

Remember to review Quizzes #1 - #4 (Chapters 1 - 3 and 4.1 - 4.4)

In Exercises 1–4, solve the equation.

1. $q^3 - q^2 - 30q = 0$

$$q = -5, 0, 6$$

2. $k^3 + 6k^2 + 9k = 0$

$$k = 0, -3 \text{ (double root)}$$

3. $3y^4 - 6y^3 = -3y^2$

$$y = 0 \text{ (double root),} \\ 1 \text{ (double root)}$$

4. $n^3 + 2n^2 - 9n - 18 = 0$

$$n = -3, -2, 3$$

In Exercises 5–10, find the zeros of the function.

5. $f(x) = x^4 + x^3 - 12x^2$

$$x = -4, 0 \text{ (double zero), } 3$$

6. $g(x) = x^4 - 8x^2 + 16$

$$x = -2 \text{ (double zero),} \\ 2 \text{ (double zero)}$$

7. $f(x) = x^4 - 8x^2 - 9$

$$x = -3, 3, -i, i$$

8. $f(x) = x^4 - 5x^2 - 36$

$$x = -3, 3, -2i, 2i$$

9. $h(x) = x^3 + 2x^2 - 5x - 6$

$$x = -1, -3, 2$$

10. $f(x) = x^4 - 5x^3 + 7x^2 + 3x - 10$

$$x = -1, 2, 2+i, 2-i$$

In Exercises 11–13, write a polynomial function f of least degree that has rational coefficients, a leading coefficient of 1, and the given zeros.

11. $-4, 1, 2$

$$f(x) = x^3 + x^2 - 10x + 8$$

12. $3, -\sqrt{7}$

$$f(x) = x^3 - 3x^2 - 7x + 21$$

13. $2, 3 + i$

$$f(x) = x^3 - 8x^2 + 22x - 20$$

In Exercises 14-17, describe the transformation of f represented by g .

14. $f(x) = x^3, g(x) = x^3 - 2$

Shift down 2 units

15. $f(x) = x^3, g(x) = (x + 3)^3$

Shift left 3 units

16. $f(x) = x^4, g(x) = -5x^4$

reflect across x-axis,
vertical stretch by a factor of 5

17. $f(x) = x^3, g(x) = 4x^3 - 3$

vertical stretch by a factor of 4,
shift down 3 units

In Exercises 18-21, write a rule for g and describe the graph of g as a transformation of the graph of f .

18. $f(x) = x^3 + 2, g(x) = f(x - 1)$

$g(x) = (x - 1)^3 + 2$

Shift 1 unit right

19. $f(x) = x^4 - 3x + 1, g(x) = 2f(x)$

$g(x) = 2x^4 - 6x + 2$

vertical stretch by a factor of 2

20. $f(x) = x^3 - 4x^2 + 2, g(x) = -\frac{1}{4}f(x)$

$g(x) = -\frac{1}{4}x^3 + x^2 - \frac{1}{2}$

reflect across x-axis, vert. shrink by a factor of 4

21. $f(x) = x^4 + x + 1, g(x) = f(-x) + 2$

$g(x) = x^4 - x + 3$

reflect across y-axis, shift up 2 unit

In Exercises 22 - 24, write a rule for g that represents the indicated transformations of the graph of f .

22. $f(x) = x^3 + 5$; translation 2 units right, followed by a reflection in the x-axis

$g(x) = -x^3 + 6x^2 - 12x + 3$

23. $f(x) = x^4 - 3x + 1$; vertical shrink by a factor of $\frac{1}{3}$, followed by a translation 2 units down

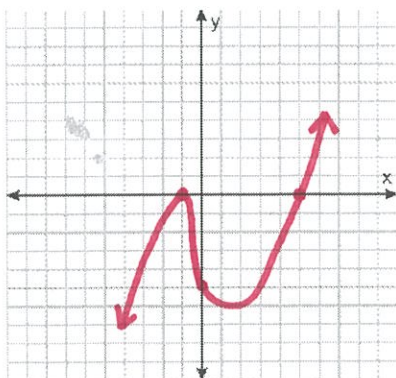
$g(x) = \frac{1}{3}x^4 - x - \frac{5}{3}$

24. $f(x) = x^3 - 3x^2 + 2$; reflection in the y-axis and a horizontal stretch by a factor of 3, followed by a translation 3 units up

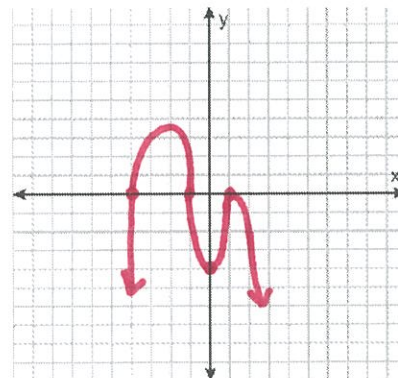
$g(x) = -\frac{1}{27}x^3 - \frac{1}{3}x^2 + 5$

In Exercises 25 and 26, graph the function.

25. $f(x) = (x + 1)^2(x - 5)$

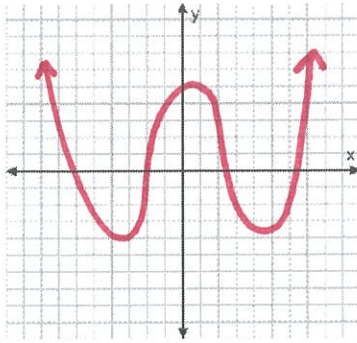


26. $g(x) = -(x - 1)^2(x + 1)(x + 4)$



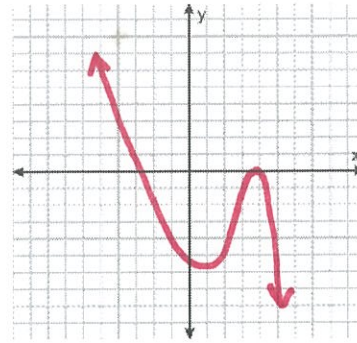
In Exercises 27 and 28, sketch the graph of a function with the given characteristics.

27. Degree 4 polynomial with 4 distinct real roots.



one possible answer

28. Degree 3 polynomial with a single real root and a double real root.



one possible answer

In Exercises 29 and 30, determine whether each function is even, odd, or neither.

29. $f(x) = x^3 - 8x^2 + 15x$

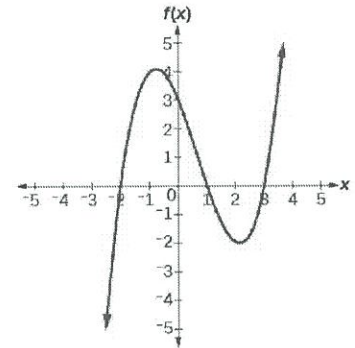
neither

30. $f(x) = x^4 + 5x^2 - 8$

even

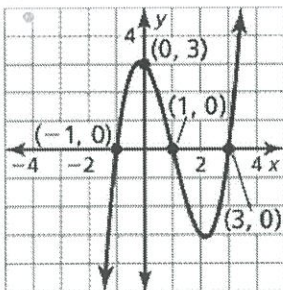
31. Use the graph to identify the x-intercepts, the local max, local min, the intervals where the function is increasing, and the intervals where the function is decreasing.

x-intercepts: $-2, 1, 3$
 local max: $(-1, 4)$
 local min: $(2, -2)$
 increasing: $x < -1$ or $x > 2$
 decreasing: $-1 < x < 2$



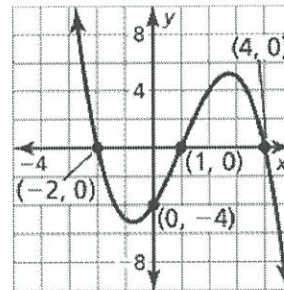
In Exercises 32 and 33, write a cubic function whose graph passes through the given points.

32.



$$y = (x+1)(x-1)(x-3)$$

33.



$$y = -\frac{1}{2}(x+2)(x-1)(x-4)$$