Interpolation and Extrapolation

Suggested time: 75 minutes

What's important in this lesson:
In this lesson you will learn to read and extend graphs. You will also build upon your algebraic skills by substituting 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:

Diagnostic/Introductory Activity:
Unit 3 Lesson 5

1. Evaluate each equation using the given value.
   (a) C= 4n + 20; when n = 3

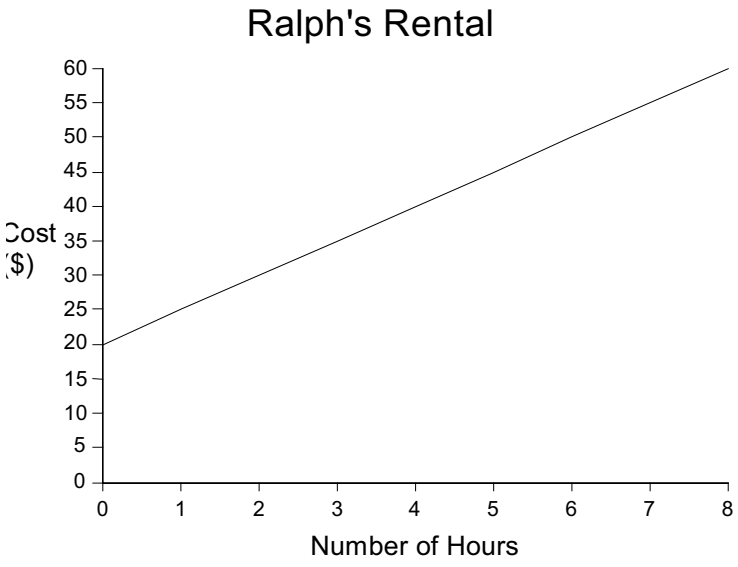
   (b) C = 25n + 220; when n = 50

   (c) C = 2.5n + 30; when n = 17

2. Use the graph to answer the following questions.
   (a) If you have $0, how many hours can you rent a machine for?

   (b) If you have $50, approximately how many hours can you rent a machine for?

   (c) How much will it cost to rent a machine for 3 hours?



   (d) How much will it cost to rent a machine for 7 hours?

Interpolation and Extrapolation

Interpolation and Extrapolation are mathematical names given to the process of reading graphs.

Interpolation -estimating information within a graph

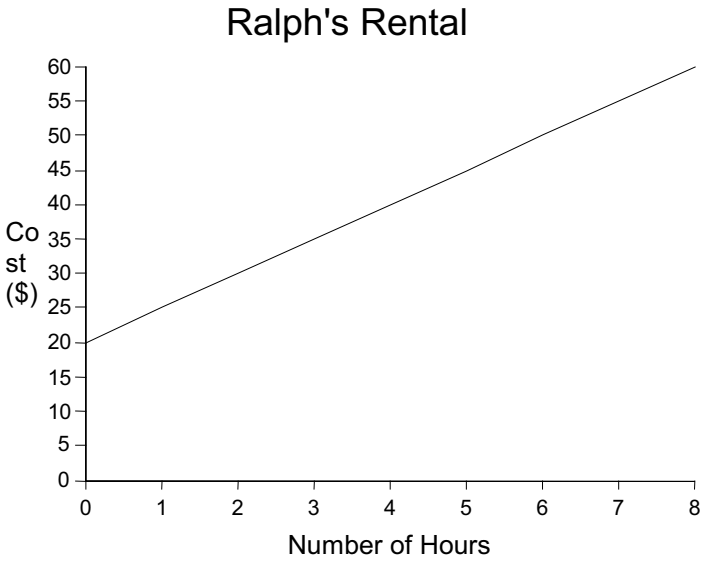
Extrapolation -extending the graph to estimate information

Consider the following example from the previous lesson on Modelling Linear Relations with Equations.

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.



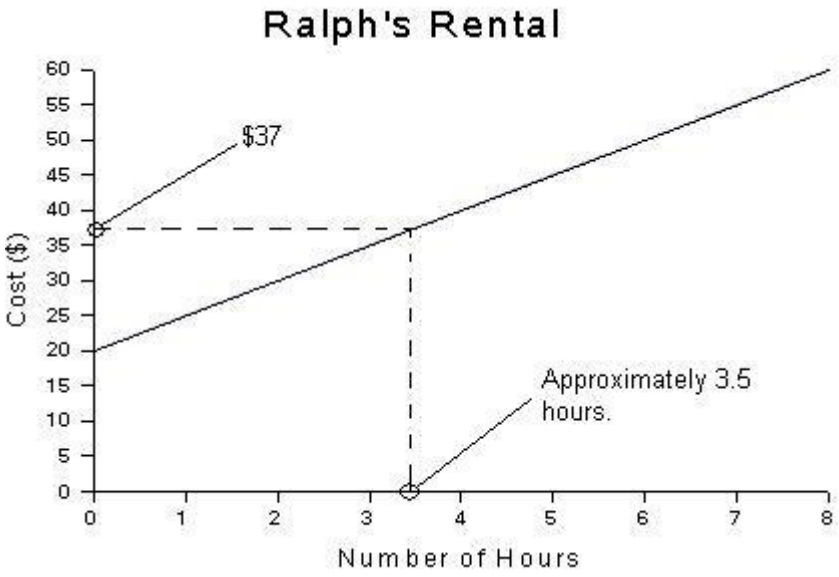
1. How many hours can you rent the post hole digger for if you have $37?

2. How much will it cost to rent the digger for 10 hours?

Solutions

1. How many hours can you rent the post hole digger for if you have $37?

   This question can be solved using **Interpolation**. We are required to read the graph.



   By Interpolating on the graph, we obtain the answer of approximately 3.5 hours.

   Using the equation

   Interpolation is a great method when you have a graph of the relation. There is room for error in our interpolation of the results. For this reason we should also consider making use of our equation.

$$\mathbf{C = 5n + 20}$$

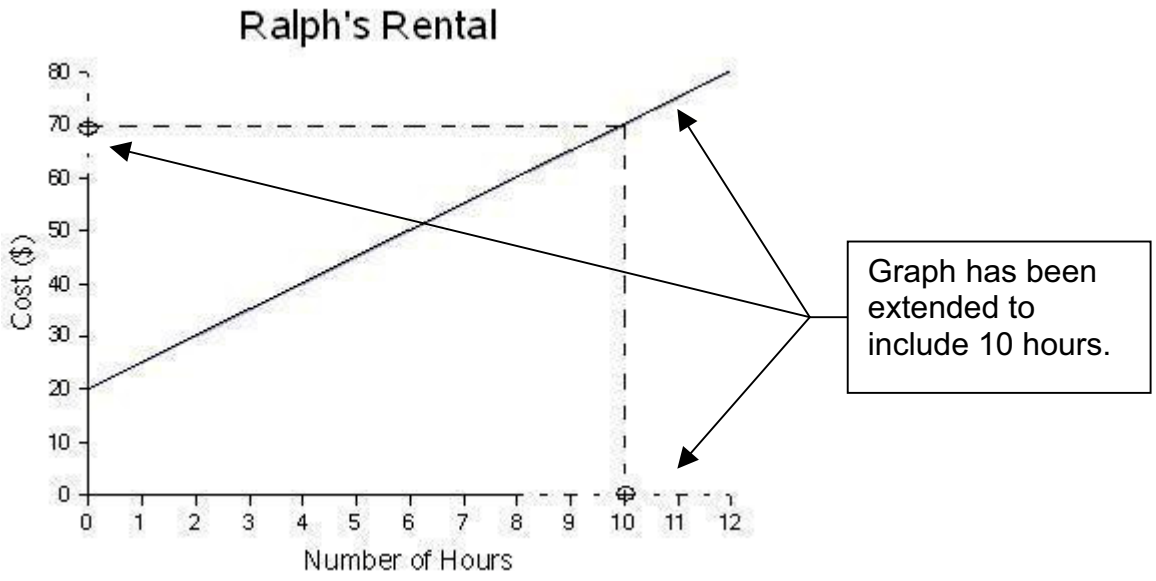
   Substituting C = 37 into the equation will allow us to solve for the number of hours.

$$\begin{aligned} C &= 5n + 20 \\ 37 &= 5n + 20 \\ 37 - 20 &= 5n \\ 17 &= 5n \\ \frac{17}{5} &= n \\ 3.4 &= n \end{aligned}$$

   Therefore, $37 will allow you to rent the digger for 3.4 hours.

2. How much will it cost to rent the digger for 10 hours?

   In order to calculate the cost for 10 hours we are required to extend the graph and continue the pattern. This is called **Extrapolation.**



   By reading the extended graph we can see that 10 hours will cost $70.

   <u>Using the equation</u>

   We can also make use of the equation to find values instead of Extrapolating.

$$\mathbf{C = 5n + 20}$$

   Substituting n = 10 into the equation will allow us to solve for the total cost.

$$C = 5n + 20$$
$$C = 5(10) + 20$$
$$C = 50 + 20$$
$$C = 70$$

   Therefore, 10 hours of use with the digger will cost $70.

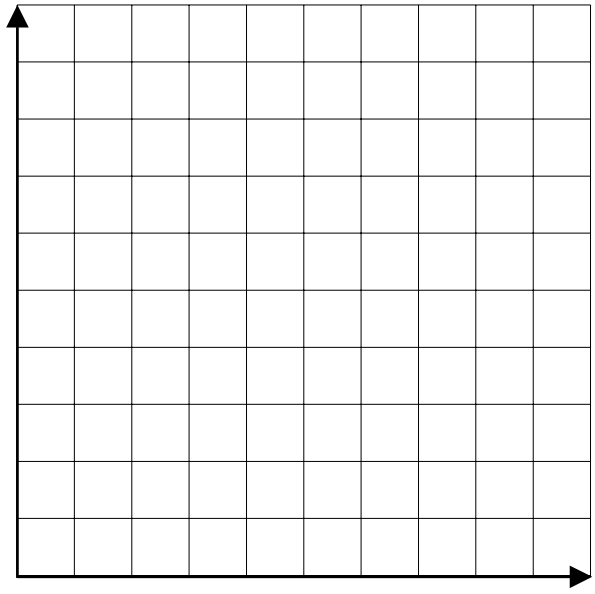
Exercise.

(A) The trip from Toronto to the badminton provincial finals in Ottawa costs $1940 for the bus and $75 per person for meals and accommodation. The cost, C dollars, is modeled by the equation C=1940+80n, where n represents the number of players.

n	C($)
0	
10	
20	
30	
40	

(a) Complete the table of values.

(b) Graph the relation.



(c) How many players attended the provincial finals if the total cost was $3700.00?

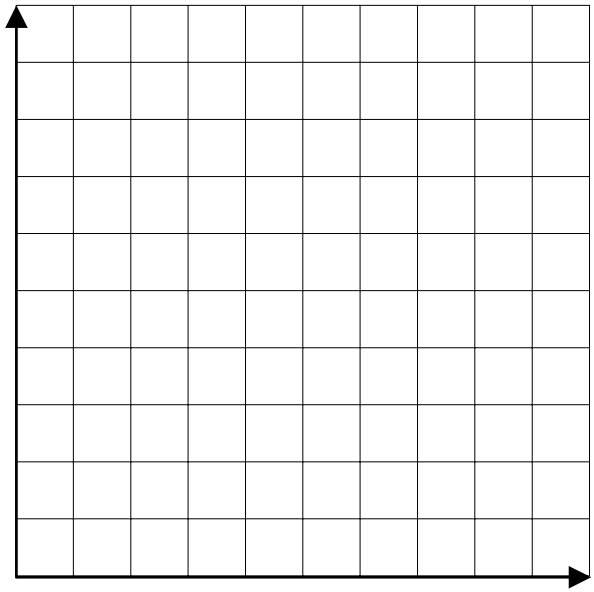
(d) How much would it cost if 41 players wanted to attend the finals?

(B) The mass of each candy in a box is 5 g. The mass of the empty box is 20 g. Let T grams represent the total mass of the box and candies. Let n represent the number of candies, so that T = 20+5n.

n	T(g)
0	
25	
50	
100	
125	

(a) Complete the table of values.

(b) Graph the relation.



(c) How many candies would be a box that weighed 320 g?

(d) How heavy would a box with 150 candies weigh?

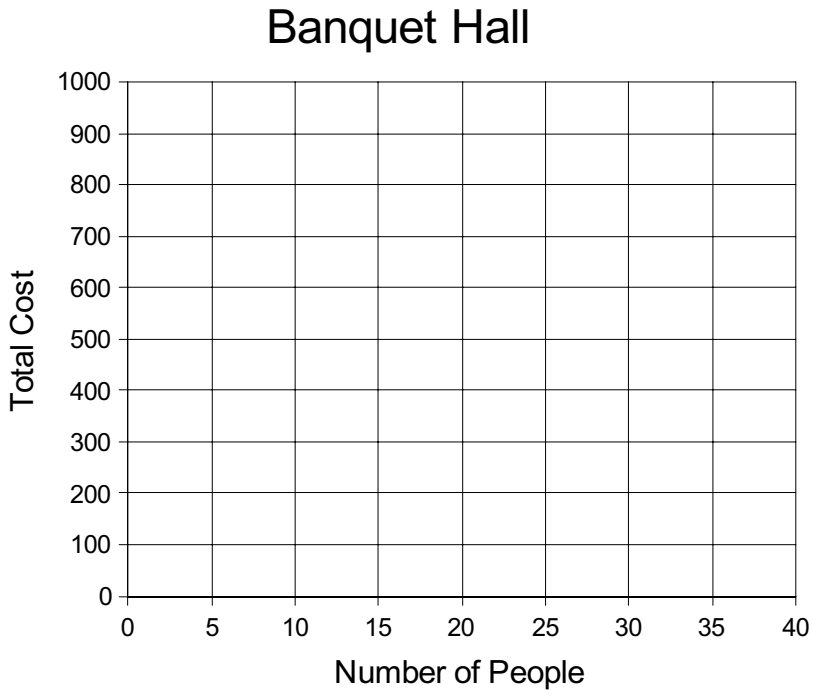
1. A banquet hall charges $100 for the hall and $20 per person for dinner.

   (a) Create an equation to model the relation.

   (b) Complete the table of values

Number of People	Total Cost
0	
5	
10	
15	
20	
25	
30	
35	
40	

   (c) Graph the relation.



(d) Use the graph to determine the cost of 22 guests.

(e) Verify your answer to (c) by using the equation to calculate the cost of 22 guests.

(f) How many guests could you pay for with $1100? Use extrapolation or the equation to arrive at your answer.