

EXPLORATION 1 Investigating the End Behavior of $f(x) = a_n x^n$

Graph each function in the window $[-5, 5]$ by $[-15, 15]$. Describe the end behavior using $\lim_{x \rightarrow \infty} f(x)$ and $\lim_{x \rightarrow -\infty} f(x)$.

1. (a) $f(x) = 2x^3$ (b) $f(x) = -x^3$
 (c) $f(x) = x^5$ (d) $f(x) = -0.5x^7$
2. (a) $f(x) = -3x^4$ (b) $f(x) = 0.6x^4$
 (c) $f(x) = 2x^6$ (d) $f(x) = -0.5x^2$
3. (a) $f(x) = -0.3x^5$ (b) $f(x) = -2x^2$
 (c) $f(x) = 3x^4$ (d) $f(x) = 2.5x^3$

Describe the patterns you observe. In particular, how do the values of the coefficient a_n and the degree n affect the end behavior of $f(x) = a_n x^n$?

Below are notes that may help you with end behavior.

Leading Term Test for Polynomial End Behavior

For any polynomial function $f(x) = a_n x^n + \dots + a_1 x + a_0$, the limits $\lim_{x \rightarrow \infty} f(x)$ and $\lim_{x \rightarrow -\infty} f(x)$ are determined by the degree n of the polynomial and its leading coefficient a_n :







