Modelling Linear Relationships

Suggested time: 75 minutes

What's important in this lesson:
In this lesson you will translate written descriptions of real life situations into equations.

Complete these steps:

1. Read through the lesson portion of the package independently.

2. Complete any of the examples in the lesson.

3. Check your lesson answers with the lesson key your teacher has.

4. Seek assistance from the teacher as needed.

5. Complete the Assessment and Evaluation and submit for evaluation. Be sure to ask for any assistance when experiencing difficulties.

Hand-in the following to your teacher:

1. Assessment and Evaluation

Questions for the teacher:

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1.   Discuss some cost that may be associated with renting a hall for a wedding or banquet.

2.   From your above list which costs are fixed and which are variable. Fixed costs are those which are set and do not change, whereas variable cost may vary depending on how many people show up to your event.

3.   Complete the following table of values. You should be able to notice a pattern.

Number of Guests	Total Cost
0	500
1	550
2	600
3	
4	
5	
6	
7	

4.   Explain the pattern from #3 in your own words.

Modelling Linear Relationships

Example 1

Ralph's Rental has many tools that are available for rent. They charge $20 fixed price plus $5 per hour for the rental of their post hole digger. This situation can be represented by the equation

$$C = 5n + 20$$

Where C represents the total rental cost and n represents the number of hours rented. The goal of this section is to be able to develop the equation on your own. We will examine a table of values, first differences and the graph.

Create a table of values showing the rental costs for 8 hours. The chart is started for you.

Number of Hours Rented	Rough Work	Cost in dollars
0	5 (0) + 20 = 20	20
1	5 (1) + 20 = 25	25
2	5 (2) + 20 = 30	30
3	5 (3) + 20 = 35	35
4		
5		
6		
7		
8		

Complete the first differences for the above situation.

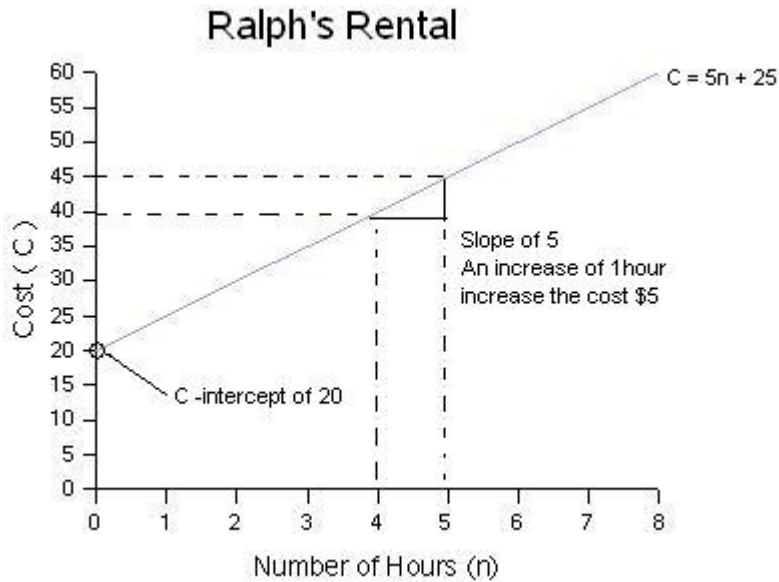| Number of Hours Rented	Cost in dollars	First Differences
0	20	
1	25	25 - 20 = 5
2	30	30 - 25 = 5
3	35	35 - 30 = 5
4		
5		
6		
7		
8		

Note, as the number of hours (n) rented increases by 1 and the cost (C) increases by 5. Therefore, the relationship is linear with a slope of 5. The slope is the same as the first differences.

In general, we can make a few notes about our equation and how it relates to the description given in the example.

$$C = 5 \ n + 20$$

Hourly Rate
(slope)

Number of Hours Rented

Fixed Cost
(C – intercept)
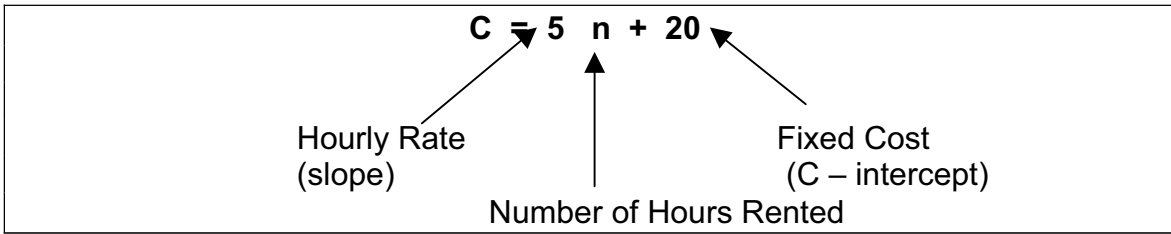
This information can also be represented by a graph.

Ralph's Rental

C = 5n + 25

Slope of 5
An increase of 1hour
increase the cost $5

C -intercept of 20

Cost (C)

Number of Hours (n)

Summary

Equations can be developed from written descriptions using the general formula below.

COST = Price per unit x Variable + Fixed Cost

Example 2

Jane and Jorge are looking at renting a hall for her their wedding.   The hall charges a maintenance fee of $300 and a cost of $25 per plate for supper. Write an equation to model this situation.

Solution

This example is similar to example #1. A one-time maintenance fee of $300 is charged. This is equivalent to our fixed cost because it must be paid regardless of the number of people who attend. The cost per plate is the number we will multiple our variable by.

$$C = 25 \; n + 300$$

Cost per Person   Maintenance Fee

Number of People Attending
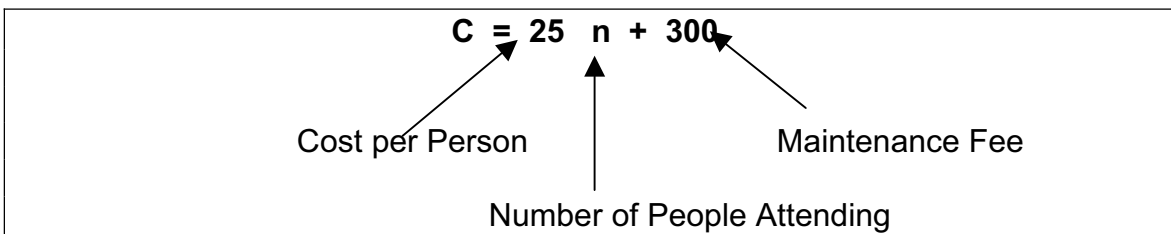
Let T dollars represent the total cost and d days represent the rental time. Write an equation to relate the variables.

(a) A rental agency charges $45/day for a mid-size car	(b) A room in a hotel costs $126/day
(c) A candy floss machine can be rented for $90/day	(d) An arena charges $100 plus $85/day
(e) A tent can be rented for $170 plus $320/day	(f) A video can be rented for $2 plus $3/day

Write the equation for each relationship.

1. A banquet hall charges $100 for the hall and $20 per person for dinner.	2. The country club charges $270 for their facilities plus $29 per guest.
3. To rent a car for the weekend it costs $50 plus $0.16/km.	4. A race car had a head start of 0.5 km. It travels at a constant speed of 220 km/h. Write an equation for the total distance travelled over time.

5.

Cost of Wedding at a Hotel

Cost($) vs Numer of Guests