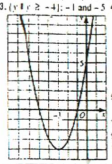
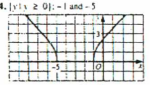
Practice Test

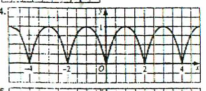
1. $\{x \mid x \neq 1, 3\}$ 2. $\{x \mid x \leq -2 \text{ or } x \geq 2\}$
3. $\{y \mid y \geq -4\}$; −1 and −5 4. $\{y \mid y \geq 0\}$; −1 and −5



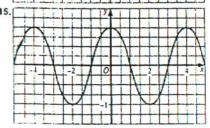


5. $x^2 + 4x - 1$ 6. $\frac{2x-1}{2x+1}$
7. $2\sqrt[3]{x+1} - 1$ 8. $x^3 - 1$
9. $A(s) = 6s^2$ 10. 486 square units
11. 4 12. 1 13. f is not one-to-one.

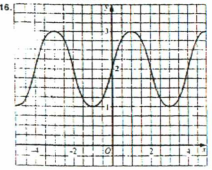
14.



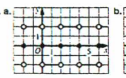
15.



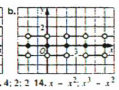
16.



11. a.



b.



12. symmetry in the origin 13. 4; 2; 2 14. $x - x^2$; $x^3 - x^2 - x + 1$; $\frac{1}{x+1}$, $x \neq \pm 1$ 15. $A(s) = s(4 - 2s)$ 16. 2 square units

Chapter 5:
Exponents and Logarithms

Sections 5-1 and 5-2

1. D 2. A 3. A 4. $-\frac{x^3}{8}$ 5. $\frac{1}{81x^3}$ 6. $\frac{x^9}{27}$ 7. $\frac{2s^2}{t} - 6s^2$ 8. 729

9. $1 - x$ 10. Answers will vary, a sample answer is given. Since $25^{1/2} = \sqrt{25} = 5$, then $-25^{-1/2} = -\frac{1}{5}$. However, $(-25)^{1/2}$ would be equal to $\frac{1}{(-25)^{1/2}}$, or $\frac{1}{\sqrt{-25}}$. But $\sqrt{-25}$ is not a real number, so $(-25)^{-1/2}$ is not defined. 11. a. about $15,601 b. about $14,036
12. a. $V(t) = 0.93^t$ b. About $1.24 13. 9 14. b^{3n} 15. 16%
16. 6.5 17. a. $\pm\frac{1}{40}$ b. −3.9, −4.1 18. Write each factor as a rational power of x and add the exponents: $x^{1/4} \cdot x^{1/3} \cdot x^{1/6} = x^{3/12+4/12+2/12} = x^{3/4}$, or $\sqrt[4]{x^3}$.

Sections 5-3 and 5-4

1. C 2. A 3. D 4. 2.2 5. $f(x) = 40(1.5)^x$ 6. 9 years 7. Answers will vary, a sample answer is given. If $f(x) = ab^x$ with $a > 0$ and $b > 0$, then $f(x) > 0$ for all x because $b^x > 0$ for all x. Because of this fact, the graph of $f(x) = ab^x$ lies entirely above the x-axis.
8. $e^3 = 20.1$, $3^e = 19.8$; e^3 is greater. 9. a. about $1083 b. about 8.3% 10. a. 8 cells b. about 59 cells 11. a. $V(t) = 102 \cdot 2^{t/16}$ or $V(t) = 102(1.044)^t$ b. Sample answers: $241,000, $243,000
12. about 33% 13. a. They are identical since $g(x) = \left(\frac{1}{e}\right)^x = (e^{-1})^x = e^{-x} = f(x)$. b. Since f and g are the same function and $h(x) = f(-x)$, the graph of g is the reflection of the graph of h in the y-axis. 14. a. yes b. yes c. yes d. no 15. Answers will vary, a sample answer is given. When the money is compounded more frequently, the effective annual yield increases. For example, if it is compounded once, twice, or twelve times per year, the corresponding effective annual yields are 6%, 6.09%, and 6.17%, respectively. The maximum effective annual yield is about 6.184%, obtained by continuous compounding, so it is *not* possible to double the amount of the investment in one year if the interest rate is 6%.

Sections 5-5, 5-6, and 5-7

1. C 2. B 3. D 4. A 5. $e^3 \approx 20$ 6. a. 4 b. −4 c. 2.5 d. 0
7. $\frac{2}{3}\log M - 2\log N$ 8. 2 9. Each expression is equal to 8.2; $\log 10^x = 10^{\log x} = x$ and $\ln e^x = e^{\ln x} = x$. Explanations will vary, a sample answer is given. Since $f(x) = \log x$ and $g(x) = 10^x$ are inverse functions, their composition in either order gives x. Similarly, $f(x) = \ln x$ and $g(x) = e^x$ are inverse functions, so their composition gives x. 10. about 5.45 11. 0.1 12. a. −1.9084 b. 2.9542 c. 1.4313 13. Answers will vary, a sample answer is given. Since 20 is between 10 and 100, $\log 20$ must be between $\log 10 = 1$ and $\log 100 = 2$. Therefore, $\log 20$ cannot be greater than 2. 14. a. 2π b. 3 15. $y = \frac{x^2}{10}$ 16. in about 6.8 years

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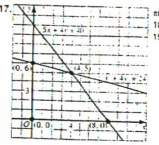
17.

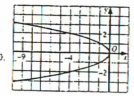


maximum: $P(4, 5) = 23$ 18. $P(I) = 110I - 11I^2$
19. 0, 10 20. 275 watts

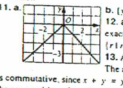
Chapter 4:
Functions

Sections 4-1 and 4-2

1. yes; domain $= \{x \mid x \leq 2\}$, range $= \{y \mid y \leq 0\}$, zero: 2
2. Answers will vary, a sample answer is given. The graph of $x = -y^2$, or $y = \pm\sqrt{-x}$, $x \leq 0$, (shown at the right) fails the vertical-line test, that is, every negative value of x has two corresponding values of y, not one.



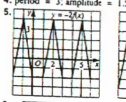
3. domain $= \{x \mid x \leq -2 \text{ or } x \geq 2\}$; range: $\{f(x) \mid f(x) \geq 0\}$; zeros: ± 2 4. The graph is the same as the graph of the line $y = x - 2$ but the graph does *not* include the point $(-2, -4)$. The range is $\{g(x) \mid g(x) \neq -4\}$ and the only zero is 2
5. a. 7; 5 b. $-2 \leq x \leq 2$ c. 11 6. $x^2 + 2x$; $-x^2 + 4$
7. $x^3 + 3x^2 - 4$; $\frac{1}{x-1}$ 8. 12; $x^2 + x$ 9. 28; $x^2 + 5x + 4$
10. Sample answers: function rules involving a square root symbol; function rules with a variable in the expression in the denominator of a fraction
11. a.

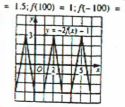


b. $\{y \mid y \leq 0\}$; 0 c. $y = -|x|$
12. a. Yes, for each value of r, there is exactly one value for A. b. domain $= \{r \mid r \geq 0\}$, range: $\{A \mid A \geq 1\}$
13. Answers will vary, a sample is given. The addition of two real numbers is commutative, since $x + y = y + x$ for all real numbers. However, the composition of two functions is not always commutative. Example 3 on text page 127 shows that $(f \circ g)(x)$ is not always equal to $(g \circ f)(x)$. 14. $(f \circ f)(x) = f(f(x)) = f\left(\frac{1}{x}\right) = \frac{1}{\frac{1}{x}} = x$, provided $x \neq 0$.

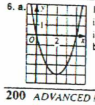
Sections 4-3, 4-4, and 4-5

1. a. C b. D c. F 2. $y = |f(x)|$ 3. a. B b. D c. A d. C
4. period $= 3$; amplitude $= 1.5$; $f(100) = 1$; $f(-100) = -2$
5.



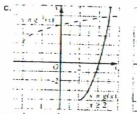


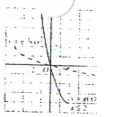
6. a.



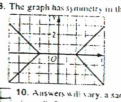
If $k > -4$, then a horizontal line through $(0, k)$ intersects the graph in two points. The function is not one-to-one, so it has no inverse.
b. Let $x \geq 2$ (or let $x \leq 2$).

c.

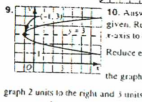




7. $f^{-1}(x) = x^3 - 1$ 8. The graph has symmetry in the x-axis, y-axis, and the origin.

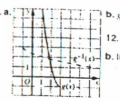


9.



10. Answers will vary, a sample
given. Reflect the graph of $y =$
x-axis to obtain the graph of $y =$
Reduce each y coordinate by $\frac{1}{2}$ to
the graph of $y = -\frac{1}{2}|x|$. Then sh
graph 2 units to the right and 3 units down to obtain the fin
$y + 3 = -\frac{1}{2}|x - 2|$, or $y = -\frac{1}{2}|x - 2| -$

11. a.



b. $g^{-1}(x) =$ $\sqrt{\frac{x+1}{t}}$
12. a. $V_{\text{fi}} \approx \frac{27W_i}{17s+t}$
b. It decreases.

Sections 4-6 and 4-7

1. the lengths x and z 2. a. 4 b. 4 c. about 1.5 3. D 4. In figure, $A(x, y)$ represents a function of two variables, that is, of a rectangle is a function of its dimensions x and y. In the s figure, $A(x, y)$ represents the location of point A in the coord plane. 5. a. $h = s + 4$ b. $r = \sqrt{16 - t^2}$ c. $\frac{1}{2}p(16 - x^2)(x + 4)$ 6. $0 < x < 4$ 7. a. 8 III. There are 8 for 4 people out of 7 to line up for a photograph. b. $3 \cdot p(7$ $3 \cdot 840 = 2520$; $p(7, 5) = 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 = 2520 =$ $3 \cdot p(7, 4)$ c. Sample answers: $p(6, 6)$, $p(6, 5)$, and $p(10, 3)$ 8. Since n and r must be whole numbers with $n \geq r$, the gra constant curve consists of discrete, or isolated, points in a co plane rather than a continuous curve. 9. a. $d(x) =$ $\sqrt{1.5625x^2 - 9x + 36}$ b. 4.8 units (when $x = 2.88$)
10. $\frac{2048\rho}{81} = 79.4$ cubic units

Chapter 4 Review
Quick Check

1. domain $= \{\text{real numbers}\}$, range $= \{y \mid y \leq 6.25\}$, zeros: −4, 1
2. a. $2x - 1 - \frac{1}{x}$ b. $\frac{2x-1}{x}$, or $2 - \frac{1}{x}$ c. $2x^2 - x$
d. 0 e. $\frac{2}{x} - 1$ f. $\frac{1}{2x-1}$ 3. a. no b. no c. yes d. no 4. 12; 3; 0
5. -1; $f^{-1}(x) = \frac{1-x}{2}$ 6. no 7. a. $A(s, h) = 2s^2 + 4sh$
b. Sample answers: (5, 2.5), (4, 4.25) 8. $A(h) = \frac{h^4}{4}$

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Chapter 4 Review
Quick Check

1. domain $= \{\text{real numbers}\}$, range $= \{y \mid y \leq 6.25\}$, zeros
2. a. $2x - 1 - \frac{1}{x}$ b. $\frac{2x-1}{x}$, or $2 - \frac{1}{x}$ c. $2x^2 - x$
d. 0 e. $\frac{2}{x} - 1$ f. $\frac{1}{2x-1}$ 3. a. no b. no c. yes d. no 4. 12;
5. -1; $f^{-1}(x) = \frac{1-x}{2}$ 6. no 7. a. $A(s, h) = 2s^2 + 4sh$
b. Sample answers: (5, 2.5), (4, 4.25) 8. $A(h) = \frac{h^4}{4}$