

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 93)

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 94)

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

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

What you should learn

How to use the *regression* feature of a graphing utility to find the equation of a least squares regression line

Example : The numbers of U.S. Air Force personnel p on active duty for the years 1995 through 1999 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 $t = 5$ corresponding to 1995.

Year	1995	1996	1997	1998	1999
p	400	389	379	363	358

(Source: U.S. Department of Defense)

III. Direct Variation (Page 95)

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 _____
 _____.

Example : 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 n th Power (Page 96)

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

Example : 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

V. Inverse Variation (Page 97)

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, then y

_____ or y _____.

Example : 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

VI. Combined Variation (Page 98)

Applications of variation involving both direct and inverse variations in the same model are said to have _____.

What you should learn

How to write mathematical models for combined variation

VII. Joint Variation (Page 99)

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

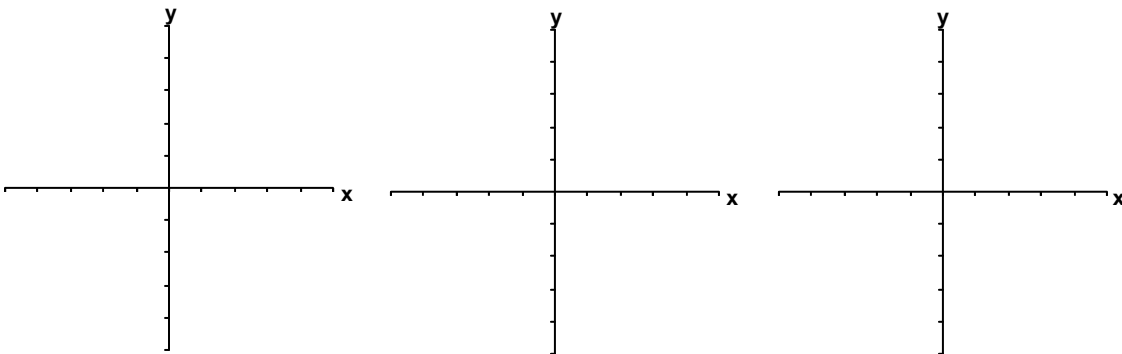
What you should learn

How to write mathematical models for joint variation

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

Example : 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 $y = 7$.

Additional notes



Homework Assignment

Page(s)

Exercises

