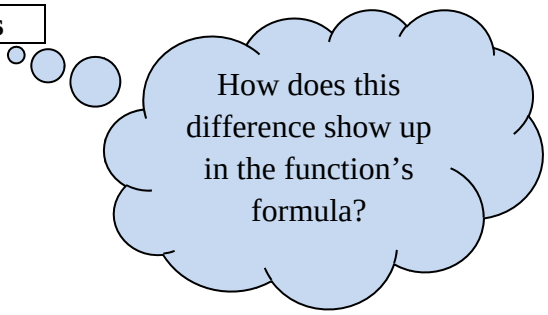
Finite Differences for Linear and Quadratic Functions NAMES:

We will see how differences in successive y-values for a function can help you find its formula.

1. Complete the table for the function, finding the difference between each two y-values.

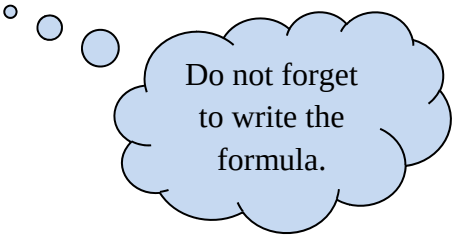
x	$y = 4x + 6$	Difference between y-values
0	6	
1	10	
2	14	
3	18	
4	22	
5	26	



2. If we were not given the formula $y = 4x + 6$ for this function, how could we guess it from the table? In other words, for the generic formula $y = f \cdot x + e$, how would you guess f and e?

3. Try out your method to find the formula for the following function shown in the table below.

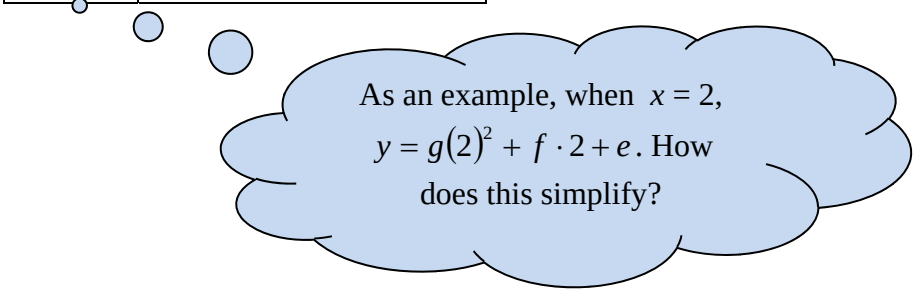
x	$y = \mathbf{f} \cdot x + \mathbf{e}$	Difference between y-values
0	14	
1	16	
2	18	
3	20	
4	22	
5	24	



4. One reason you might want to determine a function's formula is to find y-values for other x-values that are not near the table. Use the formula you found in the last question to find the y-value when x is 25.

5. Let's investigate another type of function. Complete the table of finite differences below, but this time, we do it in general using the quadratic function $y = gx^2 + fx + e$. We will also find the differences of those differences, shown in the fourth column.

x	$y = gx^2 + fx + e$	**Difference between y-values**	**Difference between entries in previous column (differences)**
0			
1			
2			
3			
4			
5			



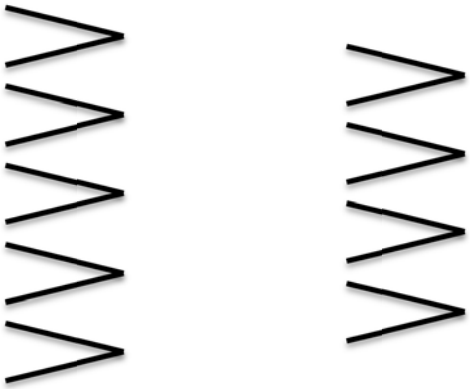
6a. Do you see the pattern? How would you use the table to find the value of e? Circle the entry in the table where e appears alone.

6b. How do we find the value of g? Circle the entries in the table that would be the easiest to use.

6c. If we know g, could you figure out what f has to be? Circle the entry in the table that would be the easiest to use.

7. Let's see this in action with a specific function.

x	$y = 2x^2 + 3x + 5$	**Difference between y-values**	**Difference between entries in previous column (differences)**
0	5		
1	10		
2	19		
3	32		
4	49		
5	70		



8. Recall the formula for the relationship in the previous question is $y = 2x^2 + 3x + 5$. Here, we are using the numbers 2, 3, and 5 for the variables g, f, and e, respectively. Let's see how the values of 2, 3, and 5 show up in the table.

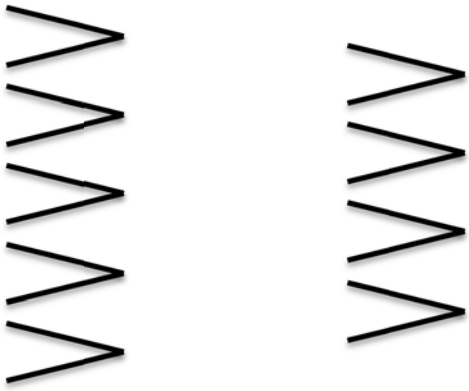
To find e (or 5): The y-value for the x-value of 0 (which is the first entry in the y column) happens to be 5. Circle this table entry. [We saw this in general for number 6a above.]

To find g (or 2): Notice that all of the entries in the fourth column (differences of the differences) are all "twice 2". Circle these table entries. [We saw this in general for number 6b above.]

To find f (or 3): Likewise from numbers 5 and 6, do you remember where "f + g" was located in the table? Find that location in this table (circle it) and show how 3 is contained within it.

9. Use this process to find the formula for the function below.

x	$y = gx^2 + fx + e$	**Difference between y-values**	**Difference between entries in previous column (differences)**
0	9		
1	16		
2	29		
3	48		
4	73		
5	104		



Be sure to write the formula of the function. Remember that is the whole point of analyzing the table.

10. For the function in the previous question, what is the y-value when the x-value is 14?