**Background**

The purpose of this file is to enable users to numerically investigate the limit of a function as  and as , or the limit as  and as . Sliders are used to quickly examine the behavior of each function, and a table of values is also computed and displayed.

**Course and Exam Description Unit**

1.4: Estimating Limit Values from Tables

1.15: Connecting Limits at Infinity ad Horizontal Asymptotes

**Calculator Files**

LimitSliders.tns

**Using the Document**

LimitSliders.tns: This calculator file provides a technology tool for investigating the limit of an arbitrary function as  approaches a specific value from the left and from the right. In a separate calculator problem, the user can investigate the limit of a function as  increases or decreases without bound, that is, as  or as . A short table of values for each type of limit is also automatically computed and displayed in a Lists and Spreadsheet page.

The default limits are

 (calculator problem 2)

and

 (calculator problem 3)

Page 1.1

|  |  |
| --- | --- |
|  | This introductory screen provides information to help utilize this tns file. In examining either the limit as  approaches a specific number, or as increases or decreases without bound, the function is defined as . A slider is used to change the value of . A table of values is given on pages 2.2 and 3.2. |

Page 2.1

|  |  |
| --- | --- |
|  | Page 2.1 is a Notes page that contains two math boxes, values of the function , and a slider to change the value of . The function is defined in the first math box, and the value of  is set in the second math box. The function  is initially evaluated at . As you click the slider, the value of  move closer to  from the right and from the left in steps of , for . This provides data that can be used to guess the overall limit, as indicated in the lower right side of the screen.Note that there are calculations at the bottom of this screen, used to compute and display the values of  and the function values. |

Page 2.2

|  |  |
| --- | --- |
|  | This Lists and Spreadsheet page contains the values of  close to  on the left and the right, and the corresponding values of the function . This spreadsheet presentation might make it easier to conjecture if the values of  are converging or diverging. |

Page 3.1

|  |  |
| --- | --- |
|  | The function is defined at the top of this Notes page in the Math Box. By default, the value of the function is given for  and . The slider at the bottom of the page is used to increase the magnitude of each of these -values, up to . The value of the function is computed and displayed automatically. These numerical values for  may provide insight into, or confirmation of, the limits and . |

Page 3.2

|  |  |
| --- | --- |
|  | This Lists and Spreadsheet page displays the values of  used on Page 3.1, and the corresponding values of the function . This spreadsheet presentation might make it easier to conjecture if the values of  are converging or diverging as  increases or decreases without bound. |

**Suggested Applications and Extensions**

Use Pages 2.1 and 2.2 to estimate the value of the limit, if it exists.

1. 
2. 
3. 
4. 
5. 
6. 
7. 
8. 
9. 
10. 
11.  where 

Use Pages 3.1 and 3.2 to estimate the value of the limit, if it exists.

1. 
2. 
3. 
4.  and 
5. 
6. 
7. 
8. 
9. 
10. 