

Page 198

- | | | | |
|------------------------|------------------------------------|---------------------|-------------------------|
| 1. a) $c \log_a(4b)$ | b) $2 \log x$ | c) $3 \ln(2 + x)$ | d) $\frac{1}{2} \ln 3x$ |
| e) $-\log_c 3x$ | f) $3 \ln\left(\frac{y}{x}\right)$ | g) $d \log_a y$ | h) $-2 \ln x$ |
| 2. a) $\log_3 6^4$ | b) $\log_7 5^2$ | c) $\ln(3t)^2$ | |
| d) $\log 5^3$ | e) $\log_m x^2$ | f) $\log 2^4$ | |
| g) $\log_3 9^7$ | h) $\log_5 10^9$ | i) $\log_6 y^4$ | |
| 3. a) ≈ 5.91 | b) ≈ 2.77 | c) ≈ 2.32 | d) ≈ 3.21 |
| e) 0.5 | f) -1 | g) -6 | h) ≈ -5.72 |
| 4. a) ≈ 2.3980 | b) ≈ 3.513 | c) ≈ 2.2695 | d) ≈ -0.7565 |
| e) ≈ 44.5977 | f) ≈ -2.3980 | g) ≈ 1.0619 | h) ≈ -0.8783 |
| i) ≈ 0.3997 | j) ≈ -4.2474 | k) ≈ 0.8905 | l) ≈ 16.8483 |

Page 199

- | | | | |
|--|--|--------------------------|-----------------------|
| 5. a) $x \approx -6.81$ | b) $x = 10^{46}$ | c) $x \approx 3.53$ | d) $x \approx -5$ |
| e) $x = -24$ | f) $x \approx -0.09$ | g) $x = -81$ | h) $x \approx 0.34$ |
| 6. a) $x > 2.15$ | b) $x \geq e^{18}$ | c) $x > 33.3$ | d) $x \geq 6$ |
| e) $-99.998 < x < 2$ | f) $x > -1.29$ | g) $x \geq -2.40$ | h) $x > \frac{9}{8}$ |
| 7. a) 1) ≈ 6.14
b) 1) -1
c) 1) ≈ 3.74
d) 1) ≈ 7.04
e) 1) ≈ 1.16
f) 1) $\frac{1}{e^2}$ | 2) Positive: $[\approx 6.14, +\infty[$ and negative: $]-\infty, \approx 6.14]$.
2) Positive: $[-1, +\infty[$ and negative: $]2, -1]$.
2) Positive: $]-\infty, \approx 3.74]$ and negative: $[\approx 3.74, +\infty[$.
2) Positive: $[\approx 7.04, +\infty[$ and negative: $]7, \approx 7.04]$.
2) Positive: $]-\infty, \approx 1.16]$ and negative: $[\approx 1.16, +\infty[$.
2) Positive: $\left]0, \frac{1}{e^2}\right]$ and negative: $\left[\frac{1}{e^2}, +\infty\right[$. | | |
| 8. a) $x = \sqrt{3}$ | b) $x = \sqrt[5]{625}$ | c) $x = \frac{1}{6}$ | d) $x = \sqrt{6} - 4$ |
| 9. a) $x = 8$ | b) $x = 2$ | c) $x = \sqrt{10} - 2$ | d) $x = -4$ |
| e) $x = 1002$ | f) $x = 6$ | g) $x = e$ or $x = -e$. | h) $x = \frac{1}{3}$ |
| i) $x = 5$ | j) $x = 2$ or $x = 5$. | | |

10. a) At $t = 0$ years.

c) At approximately 12.86 years.

$$\text{b) } 20\ 000 = 15\ 000(1.015)^{2t}$$

$$\frac{4}{3} = 1.015^{2t}$$

$$2t = \log_{1.015} \frac{4}{3}$$

$$t = \frac{\log \frac{4}{3}}{2 \log 1.015}$$

$$t \approx 9.66$$

At approximately 9.66 years.

Page 200

A	T	T ₀
30	≈ 395.28	12.5
≈ 4.08	16	10
60	18	0.018
15	≈ 84.35	15
≈ 6.02	36	18
45	9	≈ 0.05

12. $2500 = 1500(1.0175)^{2t}$

$$\frac{5}{3} = 1.0175^{2t}$$

$$2t = \log_{1.0175} \frac{5}{3}$$

$$t = \frac{\log \frac{5}{3}}{2 \log 1.0175}$$

$$t \approx 14.72$$

After approximately 14.72 years.

13. a) 1) ≈ -1.51 2) -7.5 3) -12.5 4) ≈ 1.51
 b) 1) ≈ 19.05 times. 2) ≈ 8.3×10^{-4} times. 3) ≈ 10 964.78 times.

Page 201

14. The amount of time required for total decomposition:

- of a plastic bag is approximately 461.75 years
- of a paper tissue is approximately 0.25 years (3 months)
- of a milk carton is approximately 49.88 years
- of a piece of chewing gum is approximately 5 years
- of an alkaline battery is approximately 6931.13 years

15. $0.1(1.26)^{2s+20} = 200$

$$1.26^{2s+20} = 2000$$

$$2s + 20 = \log_{1.26} 2000$$

$$2s + 20 = \frac{\log 2000}{\log 1.26}$$

$$s \approx 6.44$$

The warning should be issued approximately 6.44 weeks after May 1.

16. a) 1) 64 2) ≈ 51.98 3) ≈ 37.39 4) ≈ 32.08
 b) 1) 1 048 576 2) ≈ 104 031.92 3) ≈ 2671.54 4) ≈ 486.71
 c) 1) $A = 2^{-0.3 \log_2 B + 6}$ 2) $B = 2^{\frac{\log_2 A - 6}{-0.3}}$

17. The network reaches its maximum capacity approximately 25.09 years after it is put in place

Page 202

18. a) 1) $\approx 0.6990, \approx 1.6990, \approx 2.6990, \approx 3.6990$ 2) $\approx 0.9031, \approx 1.9031, \approx 2.9031, \approx 3.9031$
b) A multiplication of the argument by 10 is associated with an increase of 1 of the logarithm.
19. a) 1) 60 min 2) 42 min 3) ≈ 2.42 min
b) 1) At least 2 pieces. 2) At least 3 pieces. 3) At least 5 pieces.
20. The temperature is 0°C , approximately 3.03 h after activation.
21. a) 1) $\approx 8.11\%$ 2) $\approx 5.78\%$ 3) $\approx 4.58\%$
b) 1) ≈ 4.96 years 2) ≈ 15.4 years 3) ≈ 24.41 years
c) 1) $r = \frac{\ln 2}{t}$ 2) $t = \frac{\ln 2}{r}$

Page 203

22. a) The initial temperature of the first alloy is 20°C ; the temperature of the second alloy is 40°C .
- b) $20(2)^x = 40(4)^{\frac{2x}{5}}$ c) $20(2)^x = 80(4)^{\frac{2x}{5}}$
 $2^x = 2(2)^{\frac{4x}{5}}$ $2^x = 4(2)^{\frac{4x}{5}}$
 $2^x = 2^{\frac{4x}{5}} + 1$ $2^x = 2^{\frac{4x}{5}} + 2$
 $x = \frac{4x}{5} + 1$ $x = \frac{4x}{5} + 2$
 $x = 5$ $x = 10$
After 5 h. After 10 h.
23. a) 1) ≈ 18.99 cm 2) ≈ 45.75 cm
b) 1) ≈ 91.50 cm 2) ≈ 12.30 cm