GRAPHING POLYNOMIAL FUNCTIONS To graph a polynomial function, first plot points to determine the shape of the graph's middle portion. Then use what you know about end behavior to sketch the ends of the graph.

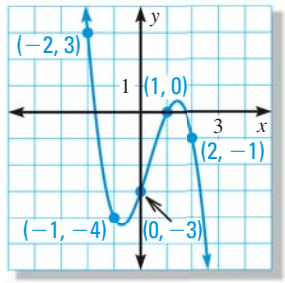
EXAMPLE 5 Graph polynomial functions

Graph (a) $f(x) = -x^3 + x^2 + 3x - 3$ and (b) $f(x) = x^4 - x^3 - 4x^2 + 4$.

Solution

a. To graph the function, make a table of values and plot the corresponding points. Connect the points with a smooth curve and check the end behavior.

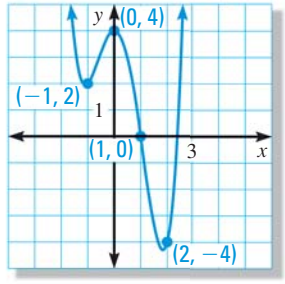
x	−3	−2	−1	0	1	2	3
y	24	3	−4	−3	0	−1	−12



The degree is odd and leading coefficient is negative. So, $f(x) \to +\infty$ as $x \to -\infty$ and $f(x) \to -\infty$ as $x \to +\infty$.

b. To graph the function, make a table of values and plot the corresponding points. Connect the points with a smooth curve and check the end behavior.

x	−3	−2	−1	0	1	2	3
y	76	12	2	4	0	−4	22



The degree is even and leading coefficient is positive. So, $f(x) \to +\infty$ as $x \to -\infty$ and $f(x) \to +\infty$ as $x \to +\infty$.

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EXAMPLE 6 TAKS REASONING: Multi-Step Problem

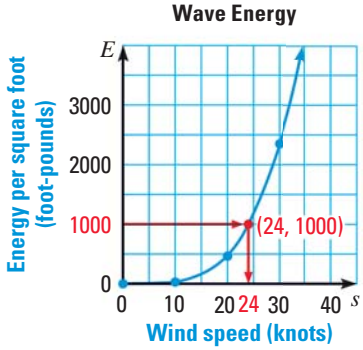
PHYSICAL SCIENCE The energy E (in foot-pounds) in each square foot of a wave is given by the model $E = 0.0029s^4$ where s is the wind speed (in knots). Graph the model. Use the graph to estimate the wind speed needed to generate a wave with 1000 foot-pounds of energy per square foot.

Solution

STEP 1 **Make** a table of values. The model only deals with positive values of s.

s	0	10	20	30	40
E	0	29	464	2349	7424

STEP 2 **Plot** the points and connect them with a smooth curve. Because the leading coefficient is positive and the degree is even, the graph rises to the right.



STEP 3 **Examine** the graph to see that $s \approx 24$ when $E = 1000$.

▶ The wind speed needed to generate the wave is about 24 knots.