

## 5.2 End Behavior of Polynomial Functions

**MATERIALS** • graphing calculator

**QUESTION** How is the end behavior of a polynomial function related to the function's equation?

Functions of the form  $f(x) = \pm x^n$ , where  $n$  is a positive integer, are examples of *polynomial functions*. The *end behavior* of a polynomial function's graph is its behavior as  $x$  approaches positive infinity ( $+\infty$ ) or as  $x$  approaches negative infinity ( $-\infty$ ).

**EXPLORE** Investigate the end behavior of  $f(x) = \pm x^n$  where  $n$  is even

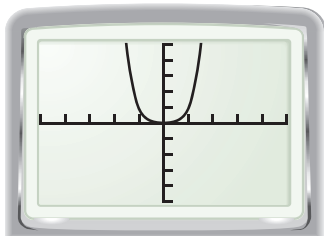
Graph the function. Describe the end behavior of the graph.

a.  $f(x) = x^4$

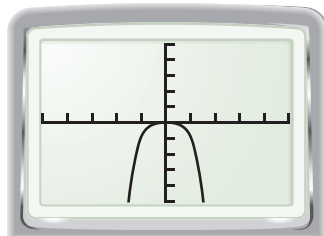
b.  $f(x) = -x^4$

**STEP 1** *Graph functions* Graph each function on a graphing calculator.

a.



b.



**STEP 2** *Describe end behavior* Summarize the end behavior of each function.

Function	As $x$ approaches $-\infty$	As $x$ approaches $+\infty$
a. $f(x) = x^4$	$f(x)$ approaches $+\infty$	$f(x)$ approaches $+\infty$
b. $f(x) = -x^4$	$f(x)$ approaches $-\infty$	$f(x)$ approaches $-\infty$

**DRAW CONCLUSIONS** Use your observations to complete these exercises

Graph the function. Then describe its end behavior as shown above.

1.  $f(x) = x^5$       2.  $f(x) = -x^5$       3.  $f(x) = x^6$       4.  $f(x) = -x^6$

5. Make a conjecture about the end behavior of each family of functions.

a.  $f(x) = x^n$  where  $n$  is odd

b.  $f(x) = -x^n$  where  $n$  is odd

c.  $f(x) = x^n$  where  $n$  is even

d.  $f(x) = -x^n$  where  $n$  is even

6. Make a conjecture about the end behavior of the function  $f(x) = x^6 - x$ .  
Explain your reasoning.