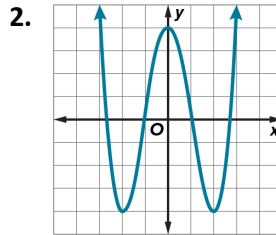
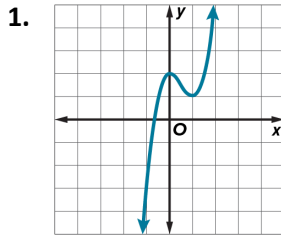


## Extrema and End Behavior • Form A

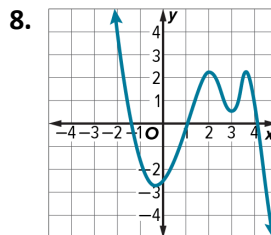
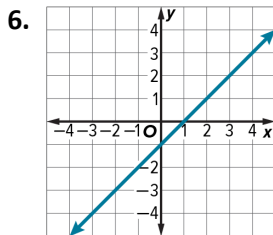
### Examples 1 and 2

Identify and estimate the  $x$ - and  $y$ -values of the extrema. Round to the nearest tenth if necessary.

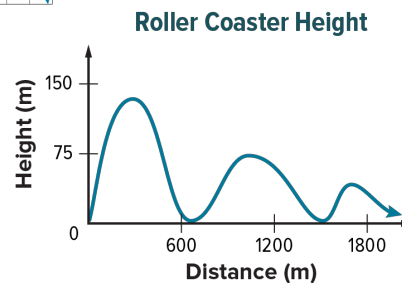


### Examples 3–5

Describe the end behavior of each function.

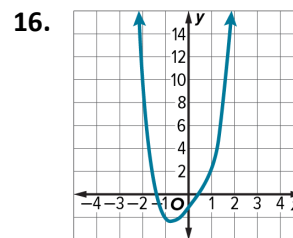
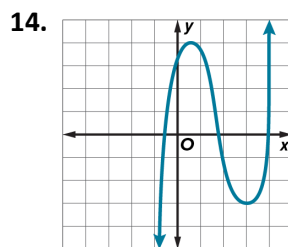
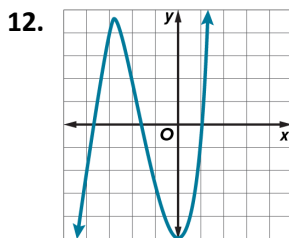


10. **ROLLERCOASTER** The graph shows the height of a rollercoaster in terms of its distance away from the starting point. Describe the end behavior and interpret the end behavior in the context of the situation.



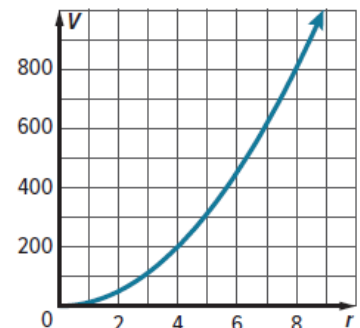
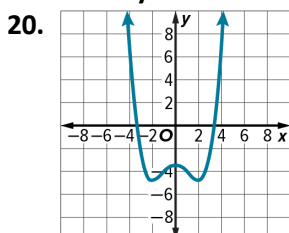
### Mixed Exercises

Identify and estimate the  $x$ - and  $y$ -values of the extrema. Round to the nearest tenth if necessary. Then use the graphs to describe the end behavior of each function.



18. **BUBBLES** The volume of a soap bubble can be estimated by the formula  $V = 4\pi r^2$ , where  $r$  is its radius. The graph shows the function of the bubble's volume. Describe the end behavior of the graph.

Identify and estimate the  $x$ - and  $y$ -values of the extrema. Round to the nearest tenth if necessary. Then use the graphs to describe the end behavior of each function.

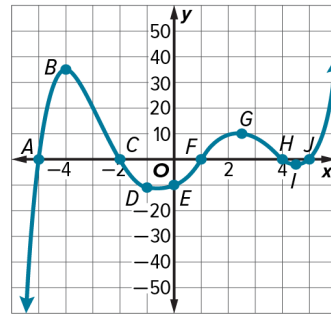


**USE ESTIMATION** Use a graphing calculator to estimate the  $x$ -coordinates at which any extrema occur for each function. Round to the nearest hundredth.

22.  $f(x) = x^3 + 3x^2 - 6x - 6$

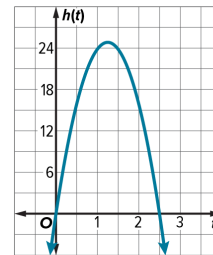
24.  $f(x) = -2x^4 + 5x^3 - 4x^2 + 3x - 7$

26. **CONSTRUCT ARGUMENTS** Sheena says that in the graph of  $f(x)$  shown below, the graph has relative maxima at  $B$  and  $G$ , and a relative minimum at  $A$ . Is she correct? Explain.



28. **ENGINEERING** Several engineering students built a catapult for a class project. They tested the catapult by launching a watermelon and modeled the height  $h$  of the watermelon in feet over time  $t$  in seconds.

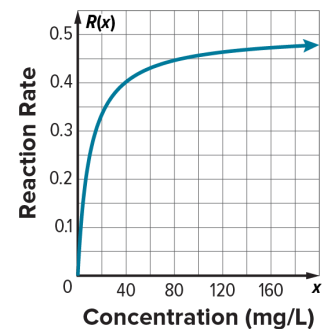
- Considering the context of the problem, what is an appropriate domain for  $h(t)$ ? Explain your reasoning.
- Use the graph of  $h(t)$  to find the maximum height of the watermelon. When does the watermelon reach the maximum height? Explain your reasoning.



30. The table shows the values of a function. Use the table to describe the end behavior of the function.

| $x$   | $y$            |
|-------|----------------|
| -1000 | -1,001,000,000 |
| -100  | -1,010,000     |
| -10   | -1100          |
| -1    | -2             |
| 1     | 0              |
| 10    | 900            |
| 100   | 990,000        |
| 1000  | 999,000,000    |

33. **ANALYZE** A catalyst is used to increase the rate of a chemical reaction. The reaction rate, or the speed at which the reaction is occurring, is given by  $R(x) = \frac{0.5x}{x+10}$ , where  $x$  is the concentration of the catalyst solution in milligrams of solute per liter. What does the end behavior of the graph mean in the context of this experiment?



35. **FIND THE ERROR** Joshua states that the end behavior of the graph is: as  $x \rightarrow -\infty$ ,  $f(x) \rightarrow -\infty$  and as  $x \rightarrow +\infty$ ,  $f(x) \rightarrow +\infty$ . What error did he make?

