

Section 5.2 – Partial Variation

MPM1D

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Part 1: DO IT NOW

The Keg Restaurant charges \$100 to reserve a private dining room plus \$40 per person.

a) Write an equation to show the relationship between the cost of the reservation and the number of people attending.

b) What is different about this equation and the equation of a direct variation ($y = mx$)?

c) How much will it cost to reserve the room if

i) An extended family of 25 want to have dinner to celebrate a recent birth of twins?

ii) The Pittsburgh Penguins want to celebrate their 2009 Cup Victory. There are 24 players and 6 coaches attending the celebration.

Part 2: Recall properties of direct variations

A direct variation is a relationship between two variables in which one variable is a constant multiple of the other.

Model a direct variation in an equation: $y = mx$

Constant of variation is defined as: $m = \text{rate of change} = \frac{\Delta y}{\Delta x}$

Direct variations are linear relations that always pass through which point on the Cartesian coordinate grid? _____

Part 3: Compare direct variations to partial variations

The Tesla electrical company charges \$25 per hour to do electrical work plus a fee of \$50 for the estimate on the proposed work. AC-DC electrical charges \$50 per hour. Write equations to model each relationship. Let x represent the number of hours and let y represent the total cost.

Tesla Electric company:

AC-DC electrical:

Use the equations to create tables to organize the data for 0 to 4 hours.

Tesla electric company:

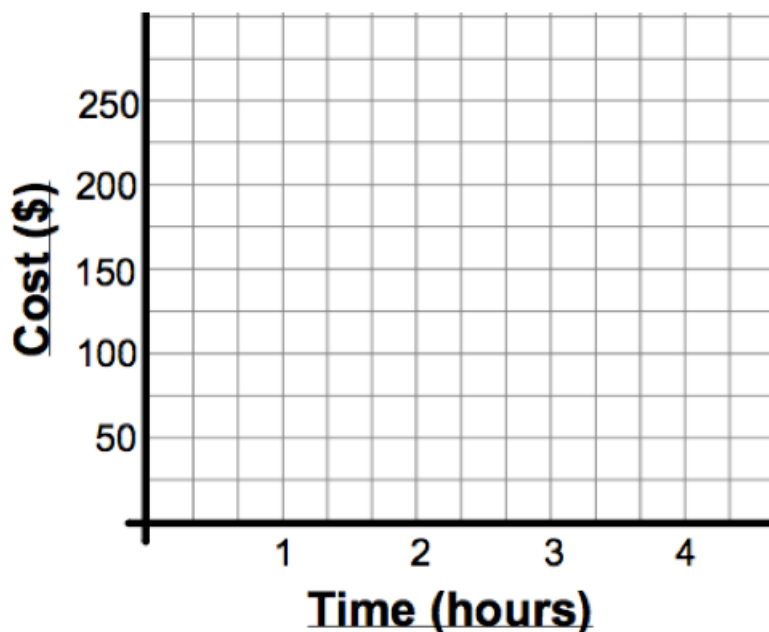
AC-DC electrical:

| Hours (h) | Cost (\$) |
|---------------|-----------|
| 0 | |
| 1 | |
| 2 | |
| 3 | |
| 4 | |

| Hours (h) | Cost (\$) |
|---------------|-----------|
| 0 | |
| 1 | |
| 2 | |
| 3 | |
| 4 | |

Which relation is a direct variation and how do you know?

Now graph the data for both companies on the same Cartesian coordinate grid.



Looking at the **graph or the table**, we should use _____ for 3 hours of electrical work. Does this company always offer the best deal? Explain.

What is different about the two relations?

A **PARTIAL VARIATION** is a relationship between two variables in which the dependent variable is the sum of a constant number and a constant multiple of the independent variable.

In general, the graph of a **partial variation** has the following properties:

- it is a straight line which does not pass through the origin (0,0)
- the equation of a partial variation is always in the form $y = mx + b$
- ' b ' is the initial value (y-intercept, fixed cost)
- ' m ' is the constant of variation (rate of change, variable cost)

Part 4: Working with Partial Variation

a) Complete the following chart given that y varies partially with x (you may need to determine the constant of variation)

| x | y |
|-----|-----|
| 0 | 6 |
| 1 | 9 |
| 2 | |
| 3 | 15 |
| 4 | |
| | 27 |

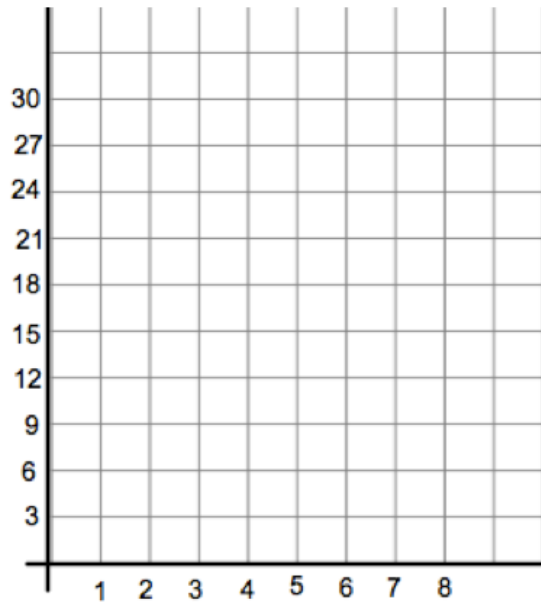
b) What is the initial value of ' y ' (y-intercept)?

c) What is the constant of variation (rate of change)?

Remember: $m = \frac{\Delta y}{\Delta x}$

d) Write an equation relating y and x in the form $y = mx + b$

e) Graph the relation



Part 5: Application of Partial Variation

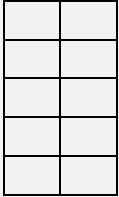
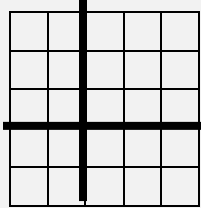
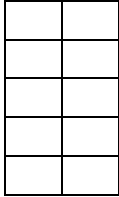
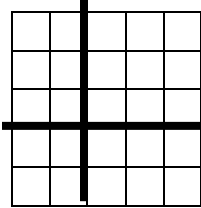
A school is planning an awards banquet. The cost of renting the banquet facility and hiring serving staff is \$675. There is an additional cost of \$12 per person for the meal.

a) Identify the fixed cost (initial value; b) and the variable cost (constant of variation; m)

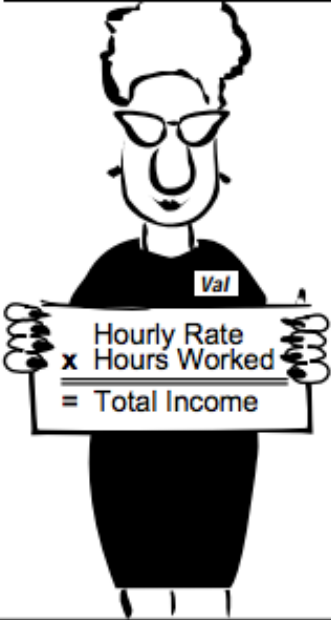
b) Write an equation to represent this relationship in the form $y = mx + b$

c) Use your equation to determine the total cost if 500 people attend the banquet.

Consolidate:

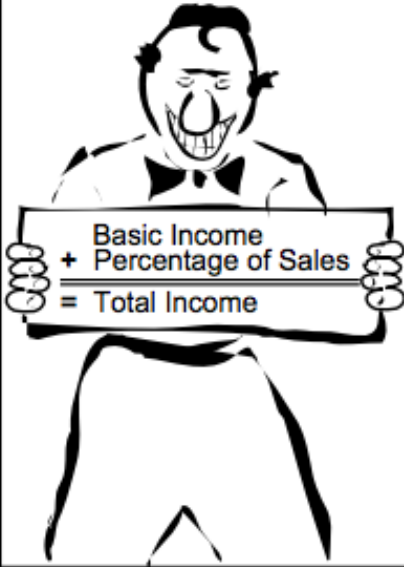
| Direct variation | | | Partial variation | | |
|---|---|---------------------------|---|--|---------------------------|
| Table | Graph | Equation | Table | Graph | Equation |
| Has (0,0) as the initial value | Passes through the origin | $y = mx$ | Has an initial value other than zero | Crosses the dependent axis (y-axis) at an initial value other than 0 | $y = mx + b$ |
| Create an example: | Create an example: | Create an example: | Create an example: | Create an example: | Create an example: |
|  |  | |  |  | |

DIRECT VARIATION SALESPERSON



$$\begin{array}{l} \text{Hourly Rate} \\ \times \text{Hours Worked} \\ \hline = \text{Total Income} \end{array}$$

PARTIAL VARIATION SALESPERSON



$$\begin{array}{l} \text{Basic Income} \\ + \text{Percentage of Sales} \\ \hline = \text{Total Income} \end{array}$$

In order to help you understand the content of this unit, Val and Sal have kindly volunteered to assist us by providing a simple but direct comparative illustration.