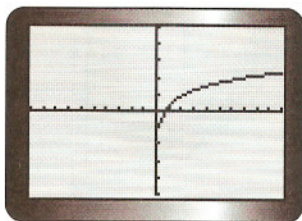
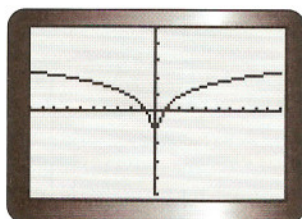


13. **Communication:** Describe three different techniques for solving  $5^x = 90$ .
14. Marisa drops a small rubber ball from a height of 6 m onto a hard surface. After each bounce, the ball rebounds to 60% of the maximum height of the previous bounce.
- Create a table to show the height of the ball after each bounce for the first five bounces.
  - Graph the relation.
  - Create an equation to model the height of the ball as it bounces.
  - Estimate the height after 12 bounces from your graph. Verify this result using your equation.
  - Use your graph to estimate when the ball's maximum height will be 20 cm. Verify this result using your equation.
15. The McKinney family has a pond in their yard, and water lilies are growing in the pond. The area of the lilies' leaves cover twice as much of the pond as they did 35 days ago. The leaves will completely cover the pond in 80 days if the lilies continue to grow unchecked. The McKinneys want to cut back the lilies when they have covered at most half the area of pond. When is this growth expected to happen?
16. **Application:** A plastic sun visor allows light to pass through but reduces the light's intensity. The light intensity is reduced by 5% if the plastic is 1 mm thick. Each additional millimetre of thickness reduces the light intensity by another 5%.
- Create a table showing the light intensity, as a percent, and the thickness of the plastic.
  - Model the relation between the thickness of the plastic and the light intensity using an equation.
  - How thick is a piece of plastic that allows only 60% of the original light intensity to pass through?
17. **Check Your Understanding:** What key law of logarithms helps you solve exponential equations?
- C** 18. **Thinking, Inquiry, Problem Solving:** An adult nonsmoker has a cup of coffee at 8:00 A.M., another coffee at 11:00 A.M., a cola for lunch at 12:30 P.M., a hot chocolate at 4:00 P.M., and a cup of tea after dinner at 6:00 P.M.
- How much caffeine will be in this adult's bloodstream at 11:00 p.m., when he is trying to fall asleep?
  - At what time will the amount of caffeine in his bloodstream be 5 mg?
19. Solve for  $x$ , to two decimal places.
- (a)  $6^{3x} = 4^{2x - 3}$       (b)  $(1.2)^x = (2.8)^{x + 4}$       (c)  $3(2)^x = 4^{x + 1}$
20. Determine the point of intersection between the graphs of  $y = 5(4)^{2x}$  and  $y = 4(2)^{6x}$ . Round your answer to three decimal places.

18. (a)



(b)



graphs have different domain; In  $y = \log x + \log 2x$ ,  $x > 0$ , so  $x$  cannot be neg. In  $y = \log 2x^2$ ,  $x \neq 0$ , so  $x$  can be neg.

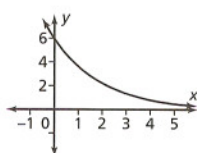
19. Answers will vary. Example:  $y = \log 3 + \log x = \log 3x$   
 20. Answers will vary. Examples:  
 Addition:  $y = \log 6 + \log 3 = \log (6)(3) = \log 18$ ;  
 Subtraction:  $y = \log 18 - \log 3 = \log \left(\frac{18}{3}\right) = \log 6$ ;  
 Power:  $y = \log 8 = \log 2^3 = 3 \log 2$

## 2.6 Exercises, page 132

- (a)  $x = \pm 6.00$  (b)  $x = \pm 2.71$  (c)  $x = 4.27$   
 (d)  $x = 2.54$  (e)  $x = \pm 2.64$  (f)  $x = 2.15$
- (a)  $x = 2.63$  (b)  $x = 2.58$  (c)  $x = 3.17$   
 (d)  $x = 3.20$  (e)  $x = 35.00$  (f)  $x = 3.39$
- (a)  $x = 2.49$  (b)  $x = 0.06$  (c)  $x = 8.33$   
 (d)  $x = -1.50$  (e)  $x = 0.04$  (f)  $x = 0.73$
- (a)  $x = 4.85$  (b)  $x = 1.05$  (c)  $x = 0.01$   
 (d)  $x = 1.03$  (e)  $x = 3.09$  (f)  $x = 1.67$
- 28.22 years
- (a)  $x = 2.6$  (b)  $x = 7.6$  (c)  $x = 1.5$   
 (d)  $x = 14.0$  (e)  $x = 44.3$  (f)  $x = 1.3$
- 3761.5 years
- 4.52 days
- 10.1 years
- 1.15 min
- 9 questions
- 6 years
- graph and find value of  $x$  when  $y = 90$ ; put log on both sides and solve for  $x$ ; guess and check
- (a)

Number of Bounces	0	1	2	3	4	5
Height (m)	6.00	3.60	2.16	1.30	0.78	0.47

(b)



(c)  $h = 6(0.6)^n$  where  $h$  is height in metres and  $n$  is number of bounces  
 (d) 0.013 m (e) between the 6<sup>th</sup> and 7<sup>th</sup> bounce

15. 45 days

16. (a)

Number of Sheets	Intensity
0	100.00%
1	95.00%
2	90.25%
3	85.74%
4	81.45%
5	77.38%
6	73.51%
7	69.83%
8	66.34%
9	63.02%
10	59.87%

(b)  $I = (0.95)^S$  where  $S$  is number of sheets and  $I$  is intensity  
 (c) about 10 sheets

17. power law  
 18. (a) 112 mg (b) 25 h after 11:00 p.m.  
 19. (a)  $x = -1.60$  (b)  $x = -4.86$  (c)  $x = -0.42$   
 20. 0.16

## 2.7 Exercises, page 140

- (a) linear (b) logarithmic (c) logarithmic (d) linear
- similarities: scales have a large range of intensity, are measured logarithmically; differences: Richter Scale ranges from 1 to 12 while Decibel Scale ranges from 0 to 130, the formulae of the scales are different
- (a)  $10^4$  times (b)  $10^6$  times (c)  $10^3$  times
- (a)  $10^{1.5}$  times (b)  $10^{0.5}$  times (c)  $10^3$  times
- (a) 3.49 (b) 4.35 (c) 3.52 (d) 2.30
- $10^{2.5}$  times
- $10^{0.9}$  times
- (a) 0.01 mol (b)  $1.58 \times 10^{-4}$  mol (c)  $2.51 \times 10^{-6}$  mol
- (a) 0.01 mol/L (b)  $7.94 \times 10^{-5}$  mol/L  
 (c)  $2.51 \times 10^{-7}$  mol/L (d)  $1.58 \times 10^{-8}$  mol/L  
 (e)  $3.16 \times 10^{-9}$  mol/L (f)  $1.26 \times 10^{-12}$  mol/L
- (a) 7 (b) more acidic; it is to the left of distilled water on pH scale
- 19.96 times
- (a) 2.85 (b)  $5.97 \times 10^{24}$  ergs
- smaller numbers are easier to understand and manage; Example: measurement of sound intensity
- (a) frequency of  $C'''$  is double of the frequency of  $C''$ ; frequency of  $C''$  is double of the frequency of  $C'$   
 (b) 2112 Hz (c) 132 Hz
- it is incorrect to compare the scale directly, should compare the intensity given by  $10^M$  where  $M$  is the scale; scale 8 earthquake is  $10^4$  times more intense than the scale 4 earthquake, not  $\frac{8}{4} = 2$  times
- (a) range is too large to manage ( $58$  to  $10^{17}$ )  
 (b) Answers will vary. Example: "log" all numbers so the range would be from  $\log 58 (= 1.76)$  to  $\log 10^{17} (= 17)$