Answers

5.

Positive real zeros	Negative real zeros	Imaginary zeros	Total zeros
2	3	0	5
2	1	2	5
0	3	2	5
0	1	4	5

6. $y = -1.7x + 16$; The number of customers in line decreases by about 2 each minute. At noon, there are 16 customers in line.

7. $x = \frac{3 \pm \sqrt{17}}{2}$ **8.** $6x^3 + 19x^2 + 11x - 6$

Chapter 4 Test Prep

1. B **2.** C **3.** C **4.** A

5. D **6.** B

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

8. 197 feet **9.** B

10. 2.17 seconds **11.** A, C, D, E

12. $J(t) = 27t^4 - 30t^3 + 10t^2 - 50t + 1600$

13. 630 cubic yards **14.** 17 yards

15. B **16.** A, C

Chapter 5

5.1 Extra Practice

1. -7 **2.** no real square root

3. ± 2 **4.** 8 **5.** 5

6. 128 **7.** 27 **8.** -3

9. -8 **10.** $\frac{1}{343}$ **11.** $\frac{1}{100}$ **12.** 6.84

13. 3.27 **14.** -0.18 **15.** 2.50 **16.** $x = -1$

17. $x \approx 5.84$ and $x \approx 12.16$

18. $x \approx -2.17$ and $x \approx -7.83$

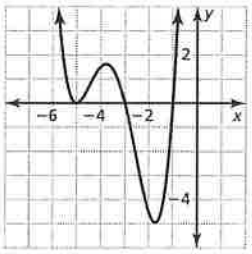
19. $x = -2$ **20.** $x = -4$ **21.** $x = 10$

22. 4, 5; $\sqrt[5]{1024} = 4$ and $\sqrt[5]{3125} = 5$

23. 12 in. **24.** about 3.01 m

5.1 Review & Refresh

1.



2. 3; $f(x) = -x^3 + 2x^2 - 5x + 8$

3. 4, 5, and $\pm 2i$ **4.** $x = -4$ and $x = 4$

5. $x \approx 14.45$

6. $g(x) = 2(x - 4)^3 + 6(x - 4)$

7. $y = \frac{1}{3}(x - 6)^2 - 1$ **8.** $15 + 11i$

9. linear; \$5

5.2 Extra Practice

1. $\frac{1}{6}$ **2.** $10^{9/5}$ **3.** $13^{5/6}$ **4.** $\frac{3^{7/3}}{16}$

5. 5 **6.** 7 **7.** 5 **8.** $2\sqrt[7]{3}$

9. $\frac{\sqrt[3]{15}}{3}$ **10.** $\frac{4 + \sqrt{5}}{11}$

11. $-\frac{\sqrt{2} - 2\sqrt{3}}{5}$ **12.** $38\sqrt[3]{5}$

13. 0 **14.** $2a^5b\sqrt[5]{2}$ **15.** $\frac{1}{h^4|k|}$

16. $\frac{3\sqrt{x}}{2x^9}$ **17.** $\frac{147yz^{3/2}}{x^2}$

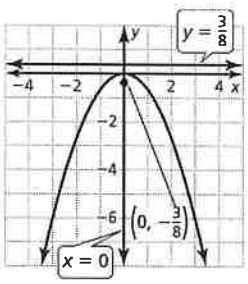
18. $P = 40x^{1/4}$; $A = 100x^{1/2}$

5.2 Review & Refresh

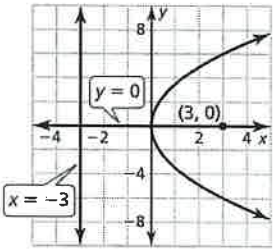
1. The graph of g is a horizontal shrink by a factor of $\frac{1}{3}$ of the graph of f; $g(x) = 81x^4 - 108x^3 + 9x$

Answers

2. The focus is $\left(0, -\frac{3}{8}\right)$. The directrix is $y = \frac{3}{8}$. The axis of symmetry is $x = 0$.



3. The focus is (3, 0). The directrix is $x = -3$. The axis of symmetry is $y = 0$.



4. $y = 2(x - 1)(x + 2)(x + 3)$

5. no; Polynomials cannot have terms with variables in the exponent.

6. geometric; The common ratio is 3.

7. 81

8. 4

9. $\frac{5 - \sqrt{2}}{23}$

10. $4\sqrt[3]{3}$

11. odd

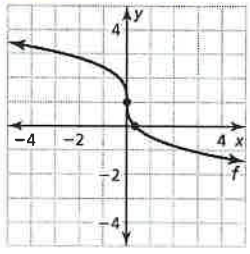
12. 27

13. a. $h(t) = -16t^2 + 14$; about 0.9 sec

b. 8; The paintbrush fell 8 feet between 0.25 second and 0.75 second.

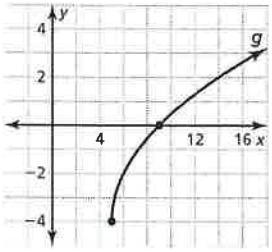
5.3 Extra Practice

1.



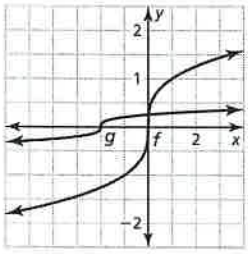
The domain and range are all real numbers.

2.

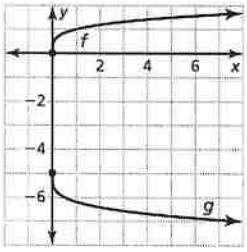


The domain is $x \geq 5$. The range is $y \geq -4$.

3. The graph of g is a vertical shrink by a factor of $\frac{1}{5}$, followed by a translation 2 units left of the graph of f.

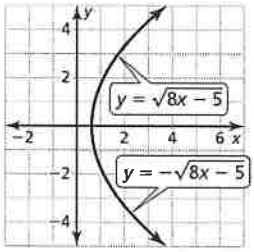


4. The graph of g is a horizontal shrink by a factor of $\frac{1}{2}$, followed by a reflection in the x-axis and a translation 5 units down of the graph of f.



5. $g(x) = \sqrt[3]{18x + 181}$

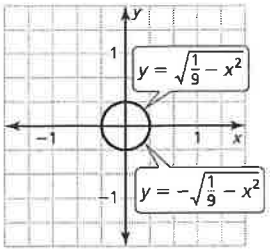
6.



$\left(\frac{5}{8}, 0\right)$, right

Answers

7.



The radius is $\frac{1}{3}$ unit. The x-intercepts are $\pm\frac{1}{3}$. The y-intercepts are $\pm\frac{1}{3}$.

8. *Sample answer:* $g(x) = 2\sqrt{x+1} - 3$, $h(x) = -2\sqrt{-x} - 1$

5.3 Review & Refresh

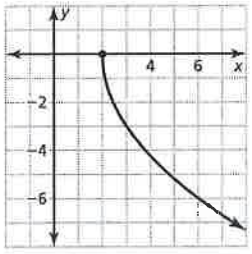
1. $x < -7$ *or* $x > -5$

2. $\dfrac{2a^{1/2}c^{1/5}}{b}$

3. 3; $y = -\frac{1}{2}x^3 + 4x^2 - \frac{3}{2}x - 7$

4. 2.41

5.



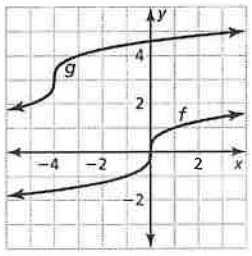
The domain is $x \geq 2$. The range is $y \leq 0$.

6. $x = \frac{7}{3}$

7. $y = \begin{cases} -2x - 1, & \text{if } x < 1 \\ -x + 3, & \text{if } x \geq 1 \end{cases}$

8. decrease by \$15; decrease by 10%

9. The graph of g is a translation 4 units left and 3 units up of the graph of f.



5.4 Extra Practice

1. $x = -48$

2. $x = -13$

3. $x = 32{,}768$

4. no real solution

5. about 1.82 ft

6. $x = 2$

7. $x = -1$ and $x = 15$

8. $x = -1$

9. $x = -6$

10. $x = 4$

11. $x = -\frac{1}{3}$

12. $1 \leq x \leq 2$

13. $x < 322.5$

14. $0 \leq x \leq 65\frac{1}{3}$

15. 1.76 ft

5.4 Review & Refresh

1. $x^4 + 8x^3 - 7x$

2. $x^4 - 3x^3 + 5$

3. $g(x) = \sqrt{x+1} + 3$

4. $x = -10$ and $x = -2$; The point $(-10, 4)$ is located 4 units to the left of the axis of symmetry, so the second solution is located 4 units to the right of the axis of symmetry at the point $(-2, 4)$.

5. $g(x) = -x^3 + 3x^2 - 6$; The graph of g is a reflection in the y-axis and a translation 2 units down of the graph of f.

6. $g(x) = \frac{1}{8}x^3 + \frac{3}{4}x^2 + 2$; The graph of g is a horizontal stretch by a factor of 2 and a translation 6 units up of the graph of f.

7. $-2 \leq x < 14$

8. $x \geq 125$

9. $x \geq -8$

10. $3 \leq x < 7$

11. 523 m^3

12. $x = \frac{7}{2}$ and $x = -1$

13. $(1, 2, -3)$; Explanations will vary.

5.5 Extra Practice

1. $(f + g)(x) = 4\sqrt[3]{x}$ and the domain is all real numbers; $(f - g)(x) = -5\sqrt[3]{x}$ and the domain is all real numbers; $(f + g)(-1000) = -40$; $(f - g)(-1000) = 50$

Answers

2. $(f + g)(x) = -4x^2 + 3x + 8$ and the domain is all real numbers; $(f - g)(x) = 2x^2 - 9x + 8$ and the domain is all real numbers; $(f + g)(-1) = 1$; $(f - g)(-1) = 19$

3. $(f + g)(x) = x^3 + 2x^2 + 21$ and the domain is all real numbers; $(f - g)(x) = 7x^3 - 2x^2 + 3$ and the domain is all real numbers; $(f + g)(2) = 37$; $(f - g)(2) = 51$

4. $(f + g)(x) = 2\sqrt[4]{x} - 1$ and the domain is $x \geq 0$; $(f - g)(x) = 8\sqrt[4]{x} + 3$ and the domain is $x \geq 0$; $(f + g)(1) = 1$; $(f - g)(1) = 11$

5. $(fg)(x) = -2x^{10/3}$ and the domain is all real numbers; $\left(\frac{f}{g}\right)(x) = -\frac{1}{2}x^{8/3}$ and the domain is $x \neq 0$; $(fg)(-64) = -2{,}097{,}152$; $\left(\frac{f}{g}\right)(-64) = -32{,}768$

6. $(fg)(x) = 132x^{3/2}$ and the domain is $x \geq 0$; $\left(\frac{f}{g}\right)(x) = \frac{12}{11}x^{1/2}$ and the domain is $x > 0$; $(fg)(4) = 1056$; $\left(\frac{f}{g}\right)(4) = \frac{24}{11}$

7. $(fg)(x) = -x^{11/6}$ and the domain is $x \geq 0$; $\left(\frac{f}{g}\right)(x) = -\frac{1}{16x^{7/6}}$ and the domain is $x > 0$; $(fg)(1) = -1$; $\left(\frac{f}{g}\right)(1) = -\frac{1}{16}$

8. $(fg)(x) = 144x^{9/4}$ and the domain is $x \geq 0$; $\left(\frac{f}{g}\right)(x) = 9x^{5/4}$ and the domain is $x > 0$; $(fg)(16) = 73{,}728$; $\left(\frac{f}{g}\right)(16) = 288$

9. a. $(A - B)(t) = \frac{1}{2}t^{2/3}$

b. the difference in the amount of mold in the two specimens

10. $f(-3) = 18$ and $g(-3) = -24$

5.5 Review & Refresh

1. $x = 6$ **2.** $x = 2$

3. $n = \frac{5}{12a - 3}$

4. yes; Every input has exactly one output.

5. $(fg)(x) = 18x^{14/3}$ and the domain is all real numbers; $\left(\frac{f}{g}\right)(x) = 2x^{10/3}$ and the domain is all real numbers; $(fg)(8) = 294{,}912$; $\left(\frac{f}{g}\right)(8) = 2048$

7. linear; As x decreases by 4, y increases by 1, so the differences are constant.

8. a. 2016

b. \$22.74 billion; The net revenue of the online store increased by \$22.74 billion each year from 2010 to 2018.

c. no; The model shows that the net revenue of the online store continues to increase for all future years, which is not likely.

5.6 Extra Practice

1. 10 **2.** 3 **3.** -3

4. 2 **5.** 16.6 **6.** $\frac{617}{16}$

7. a. $f(g(x)) = 2|x - 1| + 3$; all real numbers

b. $g(f(x)) = |2x + 2|$; all real numbers

c. $f(f(x)) = 4x + 9$; all real numbers

8. a. $f(g(x)) = 48x^2 - 72x + 27$; all real numbers

b. $g(f(x)) = -12x^2 + 3$; all real numbers

c. $f(f(x)) = 27x^4$; all real numbers

9. a. $f(g(x)) = \frac{6}{6x + 1}$; all real numbers except $x = -\frac{1}{6}$

b. $g(f(x)) = \frac{36}{x} + 1$; all real numbers except $x = 0$

c. $f(f(x)) = x$; all real numbers