**Using the Document**

PWL\_Definite\_Integral\_Function.tns:

On page 1.2, a function  is presented as a piecewise defined linear graph. The vertices that connect the linear pieces of the graph can be moved up or down (in integer steps) by grabbing any marked point on the graph and dragging to another location. The values of  and  can also be changed by grabbing the corresponding point and dragging along the horizontal axis. These values can also be manipulated by using the sliders in the left pane. For a fixed value  the value of  is displayed in the bottom pane.

On page 2.2, a function  is presented as a piecewise defined linear graph in the top pane. The vertices can be moved up or down, and the values of  and  can be changed on the graph or by using the sliders. The graph of the function  is displayed in the bottom pane.

**Suggested Applications and Extensions**

**Page 1.2**

Use the default function  to answer Questions 1-8. Remember that  is a function of  (for a fixed value of ). The values of  and  can be manipulated, the value  is displayed in the bottom pane, and the shaded region in the top pane represents the accumulated net area bounded by the graph of  and the horizontal axis from  to 

1. Find the domain and range of the function 
2. Use the graph to explain geometrically how to find 
3. On what intervals is  increasing? Decreasing?
4. Find  Explain this answer since the shaded region representing  is above the horizontal axis.
5. On the interval where does  have an absolute maximum value? Explain the behavior of the function  at and around this value. 
6. On the interval where does  have an absolute mimimum value? Does this contradict the Extreme Value Theorem? Why or why not?
7. Let  Explain how the values in Question 1 change.
8. Let  Explain how the values in Question 1 change.
9. Let  Move the points to construct a piecewise defined linear function such that the maximum value of  occurs at  Let  Where does the absolute maximum occur now?
10. Let  Move the points to construct a non-zero piecewise defined linear function such that  Let  Explain the relationship among the shaded regions in the graph of  to the left of 
11. Let  Move the points to construct a non-zero piecewise defined linear function such that the function  is increasing on the interval  In words, describe any special characteristic of your function  Does this suggest another relationship between  and  If so, explain.
12. Let  Is it possible to construct a non-zero piecewise defined linear function such that  If not, why not? If so, construct one such function.

**Page 2.2**

Use the default function  to answer Questions 1-9. Remember that  is a function of  (for a fixed value of ). The values of  and  can be manipulated, the value  is displayed in the left pane, and the shaded region in the top pane represents the accumulated net area bounded by the graph of  and the horizontal axis from  to  The bottom pane displays a complete graph of the function 

1. Find the domain and range of 
2. Find the value  Explain how to determine this value geometrically.
3. Find the value  Explain this answer geometrically.
4. On what intervals is  increasing? Decreasing? What are the values of  on each of these intervals?
5. For what values of  does  have a relative minimum value? Relative maximum value?
6. Where does  attain its absolute maximum value? Absolute minimum value?
7. On what intervals is  concave up? Concave down? Explain the behavior of the function  on each of these intervals.
8. Find any points of inflection on the graph of  Explain the behavior of the graph of at each corresponding 
9. Use your answers to questions 1-8 to suggest a relationship between and 
10. Let  Move the points to construct a non-zero piecewise defined linear function such that the function  is increasing on the interval  In words, describe any special characteristic of your function 
11. Let  Move the points to construct a non-zero piecewise defined linear function such that the graph of the function  has two relative maximum points and two relative minimum points.
12. Let  Is it possible to construct a non-zero piecewise defined function such that the graph of the function  has three relative maximum points? If not, why not? If so, then construct one such graph.
13. Let  Move the points to construct a non-zero piecewise defined linear function such that the graph of the function  is concave down over its entire domain.
14. For your graph constructed in Question 13, explain what happens to the graph of  as  changes.
15. Let  Move the points to construct a non-zero piecewise defined linear even function. Is the function  even, odd, or neither?
16. Let  Move the points to construct a non-zero piecewise defined linear odd function. Is the function  even, odd, or neither?