9. Cubic function, positive leading coefficient. The answer is (c).

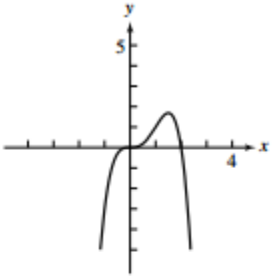
10. Cubic function, negative leading coefficient. The answer is (b).

11. Higher than cubic, positive leading coefficient. The answer is (a).

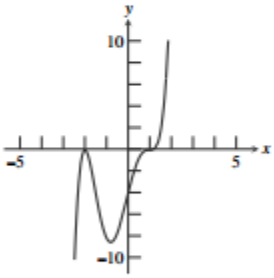
12. Higher than cubic, negative leading coefficient. The answer is (d).

13. One possibility

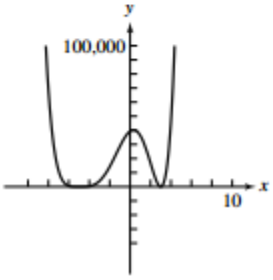
40. Degree 4; zeros: $x = 0$ (multiplicity 3, graph crosses x-axis), $x = 2$ (multiplicity 1, graph crosses x-axis).



41. Degree 5; zeros: $x = 1$ (multiplicity 3, graph crosses x-axis), $x = -2$ (multiplicity 2, graph is tangent).



42. Degree 6; zeros: $x = 3$ (multiplicity 2, graph is tangent), $x = -5$ (multiplicity 4, graph is tangent).

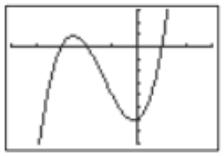


54. $f(x) = (x + 2)(x - 3)(x + 5) = x^3 + 4x^2 - 11x - 30$

55. $f(x) = (x - \sqrt{3})(x + \sqrt{3})(x - 4)$
$= (x^2 - 3)(x - 4) = x^3 - 4x^2 - 3x + 12$

For #17–24, when one end of a polynomial function's graph curves up into Quadrant I or II, this indicates a limit at ∞. And when an end curves down into Quadrant III or IV, this indicates a limit at $-\infty$.

17.

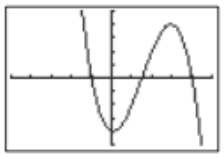


[−5, 3] by [−8, 3]

$\lim_{x \to \infty} f(x) = \infty$

$\lim_{x \to -\infty} f(x) = -\infty$

18.



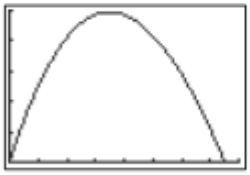
[−5, 5] by [−15, 15]

$\lim_{x \to \infty} f(x) = -\infty$

$\lim_{x \to -\infty} f(x) = \infty$

66. (a) The height of the box will be x, the width will be $15 - 2x$, and the length $60 - 2x$.

(b) Any value of x between approximately 0.550 and 6.786 inches



[0, 8] by [0, 1500]

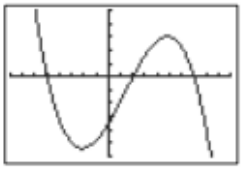
71. When $x = 0$, $f(x) = 2(x - 1)^3 + 5 = 2(-1)^3 + 5 = 3$. The answer is C.

72. In $f(x) = (x - 2)^2(x + 2)^3(x + 3)^7$, the factor $x - 2$ occurs twice. So $x = 2$ is a zero of multiplicity 2, and the answer is B.

73. The graph indicates three zeros, each of multiplicity 1: $x = -2$, $x = 0$, and $x = 2$. The end behavior indicates a negative leading coefficient. So $f(x) = -x(x + 2)(x - 2)$, and the answer is B.

74. The graph indicates four zeros: $x = -2$ (multiplicity 2), $x = 0$ (multiplicity 1), and $x = 2$ (multiplicity 2). The end behavior indicates a positive leading coefficient. So $f(x) = x(x + 2)^2(x - 2)$, and the answer is A.

19.

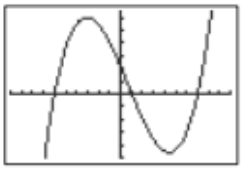


[−8, 10] by [−120, 100]

$\lim_{x\to\infty} f(x) = -\infty$

$\lim_{x\to-\infty} f(x) = \infty$

20.

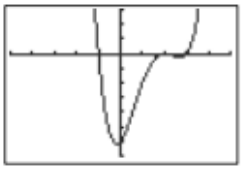


[−10, 10] by [−100, 130]

$\lim_{x\to\infty} f(x) = \infty$

$\lim_{x\to-\infty} f(x) = -\infty$

21.

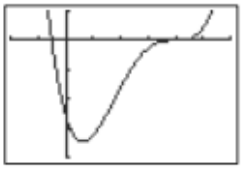


[−5, 5] by [−14, 6]

$\lim_{x\to\infty} f(x) = \infty$

$\lim_{x\to-\infty} f(x) = \infty$

22.

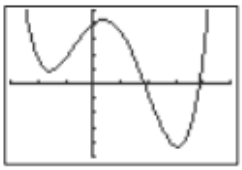


[−2, 6] by [−100, 25]

$\lim_{x\to\infty} f(x) = \infty$

$\lim_{x\to-\infty} f(x) = \infty$

23.

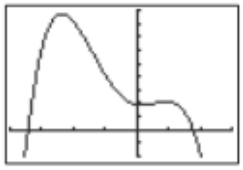


[−3, 5] by [−50, 50]

$\lim_{x\to\infty} f(x) = \infty$

$\lim_{x\to-\infty} f(x) = \infty$

24.



[−4, 3] by [−20, 90]

$\lim_{x\to\infty} f(x) = -\infty$

$\lim_{x\to-\infty} f(x) = -\infty$

For #25–28, the end behavior of a polynomial is governed by the highest-degree term.

25. $\lim_{x\to\infty} f(x) = \infty$, $\lim_{x\to-\infty} f(x) = \infty$

26. $\lim_{x\to\infty} f(x) = -\infty$, $\lim_{x\to-\infty} f(x) = \infty$

27. $\lim_{x\to\infty} f(x) = -\infty$, $\lim_{x\to-\infty} f(x) = \infty$

28. $\lim_{x\to\infty} f(x) = -\infty$, $\lim_{x\to-\infty} f(x) = -\infty$

29. (a); There are 3 zeros: they are −2.5, 1, and 1.1.

30. (b); There are 3 zeros: they are 0.4, approximately 0.429 (actually 3/7), and 3.

31. (c); There are 3 zeros: approximately −0.273 (actually −3/11), −0.25, and 1.

32. (d); There are 3 zeros: −2, 0.5, and 3.

For #33–35, factor or apply the quadratic formula.

33. −4 and 2

34. −2 and 2/3

35. 2/3 and −1/3

For #36–38, factor out x, then factor or apply the quadratic formula.

36. 0, −5, and 5

37. 0, −2/3, and 1

38. 0, −1, and 2

39. Degree 3; zeros: $x = 0$ (multiplicity 1, graph crosses x-axis), $x = 3$ (multiplicity 2, graph is tangent).