**Using the Document**

This tns file is used to produce the graphs of various Taylor polynomials, . These graphs are used to study how the accuracy of a Taylor polynomial is associated with the degree of the Taylor polynomial. The accuracy of each Taylor polynomial is visualized and can be related to symmetry, arc length, and any points of discontinuity.

Five common functions are considered and some specific questions about associated Taylor polynomials are included.

**Problems**

1. For , sketch and describe the graph of .
2. Use the graph of  and the Trace All feature to describe the accuracy of the Taylor polynomial approximation as  moves farther away from .
3. Set . Sketch and describe the graph of .
4. Set . Sketch and describe the graph of .
5. Consider the graph of other Taylor polynomials for . Describe the accuracy of the Taylor polynomial approximation as  increases.

**Problems**

Change the values of  and  as necessary and use **Page 2.3**, the Lists and Spreadsheet page, to answer the following questions.

1. For a fixed value of , describe the accuracy of the Taylor polynomial approximation as the values of  are farther away from .
2. For fixed values of  and , describe the accuracy of the Taylor polynomial approximation as  increases.
3. Set . For , find an interval in which the Taylor polynomial is a good approximation for .

Note: Page 2.4 is used for background calculations. The equations and entries on this Lists and Spreadsheet page should be left unchanged to ensure the accuracy of the results presented on other pages of this problem.

**Problems**

Change the values of  and  as necessary and use **Page 3.2** to answer the following questions.

1. For , describe the accuracy of the Taylor polynomial approximation as  increases.
2. Describe the behavior of each Taylor polynomial as  and as . Explain how the graph of the Taylor polynomial changes, as , as  increases by 1, for example, from  to . Explain why this property of the Taylor polynomials alternates as  increases.
3. Set . Consider the graph of  for various values of . Explain why the Taylor polynomial appears to be a very good approximation to the left of  but diverges rapidly to the right of .

**Problems**

Change the values of  and  as necessary and use **Pages 5.2 and 5.3** to answer the following questions.

1. Set  and . Describe the graph of the Taylor polynomial. Find the Taylor polynomial and explain why the slope of this linear approximation is 0.
2. Set . Consider the graph of the Taylor polynomial  as  increases. Explain why the graph of the Taylor polynomials for  and  are identical, and for  and for , etc.

**Problems**

Change the values of  and  as necessary and use **Pages 6.2 and 6.3** to answer the following questions.

1. Set . Consider the graph of the Taylor polynomial  for various values of . Explain why there is no graph of the Taylor polynomial to the right of .
2. Set  and . Explain the accuracy of the Taylor polynomial. Explain the accuracy of the Taylor polynomial . Why does the Taylor polynomial appear to be a much better approximation to the right of  than to the left?
3. Explain how to obtain the graph of a Taylor polynomial that can be used to approximate the portion of the graph of  to the right of .

**Suggested Extensions**

1. Explain how the accuracy of a Taylor polynomial is related to the degree of the Taylor polynomial and the value of .
2. Describe the interval about  on which a Taylor polynomial is fairly accurate.
3. Suppose the function  has a discontinuity at . Explain how this value affects a Taylor polynomial for .
4. What is the relationship between the th derivative of the function  and the th derivative of the corresponding Taylor polynomial ?
5. Consider exploring the Taylor polynomials associated with the following functions.
6. 
7. 
8. 
9. 
10. 