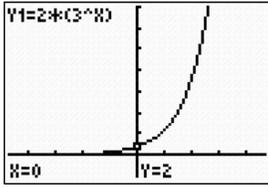


Prerequisite Skills

1. a)



b) $\{x \in \mathbb{R}\}, \{y \in \mathbb{R}, y > 0\}, y = 0$

2. a) \$23 000

b) \$11 776

3. a) p

b) n^2

c) $3x^4$

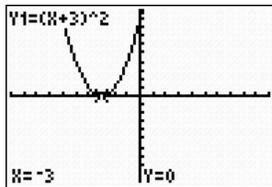
d) $\frac{4m^6}{n^2}$

4. a) 9

b) $\frac{5}{2}$

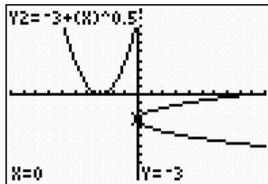
c) $-\frac{9}{7}$

5. a)



b) $\{x \in \mathbb{R}\}, \{y \in \mathbb{R}, y \geq 0\}$

c)

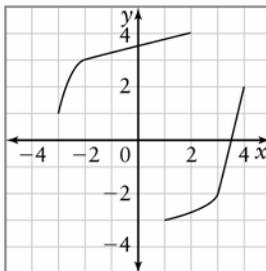


d) $\{x \in \mathbb{R}, x \geq 0\}, \{y \in \mathbb{R}\}$

e) No, the original function is not 1 to 1, so the inverse is not a function

6. b) $\{x \in \mathbb{R}, -3 \leq x \leq 2\}, \{y \in \mathbb{R}, 1 \leq y \leq 4\}$

c)



d) $\{x \in \mathbb{R}, 1 \leq x \leq 4\}, \{y \in \mathbb{R}, -3 \leq y \leq 2\}$

e) Yes, the original function is 1:1, so the inverse is a function

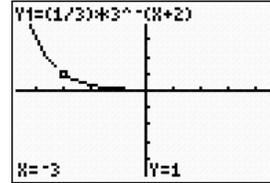
7. a) vertical stretch factor 2, translation left 3 units and down 4 units

b) reflection in x -axis, vertical stretch factor 2, translation right 2 units

8. a) vertical compression factor $\frac{1}{3}$,

reflection in y -axis, translation left 2 units

b)



6.1 The Exponential Function and Its Inverse

1. a) Data set b) is exponential. Successive terms have constant ratios.

b) $y = 5^x$

2. a) iii, $y = 3^x$

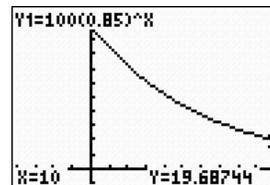
b) i, $y = 5^x$

c) ii, $y = \left(\frac{1}{3}\right)^x$

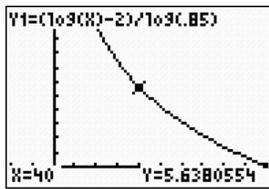
3.

	$f(x) = \left(\frac{1}{2}\right)^x$	Inverse of f
Domain	$\{x \in \mathbb{R}\}$	$\{x \in \mathbb{R}, x > 0\}$
Range	$\{y \in \mathbb{R}, y > 0\}$	$\{y \in \mathbb{R}\}$
x-intercept	none	1
y-intercept	1	none
Intervals for which $f(x)$ is positive	$(-\infty, +\infty)$	$(0, 1)$
Intervals for which $f(x)$ is increasing	none	none
Equation of asymptote	$y = 0$	$x = 0$

4. a)



b)



- c) 4.3 m d) -11.13%/m
 e) -7.21 %/m; greater, magnitude of slope is increasing as d increases

5. a) increases b) 1.44

6.2 Logarithms

1. a) $\log_3 243 = 5$ b) $\log_6 \frac{1}{216} = -3$

2. a) $4^3 = 64$ b) $10^y = 30$

3. a) 2 b) -6 c) 2 d) -2.6

4. a) 2.3 b) 1.6

5. a) 1.68 b) -0.32

6. a) 2374 years b) 19 000 years

c) $R = 10^{\frac{A}{19\,000}}$ d) 99%

7. Answers may vary.

8. a) 2.6 b) $C = 10^{-pH}$ c) 10^{-7} mol/L

9. a) 0.50, 1.00, 1.50, 2.00, $\log(3.16^k) = \frac{k}{2}$

b) 5.00, 1.25 c) 100, 25, 1.5

10. a) 0.6, 1.3, 1.9,
 $\log m + \log n = \log(m + n)$

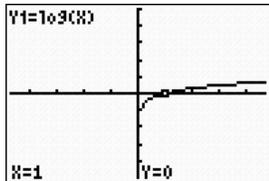
b) 2.5, 3.2 c) 8, 2.5

6.3 Transformations of Logarithmic Functions

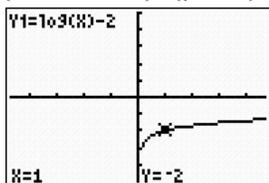
1. a) $y = 2\log(x)$ b) $y = \log(x + 2)$

c) $y = \log(x) + 2$ d) $y = \log(2x)$

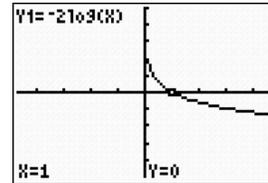
2. a) $\{x \in \mathbb{R}, x > 0\}, \{y \in \mathbb{R}\}$



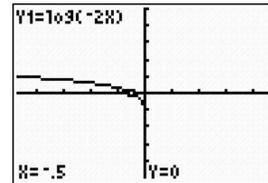
b) $\{x \in \mathbb{R}, x > 0\}, \{y \in \mathbb{R}\}$



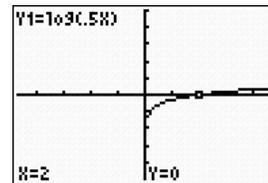
c) $\{x \in \mathbb{R}, x > 0\}, \{y \in \mathbb{R}\}$



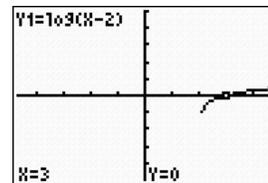
d) $\{x \in \mathbb{R}, x < 0\}, \{y \in \mathbb{R}\}$



e) $\{x \in \mathbb{R}, x > 0\}, \{y \in \mathbb{R}\}$

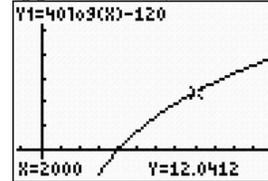


f) $\{x \in \mathbb{R}, x > 2\}, \{y \in \mathbb{R}\}$



3. a) i) 12 years ii) 19 years

b) approximately \$1590

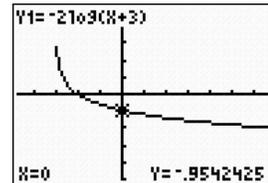


c) $A \geq 1000$ because $n \geq 0$

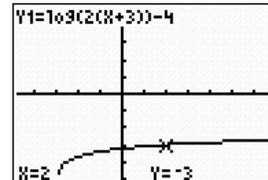
4. a) $y = \log(x) + 3$

b) $y = -2\log(x + 5)$

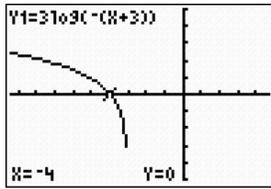
5. a)



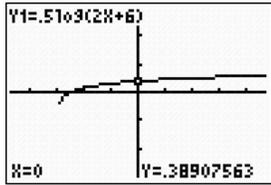
b)



c)



d)

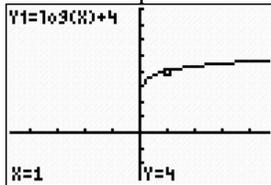


6. a) compress horizontally by a factor of $\frac{1}{2}$, translate left 3 units, reflect in the x -axis

b) reflect in the y -axis, stretch vertically by a factor of 3, translate up 4 units

7. The function $y = -\log(-x)$ can be obtained by reflecting $y = \log x$ in the y -axis and reflecting in the x -axis, so a point (a, b) is transformed to $(-a, -b)$. Reflection of the function $y = \log x$ in the line $y = x$ has the exact same effect, so the two log functions are inverses.

8. a) each pair of graphs is identical
b) translated up 4 units



6.4 Power Law of Logarithms

1. a) 21 b) -10 c) $\frac{2}{3}$ d) $\frac{1}{6}$
2. a) 1.756 b) 31.495
3. a) 1.4 m b) 10
4. a) 1.1 b) -2.9
5. a) $\log_4 16, 2$ b) $\log_{\frac{2}{3}} \frac{8}{27}, 3$
6. a) 11.63 b) 9.51
7. b) 2030
8. a) 800 years b) 96.6%
9. a) $1^x = 5; b \neq 1$ because $1 \neq 5$
b) $\frac{\log 5}{\log 1}; b \neq 1$ because of division by 0

10. a) vertical compression

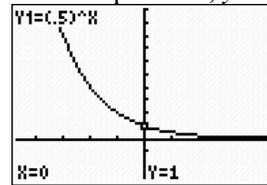
b) $y = \frac{\log x}{\log a}; \frac{1}{\log a}$ acts as a vertical compression factor, therefore as a increases, $\frac{1}{\log a}$ decreases

6.5 Making Connections: Logarithmic Scales in the Physical Sciences

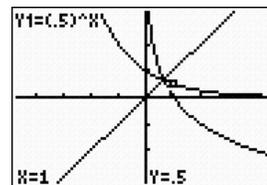
1. a) 3.5 b) 8.1
2. a) 6.31×10^{-3} mol/L
b) 2.51×10^{-12} mol/L
3. a) 1000 b) 3.2
4. 30 dB
5. 39.8
6. 6.8
7. a) 50119 b) star B
8. a) 10^{-6} W/m² b) 0.5 W/m²
9. a) 31 b) 6.0 c) 5351

Chapter 6 Review

1. a) $\{x \in \square\}, \{y \in \square, y > 0\}$, function is always positive and decreasing, $y = 0$, x -intercept: none, y -intercept: 1



b)



c) $\{x \in \square, x > 0\}, \{y \in \square\}$, function positive when $x \in (0, 1)$, negative when $x \in (1, +\infty)$, function always decreasing, $x = 0$, x -intercept: 1, y -intercept: none

2. a) $\log_5 625 = 4$ b) $\log_4 12 = x$
c) $\log_{12} y = 3$
3. a) $8 = 10^x$ b) $x = 5^4$ c) $200 = b^7$
4. a) -3 b) 3 c) -2 d) 8
5. a) 6 b) $x > 0, x \neq 1$

6. a) $y = -\log\left[\frac{1}{2}(x+5)\right] - 3$

b) $y = -\log\left(\frac{1}{2}x+5\right) - 3$

7. a) 10^{-7} W/m^2
c) 86 dB

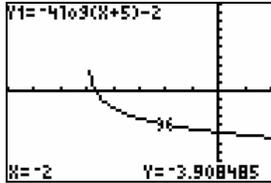
b) 3162

8. 11.3 cm

9. a) 398

b) -0.4

7.



8. $y = 5\log(x+1)$

9. a) $\frac{5}{2}$ b) $-\frac{2}{5}$

10. a) 2.32 b) 2.26 c) 1.43 d) 0.09

11. a) 0.65 mV b) 11.3 s c) 3.54 mV

12. a) 251 b) 7.9

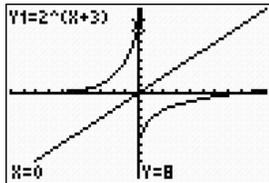
13. a) $6.3 \times 10^{-5} \text{ mol/L}$

b) no, pH is 3.8

Chapter 6 Test

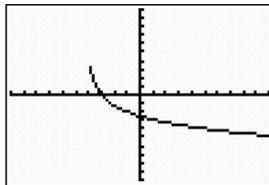
1. a) $\{x \in \square\}, \{y \in \square, y > 0\}$, y-intercept 8,
no x-intercept, function always
positive and increasing, horizontal
asymptote: $y = 0$

b)



c) $y = \log_2 x - 3$

2. a)



b) $\{x \in \square, x > -4\}, \{y \in \square\}, x = -4$

3. $y = -\log(x+5)$

4. a) 3 b) 4 c) $\frac{3}{4}$ d) $\frac{3}{2}$

5. a) 2.551 b) 2.661

c) 1.760 d) -1.576

6. 9.1%