bh$

10. $h = \frac{V}{\pi r^2}$

11. $V = \frac{4}{3}\pi r^3$

12. $P = \frac{I}{rt}$

Problems 13 – 16, each pair of values is from an inverse variation. Find the missing value.

13. $(3,2), (8, y)$

14. $\left(\frac{1}{4}, -3\right), \left(x, -\frac{1}{8}\right)$

15. $(1.4, 5.5), (2.8, y)$

16. $\left(\frac{1}{4}, \frac{8}{9}\right), \left(x, \frac{1}{9}\right)$

Problems 17 – 20, each ordered pair is from an inverse variation. Find the constant of variation.

17. $(7,4)$

18. $(\sqrt{3}, \sqrt{12})$

19. $(0.8,4)$

20. $(\sqrt{48}, \sqrt{27})$

Problems 21 – 25, write a function that models each situation. Then use it to solve the question.

21. Suppose that y varies inversely with the square of x, and $y = 50$ when $x = 3$. Find y when $x = 5$.

22. Suppose that z varies jointly with x and the square of y, and $z = 40$ when $x = 20$ and $y = 2$. Find x when $z = 6$ and $y = 8$.

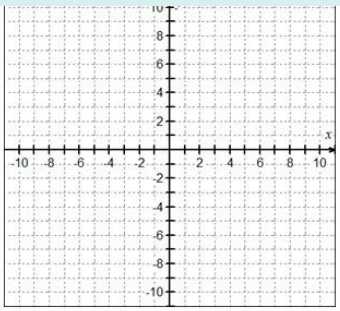
23. Suppose that z varies directly with the square of x and inversely with y. When $x = 3$ and $y = 6$, $z = 2$. Find z when $x = 5$ and $y = 8$.

24. Premixed concrete arrives on a construction site in a 300 ft^3 truck. The area A that the concrete will cover is inversely proportional to the depth d of the concrete. If the foundation for a new home is a 4-inch-deep slab, how many trucks are needed to pour the foundation for a 2500 square-foot home?

Practice Sets

Lesson Warm-Ups

3. Find y when $x = 5$



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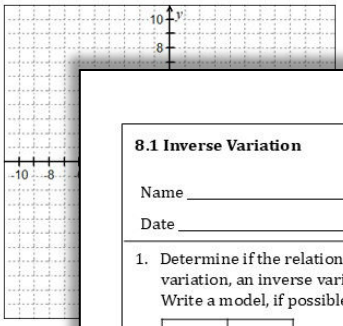
Name _____ Date _____ Period _____

Lesson 8.1: Exploring Exponential Models **Warm-Up #2**

1. Suppose x and y vary inversely. When $x = 5$, $y = 0.6$. Write a function that models the variation.

2. Graph the function from your equation



3. Find y when $x = 2$

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8.1 Inverse Variation **Form A**

Name _____

Date _____ Period _____

1. Determine if the relationship is a direct variation, an inverse variation or neither. Write a model, if possible.

x	y
−3	−5.4
4	7.2
5	9

Questions 2 – 4: Suppose x and y vary inversely and $x = 6$ when $y = \frac{1}{3}$

2. Write the function that models the inverse variation.

3. What is y when $x = -8$

4. Sketch the graph.



8.1 Inverse Variation **Form B**

Name _____

Date _____ Period _____

1. Determine if the relationship is a direct variation, an inverse variation or neither. Write a model, if possible.

x	y
−5	−12
3	7.2
7	16.8

Questions 2 – 4: Suppose x and y vary inversely, and $x = 6$ when $y = \frac{1}{2}$

2. Write the function that models the inverse variation.

3. What is y when $x = -5$

4. Sketch the graph.



Daily Lesson Quiz