Who Should Take 107?

- Students who plan to take Math 115 (Cal 1) or Math 109 (Bus cal).
- You should have an ACT math score higher than 16, or a SAT math score higher than 420, or a placement test score higher than 16.
- This is a core class, but so are Math 102, Math 104 and CSC 107. All of which are easier than Math 107

Material Covered

- The material covered in this class is similar to the material covered in a high school advanced math class, but at a much faster pace.

Core Course Outcomes

- Students will be able to represent real-life problems through the use of mathematical formulas.
- Students will be able to solve problems using symbolic manipulation.
- Students will be able to interpret the meaning of mathematical representations.
- Students will be able to verify the validity of a mathematical argument.

CHAPTER 1
SECTION 1

Functions and Function Notation

- What does it mean for one thing to depend on another, e.g. your grade in this class depends on your class attendance? Election results are a function of the economy.
- Define function.

Definition: A ***function*** is a rule which takes certain numbers as inputs and assigns to each input number exactly one output number. The output is a function of the input.

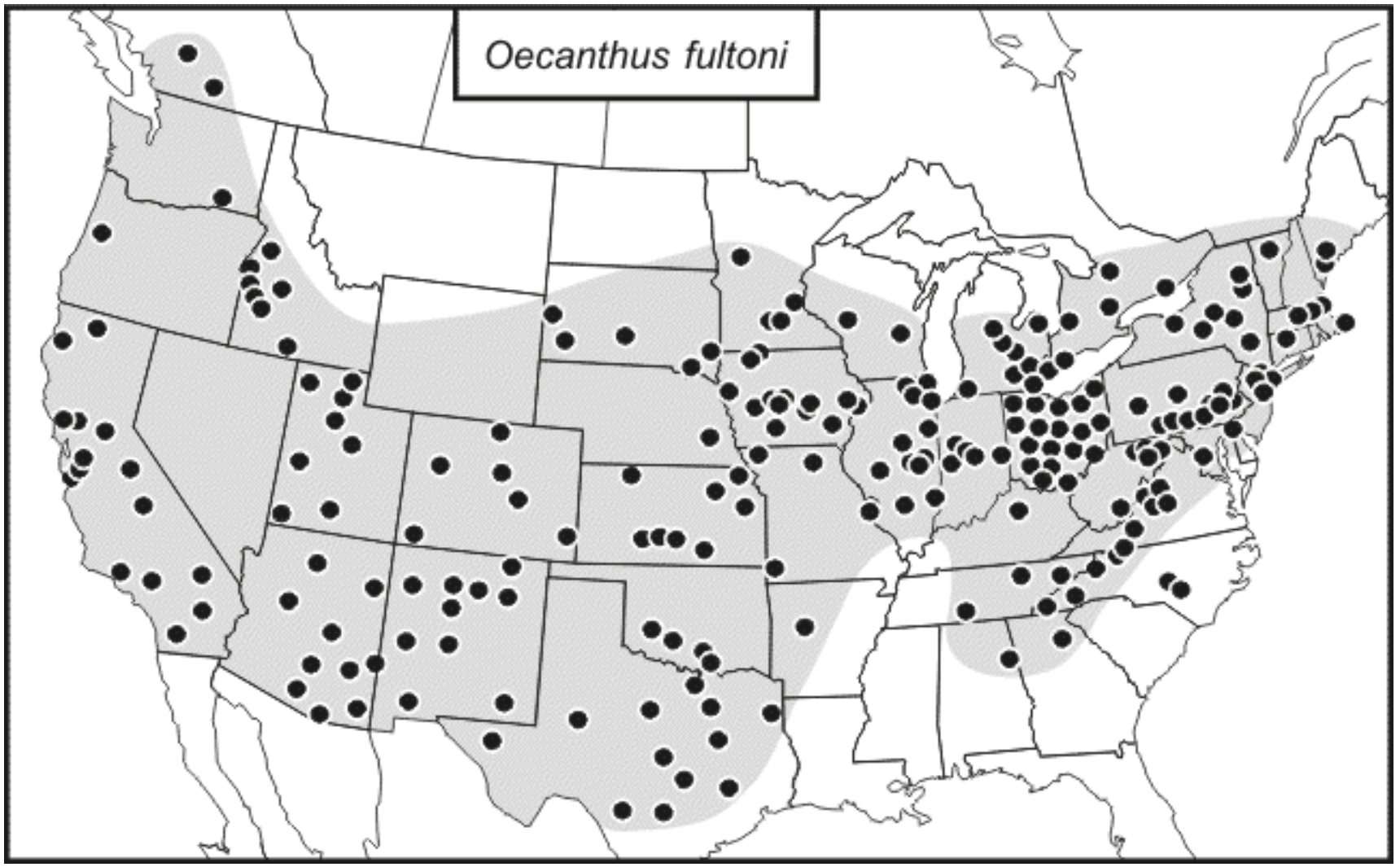
Chirps of the Snow Tree Cricket

"He listened to that most ethereal of all sounds, the song of crickets, coming in full choir upon the wind, and fancied that, if moonlight could be heard, it would sound just like that."

The Canterbury Pilgrims

Nathaniel Hawthorn


5387688


Oecanthus fultoni

Chirps of the Snow Tree Cricket

A surprising biological fact is that most crickets chirp at a rate that increases as the temperature increases. For the snowy tree cricket (Oecanthus fultoni) the relationship between temperature and chirp rate is so reliable this type of cricket is called the thermometer cricket.

Describing a Function Using Words

- To estimate the temperature, you count the number of chirps in a 15 second time interval and add 40. Or you can count the number of chirps in a minute and divide that by 4 and add the result to 40. So temperature is a function of the chirp rate.
  - What is the input?
  - What is the output?

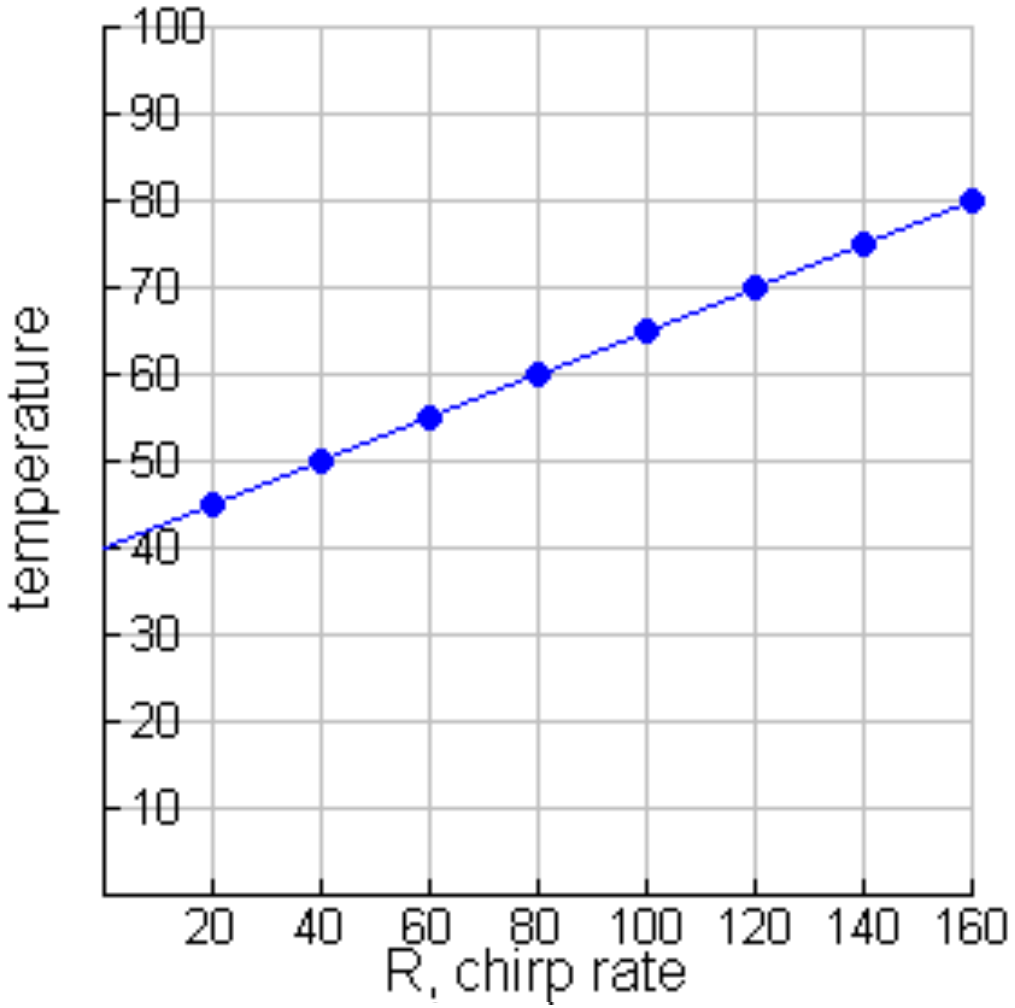
Describing a Function Using a Table

R, chirp rate (chirps/minute)	T, predicted temperature (°F)
20	
40	
60	
80	
100	
120	
140	

Describing a Function Using a Table

R, chirp rate (chirps/minute)	T, predicted temperature (°F)
20	45
40	50
60	55
80	60
100	65
120	70
140	75

Describe a Function Using a Graph



Describing a Function Using a Formula

A formula is an equation giving *T* in terms of *R*. Dividing the chirp rate by four and adding forty gives the estimated temperature.

$$\underbrace{\text{Estimated temperature (in }^\circ\text{F)}}_{T} = \frac{1}{4}\underbrace{\text{Chirp rate (in chirps/minute)}}_{R} + 40$$

$$T = \frac{1}{4}R + 40$$

Function Notation

- To indicate that a quantity Q is a function of a quantity, t, we abbreviate Q is a function of t to Q equals "f of t" and using function notation to $Q = f(t)$.
- If you apply the rule f to the input value, t, you get the output value $f(t)$ or Q. Here Q is called the *dependent variable* and t is called the *independent variable*.
  - Output = f(input) or Dependent = f(independent)

House Painting Example

- The number of gallons of paint needed to paint a house depends on the size of the house. A gallon of paint typically covers 250 square feet. Thus, the number of gallons of paint, n, is a function of the area to be painted, A ft^2. We write $n = f(A)$.
  - Find a formula for f.
  - Explain in words what the statement $f(10{,}000) = 40$ tells us about painting houses.

Fox and Rabbit Example

A national park contains foxes that prey on rabbits. The table below gives the two populations, *F* and *R*, over a 12-month period.

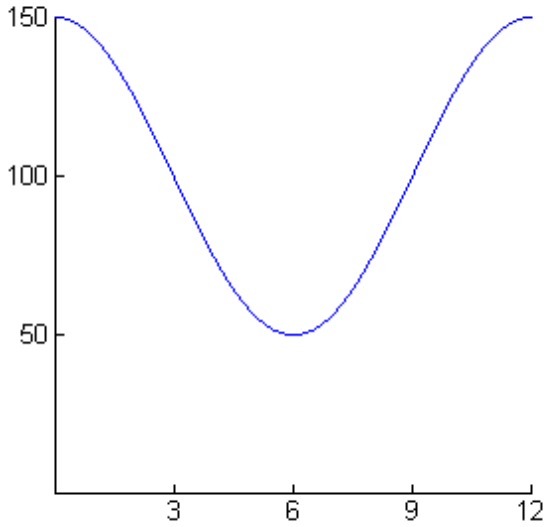
Is *F* a function of *t*? Is *R* a function of *t*?

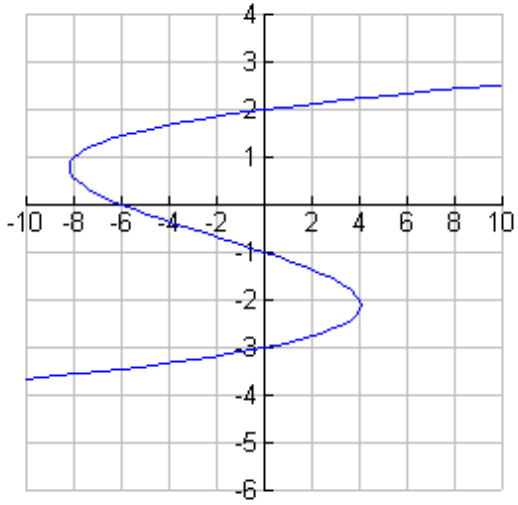
Is *F* a function of *R*? Is *R* a function of *F*?

t	0	1	2	3	4	5	6	7	8	9	10	11
R	1000	750	567	500	567	750	1000	1250	1433	1500	1433	1250
F	150	143	125	100	75	57	50	57	75	100	125	143

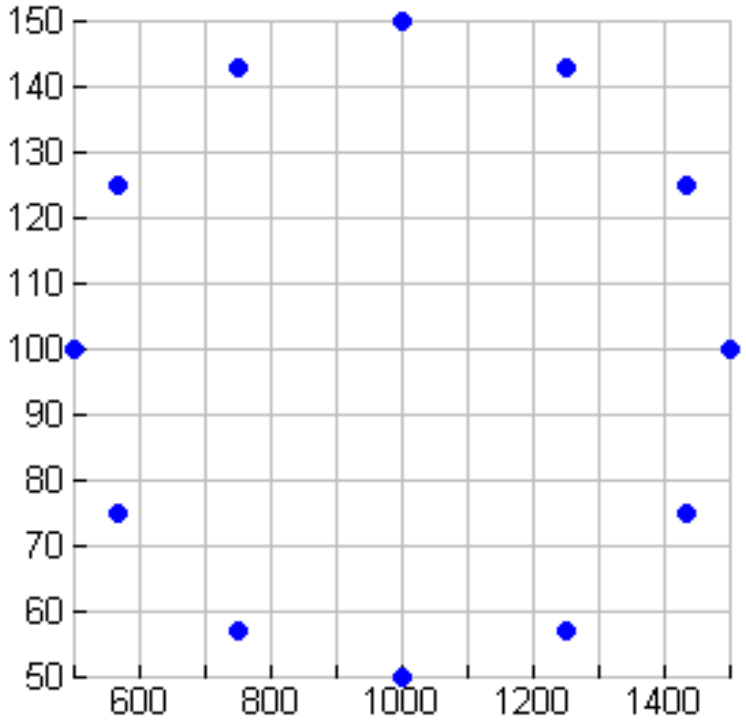
Vertical Line Test

If there is a vertical line which intersects a graph in more than one point, then the graph does not represent a function.



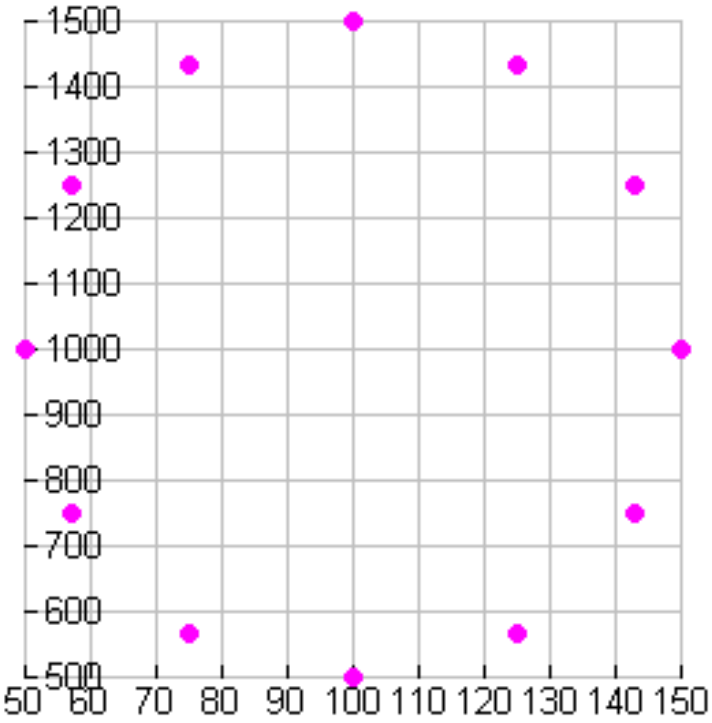


Is *F* a function of *R*?



R	1000	750	567	500	567	750	1000	1250	1433	1500	1433	1250
F	150	143	125	100	75	57	50	57	75	100	125	143

Is *R* a function of *F*?

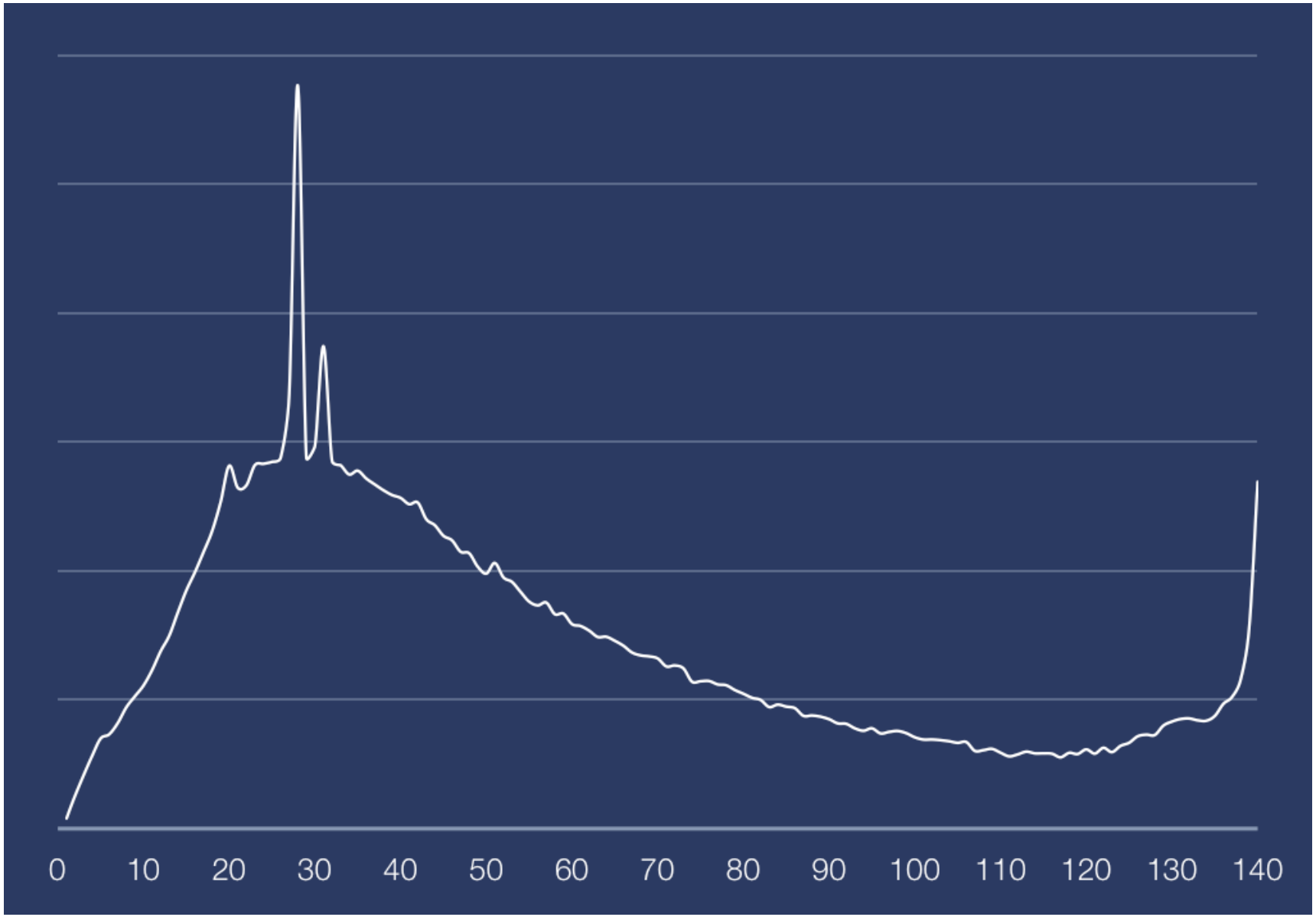


R	1000	750	567	500	567	750	1000	1250	1433	1500	1433	1250
F	150	143	125	100	75	57	50	57	75	100	125	143

Non-Formula Example

- The average monthly rainfall, *R* at Chicago's O'Hare airport is given in the table below, where time, *t* is in months and *t* = 1 is January, *t* = 2 is February, and so on.

Month, *t*	1	2	3	4	5	6	7	8	9	10	11	12
O'Hare, *R*	1.8	1.8	2.7	3.1	3.5	3.7	3.5	3.4	3.2	2.5	2.4	2.1
SHV, *S*	4.6	4.2	4.2	4.4	5.3	5.1	4.0	2.7	3.2	4.5	4.7	4.6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