Homework #6
Math 211

Problems for Section 1.6

For Problems 1–16, solve for t using natural logarithms.

1. $5^t = 7$
3. $2 = (1.02)^t$
5. $50 = 10 \cdot 3^t$
7. $10 = e^t$
9. $e^{3t} = 100$
11. $40 = 100e^{-0.03t}$
13. $B = Pe^{rt}$
15. $5e^{3t} = 8e^{2t}$

21. The following formulas give the populations of four different towns, A, B, C, and D, with t in years from now.

$$P_A = 600e^{0.08t} \qquad P_B = 1000e^{-0.02t}$$
$$P_C = 1200e^{0.03t} \qquad P_D = 900e^{0.12t}$$

(a) Which town is growing fastest (that is, has the largest percentage growth rate)?
(b) Which town is the largest now?
(c) Are any of the towns decreasing in size? If so, which one(s)?

41. In 2000, there were about 213 million vehicles (cars and trucks) and about 281 million people in the US. The number of vehicles has been growing at 4% a year, while the population has been growing at 1% a year. If the growth rates remain constant, when is there, on average, one vehicle per person?

Problems for Section 1.7

1. World wind energy generating[59] capacity, W, was 18,000 megawatts in 2000 and has been increasing at a continuous rate of approximately 27% per year. Assume this rate continues.

5. If a bank pays 6% per year interest compounded continuously, how long does it take for the balance in an account to double?

17. A firm decides to increase output at a constant relative rate from its current level of 20,000 to 30,000 units during the next five years. Calculate the annual percent rate of increase required to achieve this growth.

23. If the quantity of a substance decreases by 4% in 10 hours, find its half-life.

Problems for Section 1.8

1. For $g(x) = x^2 + 2x + 3$, find and simplify:

(a) $g(2+h)$ (b) $g(2)$
(c) $g(2+h) - g(2)$

For the functions f and g in Problems 3–6, find

(a) $f(g(1))$ (b) $g(f(1))$ (c) $f(g(x))$
(d) $g(f(x))$ (e) $f(t)g(t)$

3. $f(x) = x^2$, $g(x) = x + 1$

Problems for Section 1.9

In Problems 1–12, determine whether or not the function is a power function. If it is a power function, write it in the form $y = kx^p$ and give the values of k and p.

1. $y = 5\sqrt{x}$
3. $y = 2^x$
5. $y = (3x^5)^2$
7. $y = 3 \cdot 5^x$
9. $y = \frac{8}{x}$
11. $y = 3x^2 + 4$

Solutions

Section 1.6

1 $t = (\ln 7)/(\ln 5) \approx 1.209$

3 $t = (\ln 2)/(\ln 1.02) \approx 35.003$

5 $t = (\ln 5)/(\ln 3) \approx 1.465$

7 $t = \ln 10 \approx 2.3026$

9 $t = (\ln 100)/3 \approx 1.535$

11 $t = 30.54$

13 $t = (\ln B - \ln P)/r$

15 $t = \ln 8 - \ln 5 \approx 0.47$

17 5; 7%

19 15; −6% (continuous)

21 (a) D
(b) C
(c) B

23 $P = 15(1.2840)^t$; growth

25 $P = P_0(1.2214)^t$; growth

27 $P = 15e^{0.4055t}$

29 $P = 174e^{-0.1054t}$

31 $P = 6.4e^{0.01252t}$

33 (a) \$5 million; \$3.704 million dollars
(b) 4.108 years

35 (a) 12%
(b) $P = 25e^{-0.128t}$, 12.8%

37 (a) $P = 5.4(1.034)^t$
(b) $P = 5.4e^{0.0334t}$
(c) Annual = 3.4%
Continuous = 3.3%

39 9.53%

41 2009

Section 1.7

1 (a) $W = 18000e^{0.27t}$
(b) About 2010

3 \$14,918.25

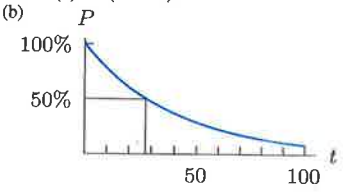
5 About 11.6 years

13 A: continuous
B: annual
\$20

15 (a) 47.6%
(b) 23.7%

17 8.45%

19 (a) $P(t) = (0.975)^t$
(b)



(c) About 27 years
(d) About 8%

21 (a) 4 years
(b) 4 years

23 About 173 hours

25 96.34 years

Section 1.8

1 (a) $h^2 + 6h + 11$
(b) 11
(c) $h^2 + 6h$

3 (a) 4

(b) 2
(c) $(x+1)^2$
(d) $x^2 + 1$
(e) $t^2(t+1)$

Section 1.9

1 $y = 5x^{1/2}$

3 Not a power function.

5 $y = 9x^{10}$

7 Not a power function

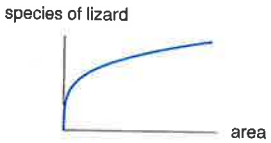
9 $y = 8x^{-1}$

11 Not a power function

13 $S = kh^2$

15 $v = d/t$

17 $N = kA^{1/4}$, with $k > 0$,
Increasing, concave down



19 (a) $y = (x-2)^3 + 1$
(b) $y = -(x+3)^2 - 2$

21 Yes; $k \approx 0.0087$

23 $N = k/L^2$; small

25 (a) $T = kB^{1/4}$
(b) $k = 17.4$
(c) 50.3 seconds

27 (a) $N = kP^{0.77}$
(b) A has 5.888 times more than B
(c) Town

29 (a) 0.5125
(b) 0.3162
(c) 201,583 dynes/cm^2

31 (a) $C = 115{,}000 - 700p$
$R = 3000p - 20p^2$
(b)