

Mini-Lab 24 End Behavior

Purpose

To investigate end behavior models for polynomial functions.

Investigations

1. Given $f(x) = x^3 - 7x^2 - 9x + 5$:

- a. Enter the function as Y_1 . Complete Table 1 using the **Ask** feature of the TI-82 **TABLE**.

TI-82 Procedure to set table in Ask mode

- Press **2nd** **WINDOW** to open **TblSet**.
- Arrow to **Ask** next to **Indpnt** and press **ENTER**.

If you now open the table, the calculator waits for you to enter a value for x . After doing so, press **ENTER** to see the corresponding output. Use this approach to complete Table 1.

x	$f(x)$	x	$f(x)$
10		-10	
100		-100	
1000		-1000	
10000		-10000	
100000		-100000	

Table 1: Behavior of $f(x)$ as the absolute value of x increases

As $x \rightarrow \infty, f(x) \rightarrow$ _____ and as $x \rightarrow -\infty, f(x) \rightarrow$ _____

- b. Graph both the given function and $y = x^3$ in the viewing window $X_{\min} = -10, X_{\max} = 10, Y_{\min} = -100, Y_{\max} = 100$. Set the **zoom factors** so that $X_{\text{Fact}} = 2$ and $Y_{\text{Fact}} = 10$.

TI-82 Procedure to set zoom factors

- Press **ZOOM** and arrow to the **MEMORY** menu.
- Type **4** to select **SetFactors**.

Type the given values for X_{Fact} and Y_{Fact} . These values control how fast you zoom in or out along the horizontal axis and along the vertical axis. In this case, we have chosen to zoom faster in the vertical direction.

Zoom out by pressing **ZOOM** **3** **ENTER**. Do this several times. Describe in words what happens to the two graphs as you zoom out.

- c. How do you think we used the original function to choose the function $y = x^3$?

2. Given $f(x) = -5x^3 - x^2 + 4x - 3$:

- a. Enter the function as Y_1 . Complete Table 2 using the **Ask** feature of the TI-82 **TABLE**.

x	$f(x)$	x	$f(x)$
10		-10	
100		-100	
1000		-1000	
10000		-10000	
100000		-100000	

Table 2: Behavior of $f(x)$ as the absolute value of x increases

As $x \rightarrow \infty, f(x) \rightarrow$ _____ and as $x \rightarrow -\infty, f(x) \rightarrow$ _____

- b. Graph both the given function and $y = -5x^3$ in the viewing window $X_{\min} = -5, X_{\max} = 5, Y_{\min} = -10, Y_{\max} = 10$. Set the **zoom factors** so that $X_{\text{Fact}} = 2$ and $Y_{\text{Fact}} = 10$.

Zoom out by pressing **ZOOM** **3** **ENTER**. Do this several times. Describe in words what happens to the two graphs as you zoom out.

- c. How do you think we used the original function to choose the function $y = -5x^3$?

3. Given $f(x) = 2x^4 + x^3 - 4x^2 - 2x - 5$:

- a. Enter the function as Y_1 . Complete Table 3 using the **Ask** feature of the TI-82 **TABLE**.

x	$f(x)$	x	$f(x)$
10		-10	
100		-100	
1000		-1000	
10000		-10000	
100000		-100000	

Table 3: Behavior of $f(x)$ as the absolute value of x increases

As $x \rightarrow \infty, f(x) \rightarrow$ _____ and as $x \rightarrow -\infty, f(x) \rightarrow$ _____

- b. An **end behavior model** for a function is a function whose graph merges with the original function when you zoom out. Use the original function to write a one-term polynomial function that is an end behavior model for the given function. Give a reason for your answer.

- c. Graph both the given function and the end behavior model you selected in investigation 3b. Use the viewing window $X_{\min} = -5, X_{\max} = 5, Y_{\min} = -10, Y_{\max} = 10$. Set the **zoom factors** so that $X_{\text{Fact}} = 2$ and $Y_{\text{Fact}} = 10$.

Zoom out by pressing **ZOOM** **3** **ENTER**. Do this several times. Is your end behavior model correct? How can you tell? If not, revise your answer to investigation 3b.

4. Using the ideas of investigations 1–3:

- a. What function acts as an end behavior for $f(x) = 7x^3 - 43x + 12x^2 - 3x^4 + 28$? Give reasons for your answer.

- b. Graph both the original function and the function from investigation 4a. Is your end behavior model correct? How can you tell? If not, revise your answer to investigation 4a.

- c. Use the graph to answer the following:

As $x \rightarrow \infty, f(x) \rightarrow$ _____ and as $x \rightarrow -\infty, f(x) \rightarrow$ _____

5. Given a polynomial function $f(x)$, state in words how to determine a function that acts as the end behavior model for $f(x)$.