

Section 1.10 Mathematical Modeling and Variation

Objective: In this lesson you learned how to write mathematical models for direct, inverse, and joint variation.

Course Number

Instructor

Date

Important Vocabulary

Define each term or concept.

Directly proportional**Sum of square differences****Least squares regression line****I. Introduction** (Page 103)

Describe what is meant by “fitting a model to data.”

What you should learn

How to use mathematical models to approximate sets of data points

II. Least Squares Regression and Graphing Utilities (Page 104)

To find the least squares regression line for a set of data, . . .

What you should learnHow to use the *regression* feature of a graphing utility to find the equation of a least squares regression line

The correlation coefficient r of a set of data gives a measure of _____ . The closer the value of $|r|$ is to 1, the better . . .

Example 1: The numbers (in thousands) of U.S. Air Force female personnel p on active duty for the years 2000 through 2004 are shown in the table. Use the regression capabilities of a graphing utility to find a linear model for the data. Let t represent the year with $t = 0$ corresponding to 2000.

Year	2000	2001	2002	2003	2004
p	66.8	67.6	71.5	73.5	73.8

(Source: U.S. Department of Defense)

III. Direct Variation (Page 105)

When a variable y is directly proportional to a variable x , the **constant of variation** is . . . _____
 _____ . Another
 name for the constant of variation is the _____
 _____.

In a direct variation model, the y -intercept of the model is _____.

Example 2: If y varies directly as x , and y is 6 when x is 4, find the value of y when x is 20.

What you should learn
 How to write
 mathematical models for
 direct variation

IV. Direct Variation as an n th Power (Page 106)

If $y = kx^n$ for some nonzero constant k , then describe the relationship between y and x in two different ways.

Example 3: If y is directly proportional to the third power of x , and y is 750 when x is 10, find the value of y when x is 8.

What you should learn
 How to write
 mathematical models for
 direct variation as an n th
 power

IV. Inverse Variation (Page 107)

If y **varies inversely** as x , then x and y are related by an equation of the form _____, where k is some nonzero constant.

If y varies inversely as x , then another way to describe this relationship is that y is _____ to x .

If x and y are related by an equation of the form $y = k/x^n$, then y

_____ or y _____.

Example 4: If y varies inversely as x , and y is 4 when x is 16, find the value of y when x is 10.

What you should learn

How to write mathematical models for inverse variation

V. Joint Variation (Page 108)

If z **varies jointly** as x and y , then $z =$ _____

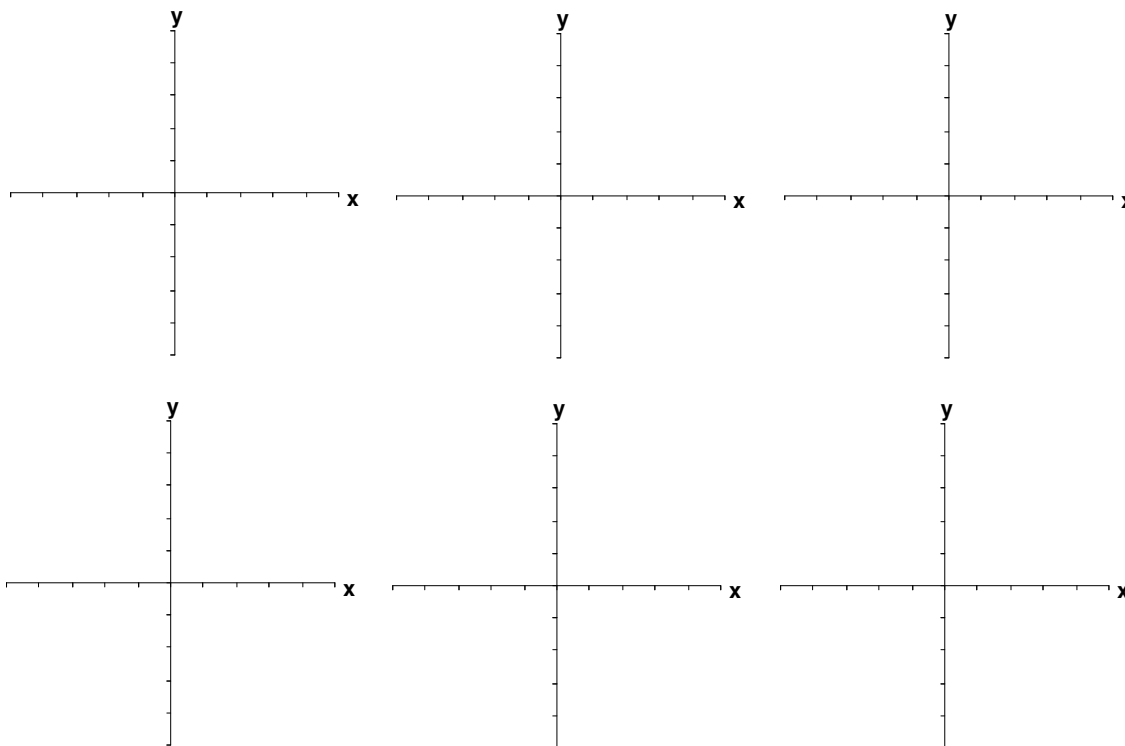
Another way to say that z varies jointly as x and y is . . .

Example 5: If z varies jointly as x and y , and if $z = 10$ when $x = 4$ when $y = 15$, find the value of z when $x = 12$ and $y = 7$.

What you should learn

How to write mathematical models for joint variation

Additional notes



Homework Assignment

Page(s)

Exercises