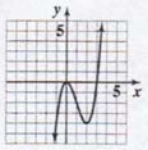
Section 3.2

Check Point Exercises

1. The graph rises to the left and to the right. **2.** The graph falls to the left and rises to the right. **3.** Since n is odd and the leading coefficient is negative, the function falls to the right. Since the ratio cannot be negative, the model won't be appropriate. **4.** No; the graph should fall to the left, but doesn't appear to. **5.** $\{-2, 2\}$ **6.** $\{-2, 0, 2\}$ **7.** $-\frac{1}{2}$ with multiplicity 2 and 5 with multiplicity 3; touches and turns at $-\frac{1}{2}$ and crosses at 5 **8.** $f(-3) = -42$; $f(-2) = 5$ **9.**

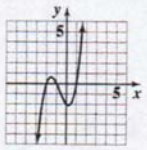


$f(x) = x^3 - 3x^2$

Exercise Set 3.2

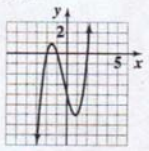
1. polynomial function; degree: 3 **2.** polynomial function; degree: 4 **3.** polynomial function; degree: 5 **4.** polynomial function; degree: 7
5. not a polynomial function **6.** not a polynomial function **7.** not a polynomial function **8.** not a polynomial function
9. not a polynomial function **10.** polynomial function; degree: 2 **11.** could be polynomial function **12.** not a polynomial function
13. not a polynomial function **14.** could be polynomial function **15.** b **16.** c **17.** a **18.** d
19. falls to the left and rises to the right **20.** falls to the left and rises to the right **21.** rises to the left and to the right
22. rises to the left and to the right **23.** falls to the left and to the right **24.** falls to the left and to the right
25. $x = 5$ has multiplicity 1; The graph crosses the x-axis; $x = -4$ has multiplicity 2; The graph touches the x-axis and turns around.
26. $x = -5$ has multiplicity 1; The graph crosses the x-axis; $x = -2$ has multiplicity 2; The graph touches the x-axis and turns around.
27. $x = 3$ has multiplicity 1; The graph crosses the x-axis; $x = -6$ has multiplicity 3; The graph crosses the x-axis.
28. $x = -\frac{1}{2}$ has multiplicity 1; The graph crosses the x-axis; $x = 4$ has multiplicity 3; The graph crosses the x-axis.
29. $x = 0$ has multiplicity 1; The graph crosses the x-axis; $x = 1$ has multiplicity 2; The graph touches the x-axis and turns around.
30. $x = 0$ has multiplicity 1; The graph crosses the x-axis; $x = -2$ has multiplicity 2; The graph touches the x-axis and turns around.
31. $x = 2$, $x = -2$ and $x = -7$ have multiplicity 1; The graph crosses the x-axis.
32. $x = 3$, $x = -3$, and $x = -5$ have multiplicity 1; The graph crosses the x-axis.
33. $f(1) = -1$; $f(2) = 5$; 1.3 **34.** $f(0) = 2$; $f(1) = -1$; 0.8 **35.** $f(-1) = -1$; $f(0) = 1$; -0.5 **36.** $f(2) = -8$; $f(3) = 81$; 2.2
37. $f(-3) = -11$; $f(-2) = 1$; -2.1 **38.** $f(1) = -1$; $f(2) = 23$; 1.2 **39.** $f(-3) = -42$; $f(-2) = 5$; -2.2 **40.** $f(2) = -4$; $f(3) = 14$; 2.4

41. a. $f(x)$ rises to the right and falls to the left.
b. $x = -2$, $x = 1$, $x = -1$;
$f(x)$ crosses the x-axis at each.
c. The y-intercept is -2.
d. neither
e.



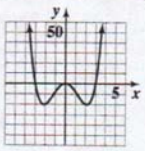
$f(x) = x^3 + 2x^2 - x - 2$

42. a. $f(x)$ rises to the right and falls to the left.
b. $x = -1$, $x = 2$, $x = -2$;
$f(x)$ crosses the x-axis at each.
c. The y-intercept is -4.
d. neither
e.



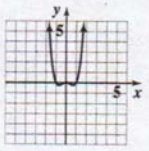
$f(x) = x^3 + x^2 - 4x - 4$

43. a. $f(x)$ rises to the left and the right.
b. $x = 0$, $x = 3$, $x = -3$;
$f(x)$ crosses the x-axis at -3 and 3;
$f(x)$ touches the x-axis at 0.
c. The y-intercept is 0.
d. y-axis symmetry
e.



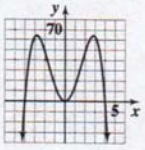
$f(x) = x^4 - 9x^2$

44. a. $f(x)$ rises to the left and the right.
b. $x = 0$, $x = 1$, $x = -1$;
$f(x)$ touches but does not cross the x-axis at 0;
$f(x)$ crosses the x-axis at -1 and 1.
c. The y-intercept is 0.
d. y-axis symmetry
e.



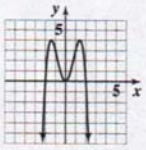
$f(x) = x^4 - x^2$

45. a. $f(x)$ falls to the left and the right.
b. $x = 0$, $x = 4$, $x = -4$;
$f(x)$ crosses the x-axis at -4 and 4;
$f(x)$ touches the x-axis at 0.
c. The y-intercept is 0.
d. y-axis symmetry
e.



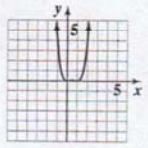
$f(x) = -x^4 + 16x^2$

46. a. $f(x)$ falls to the left and the right.
b. $x = 0$, $x = 2$, $x = -2$;
$f(x)$ touches but does not cross the x-axis at 0;
$f(x)$ crosses the x-axis at -2 and 2.
c. The y-intercept is 0.
d. y-axis symmetry
e.



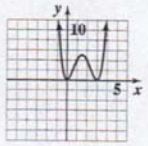
$f(x) = -x^4 + 4x^2$

47. **a.** $f(x)$ rises to the left and the right.
b. $x = 0, x = 1$;
$f(x)$ touches the x-axis at 0 and 1.
c. The y-intercept is 0.
d. neither
e.



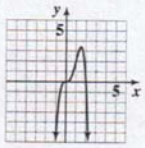
$f(x) = x^4 - 2x^3 + x^2$

48. **a.** $f(x)$ rises to the left and the right.
b. $x = 0, x = 3$;
$f(x)$ touches the x-axis at 3 and 0.
c. The y-intercept is 0.
d. neither
e.



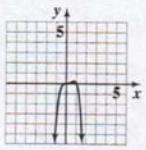
$f(x) = x^4 - 6x^3 + 9x^2$

49. **a.** $f(x)$ falls to the left and the right.
b. $x = 0, x = 2$;
$f(x)$ crosses the x-axis at 0 and 2.
c. The y-intercept is 0.
d. neither
e.



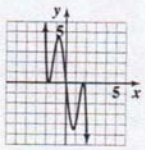
$f(x) = -2x^4 + 4x^3$

50. **a.** $f(x)$ falls to the left and the right.
b. $x = 0, x = 1$;
$f(x)$ crosses the x-axis at 0 and 1.
c. The y-intercept is 0.
d. neither
e.



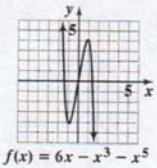
$f(x) = -2x^4 + 2x^3$

51. **a.** $f(x)$ rises to the left and falls to the right.
b. $x = 0, x = \pm\sqrt{3}$;
$f(x)$ crosses the x-axis at 0;
$f(x)$ touches the x-axis at $\sqrt{3}$ and $-\sqrt{3}$.
c. The y-intercept is 0.
d. origin symmetry
e.



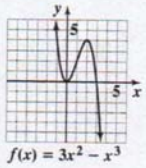
$f(x) = 6x^3 - 9x - x^5$

52. **a.** $f(x)$ rises to the left and falls to the right.
b. $x = 0, x = \pm\sqrt{2}$;
$f(x)$ crosses the x-axis at $-\sqrt{2}$, 0 and $\sqrt{2}$.
c. The y-intercept is 0.
d. origin symmetry
e.



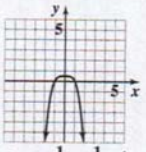
$f(x) = 6x - x^3 - x^5$

53. **a.** $f(x)$ rises to the left and falls to the right.
b. $x = 0, x = 3$;
$f(x)$ crosses the x-axis at 3;
$f(x)$ touches the x-axis at 0.
c. The y-intercept is 0.
d. neither
e.



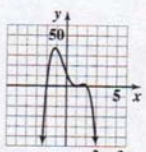
$f(x) = 3x^2 - x^3$

54. **a.** $f(x)$ falls to the left and the right.
b. $x = \pm 1$;
$f(x)$ crosses the x-axis at -1 and 1.
c. The y-intercept is $\frac{1}{2}$.
d. y-axis symmetry
e.



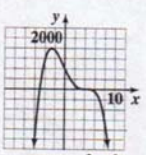
$f(x) = \frac{1}{2} - \frac{1}{2}x^4$

55. **a.** $f(x)$ falls to the left and the right.
b. $x = 1, x = -2, x = 2$;
$f(x)$ crosses the x-axis at -2 and 2;
$f(x)$ touches the x-axis at 1.
c. The y-intercept is 12.
d. neither
e.



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

56. **a.** $f(x)$ falls to the left and the right.
b. $x = 4, x = -5, x = 5$;
$f(x)$ crosses the x-axis at -5 and 5;
$f(x)$ touches the x-axis at 4.
c. The y-intercept is 800.
d. neither
e.



$f(x) = -2(x - 4)^2(x^2 - 25)$