Functions and Varying Quantities in GC

The function $A(t)$ represents the expected attendance, in thousands, at a football game if the temperature is T deg farenheit.

$$A(T) = -0.01T^2 + 1.46T + 11.71$$

1. Define this function in GC as $A(T)$. Remember to use control-9 for parentheses in defining a function (otherwise with shift-9, you are telling GC to multiply).

2. GC did not create a graph after entering the definition of A. Why not?

3. Enter each expression below into GC. Interpret its value in terms of temperature and expected attendance. ('subtract,' 'minus,' 'difference' not allowed in explanations!)

    a. $A(10)$

    b. $A(95)$

    c. $A(45) - A(30)$

    d. $A(45) - 30$

ii) Use GC to determine the expected attendance when the temperature is 10°, 15.5°, and 75°.

4. On a new line, command GC to graph *A* for temperatures from 0 to 110 F° (temperature on the horizontal axis, and expected attendance on the vertical axis).

   Adjust the window using the scale icon buttons to show the entire graph.

5. By observing the graph, describe in sentences how expected attendance co-varies with temperature. In other words, what does the graph reveal about the relationship of these quantities? Be specific and thorough.

6. For each expression below:

   i) Use the graph of *A* to find the value of *b* that makes the statement true (click on the curve to get the movable crosshairs).

   ii) After knowing *b*'s value, interpret the meaning of the expression in terms of attendance and temp.

   a. $A(b) = 27$

   b. $A(b) = 60$ (Consider carefully!)

Plotting points with GC

Use your graph from the first part of this activity.
To plot a point, start a new command line and type control-2. The expression $\begin{bmatrix} x \\ y \end{bmatrix}$ should appear.

Change the *x* to 50 and the *y* to 40: $\begin{bmatrix} 50 \\ 40 \end{bmatrix}$. Press Enter (Return).Then check the graph to see that the point (50, 40) is now plotted.

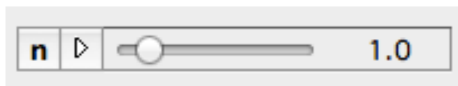
7. Change the existing $\begin{bmatrix} 50 \\ 40 \end{bmatrix}$ command line so that it plots the point on the curve associated with 80 ºF. *Utilize function notation for the expected attendance value* in the brackets.

   Confirm your point is plotted correctly on the graph. Write the GC command line here: $\begin{bmatrix} \quad \end{bmatrix}$

Sliders

A slider allows you to quickly change the value of a parameter within a chosen range of values, rather than repeatedly typing, deleting, and replacing numbers in the command lines.

The symbol *n* is built into GC as a slider parameter. If you type *n* in any command line, the slider will appear below the graph, like below.



Click on the **n**. A dialog box will appear that will allow you to enter the lowest value of *n*, the highest values of *n*, and the number of steps between highest and lowest. Press the play button to let the values change automatically. Or, you can drag the knob to change the value of *n*,.

8. a. On a new command line, use *n* (for temperature) to plot a *movable* point that highlights points on the graph of $y = A(x)$. .

   Write the GC command line here: [ ].

   b. Before using the slider, define *n* to be whole number temperatures that are multiples of 5, within the range of temperatures graphed.

   Type the highest value, lowest value, and number of steps for *n* that you entered: ___ , ___ , ___

   Change the value of *n* and observe the graph to confirm that the point is plotted on the graph of *A* and is moving correctly.

9. Suppose the temperature is 25 ºF. Highlight this point on the curve by adjusting the *n* slider. For this page, all responses should be related the particular temperature of 25, i.e. **don't use *n*.**

   a. On a new command line, have GC graph a line segment that begins at the highlighted point and represents an increase of temperature, d*T*, of 10 ºF. (This segment does *not* extend to another point on the curve; it represents a *change in temperature only* without any connection to expected attendance.) In your command line that creates this segment, use function notation.

   Verify that this segment is graphed correctly, then write the command line below.

   b. What are the coordinates of the starting and ending points of your segment?

   No decimal approximations! Use exact values and function notation.

   Starting Point: (_____ , _____) Ending Point: (_____ , _____)

   c. On a new command line, have GC create a line segment that represents the change of expected attendance, d*A*, that results from the specific change in temperature above. This new segment should begin at the *ending* point of the segment above, and end at a new point on the curve. Use all exact values and expressions in your command line that generates this segment.

Verify that this segment is correct, then write the command line below.

d. Write an expression using function notation that would calculate the length of the line segment you graphed in part c, which is the value of d*A*. This type of expression should look familiar.

e. Using a new command line, find this value of d*A* and interpret its meaning below with a sentence.

10. If you've graphed the two segments correctly, your curve should now include something like a right triangle attached to it. Summarize in a sentence what this specific "calculus triangle" is showing about the two quantities *A* and *T* and how they change together.

11. Now alter the command lines you created in #9 above to create a *movable* calculus triangle that can be chosen to start at *any* temperature T with the n-slider. Keep n values (temperatures) as multiples of 5 ºF as in the earlier exercise, and keep $dT = 10$ ºF. Once you've verified that your movable triangle works correctly when you change the value of n, write the new command lines below.

12. You will notice that there's a problem for $n \geq 73$. Why is this happening? Explain. Identify and remedy the problem by adding another command line similar to one you already have, and include your new command line along with your explanation below.