

Integral Properties Questions

For this homework question, you will need to use the applet "Integral Properties" located at <http://www.jimrolf.com/integralProperties.html> to answer the questions listed below. Your answers will probably need to include screen shots or other facsimiles of the graphs that you generate with the applet in order for the grader to best understand your thought processes.

Applet information. When the applet opens up you should see the graph of the function $g(x) = \int_a^x f(t) dt$ on the domain $[-3, 3]$. Note that the equation that describes $f(x)$ has been hidden from the user. You may adjust the default value of $a = -3$ by dragging the slider with the mouse, by using the arrow buttons on your keyboard, or by typing a number in the text field and clicking "Graph." Additionally, you may want to zoom in/out via mouse clicks on the graph or slide the graph around by grabbing it with the mouse and dragging.

Questions

1. Describe and graph the function $f(x)$ on the domain $[-3, 3]$. In particular, you should describe where $f(x)$ is increasing/decreasing, the location of any critical points, and any function values that you can determine. As usual, it's important to explain how you arrived at these conclusions.
2. Does changing the value of a change your answers to question #1? Why or why not?
3. As you vary the parameter a , the graph of $g(x)$ appears to always cross (or touch) the x -axis in at least one place. In other words, $g(x) = 0$ for at least one point in the domain for all choices of a . Do you think this fact is specific only to the underlying function $f(x)$ used in this applet? If another definition of $f(x)$ was utilized, would this fact remain true for the new $f(x)$? Can you provide another either an example of another $f(x)$ (and a parameter a) or an explanation of why this must always be true.
4. When varying the parameter a from -3 to $+3$, the graph $g(x)$ sometimes does not change, sometimes slides down, and sometimes slides up. Explain why this behavior occurs but yet no other characteristics of the graph change when varying a . *Hint:* It may be useful to consider the graph of $f(x)$ that you determined in question #1.
5. Determine the values of parameter a that correspond to the transitions between the behaviors described in question #4. You will probably want to consider the graph of $f(x)$ you determined in question #1. Note that merely observing the value of the parameter a as you vary the slider is not a sufficient answer.