WS- Exponent/Log Review Day 1

Do all work neatly on a separate sheet of paper. This should be done WITHOUT using your calculator.

Solve each equation.

1. $3^4 = 3^{x+1}$

2. $7^y = 7^{4y-9}$

3. $\left(\sqrt{3}\right)^{n+2} = 27^{n-3}$

Simplify.

4. $2^{\sqrt{3}} \cdot 2^{\sqrt{3}}$

5. $\left(5^{\sqrt{6}}\right)^{\sqrt{2}}$

6. $8^{\sqrt{3}} \div 16^{\sqrt{2}}$

Change each equation to logarithmic form.

7. $5^2 = 25$

8. $2^5 = 32$

9. $3^{-2} = \dfrac{1}{9}$

10. $5^{-3} = \dfrac{1}{125}$

Change each equation to exponential form.

11. $\log_3 81 = 4$

12. $\log_9 81 = 2$

13. $\log_4 8 = \dfrac{3}{2}$

14. $\log_{10} 0.01 = -2$

Solve each equation.

15. $\log_2 x = 3$

16. $\log_2 x = 0.5$

17. $\log_x 8 = \dfrac{1}{2}$

18. $\log_x 27 = -3$

Evaluate each expression.

19. $\log_{64} 8$

20. $\log_2 0.5$

21. $8^{\log_8 9}$

22. $\log_x x^3$

Graph the following on graph paper.

G1. $y = 3^x$

G2. $y = 3^x + 2$

G3. $y = \left(\dfrac{1}{3}\right)^x$

G4. $y = 2\left(\dfrac{1}{3}\right)^x$

WS- Exponent/Log Review Day 2

Do all work neatly on a separate sheet of paper. This should be done WITHOUT using your calculator.

Solve each equation.

23. $\log_3 2x = \log_3 (3x-5)$

24. $\log_{10}(5+y) = \log_{10} 13$

25. $\log_9\left(x^2 + x\right) = \log_9 6$

26. $\log_2(3x+1) = \log_2(x+7)$

Use $\log_{10} 3 = 0.4771$ and $\log_{10} 5 = 0.6990$ to evaluate each expression.

27. $\log_{10} 15$

28. $\log_{10} \dfrac{5}{3}$

29. $\log_{10} 75$

Solve each equation.

30. $\log_3 x - \log_3 4 = 3$

31. $\log_6 x - \log_6 (x-1) = \log_6 4$

32. $\log_5(x+2) + \log_5(x-3) = \log_5 5$

33. $\log_7(x-1) + \log_7(x+1) = \log_7 8$

Use the change of base formula to write in terms of common logs only.

34. $\log_2 15$

35. $\log_{1/3} 9$

36. $\log_8 0.25$

Evaluate each expression.

37. $\ln e^3$

38. $\log_e e^2$

39. $e^{\ln 10}$

Solve each equation.

40. $\ln(3x+1) = \ln(2x-8)$

41. $4e^x - 2 = 14$

42. $3\ln(5x+2) = 12$

Graph the following on graph paper. Identify each domain and range.

G5. $y = \log_3 x$

G6. $y = 2 + \log_3 x$

G7. $y = \log_3 x - 2$

Do all work neatly on a separate sheet of paper.

1. The half-life of the radioactive krypton-19 is 10 seconds. If 16 grams of the element are initially present, how many grams are present 29 seconds?

2. The half-life of radioactive plutonium-239 is 25,000 years. If 16 grams of the element are initially present, how many grams are present after 80,000 years?

3. Prehistoric cave paintings were discovered in a cave in France. The paint contained 15% of the original carbon-14. Estimate the age of the paintings is the half-life for carbon-14 is 5730 years.

4. Skeletons were found at a construction site in San Francisco in 1989. The skeletons contained 88% of the expected amount of carbon-14 found in a living person. How old were the skeletons in 1989 if the half-life for carbon-14 is 5730 years?

5. A bird species in danger of extinction has a population of 1400 five years ago and today only 1000 of the birds are alive. Once the population drops below 100, the situation will be irreversible and extinction occurs. When will this happen?

6. The population of a single-celled organism in a pond doubles every 5 days. If the initial count of organisms is 5000 and the final count is 25,000, how many days have passed?

7. A certain strain of bacteria increases from an initial count of 1000 to a final count of 35,000 in six hours. How long does it take for this strain to triple?

8. A culture of bacteria grew from 2500 at 2:00pm to 4000 at 5:00pm. What will the population be at 10:00pm?

Do all work neatly on a separate sheet of paper.

9. During the first week of flu season, 100 people became ill. After the 4th week, 1080 had the flu, and after the 7th week, 5100 were ill.
   a) Determine the logistics model for this data
   b) When will the flu outbreaks "level" off?

10. The percentage of 1-year olds with some heart disease is 0.5%, for 20-year olds with some heart disease is 4% while the percentage of 80-year olds is 89%.
   a) Determine the logistics model for this data
   b) What percentage of 40-year olds have some coronary heart disease.

11. Shown is world population, in billions, for seven selected years. Find the logistic regression to model this data. According to the model, what is the limiting size of the population that the Earth will eventually sustain? What does this mean in terms of the statement made by the U.S. National Academy of Sciences that 10 billion is the maximum that the world can support with some degree of comfort and individual choice?

x, Number of Years After 1949	y, World Population (Billions)
1 (1950)	2.6
11 (1960)	3.0
21 (1970)	3.7
31 (1980)	4.5
41 (1990)	5.3
51 (2000)	6.1
54 (2003)	6.3

Determine the regression, exponential or logistics, you would choose to model each data set and why.

Miscarriages in Women

Women's Age	Percent of Miscarriages
22	9
27	10
32	13
37	20
42	38
47	52

Number of Illegal Immigrants Living in the US

Year	# of Illegal Immigrants (Millions)
1992	3.4
1996	5.0
2000	7.0
2004	8.0

# of US Households with Pets

Year	# with Pets (Millions)
1998	54.0
1999	58.2
2000	61.1
2001	63.0
2002	64.2

Number of Countries Connected to the Internet

Year	# of Countries
1985	11
1991	91
1994	146
1997	195
2002	220

Alcohol Use by US High School Seniors

Year	% Usage 30 days Prior to Survey
1980	72.0
1985	65.9
1990	57.1
1995	51.3
2000	50.0
2002	48.6
2003	47.5

WS- Compound Interest Review

Do all work neatly on a separate sheet of paper.

1. The value of a new car purchased for $18,000 decreases by 12% each year. Estimate the value of the car after two years.

2. You deposit $1000 in an account that pays 5% annual interest. Find the balance at the end of three years if your interest is compounded:
   a. Yearly?
   b. Quarterly?
   c. Monthly?
   d. Continuously?

3. A newly married couple has $15,000 toward a new home. How long will the money have to be invested at 10% compounded quarterly to grow to the estimated $20000 needed for a down payment?

4. Sue has saved $7000 toward the purchase of a $9000 used car. How long will Sue's money need to be invested at 9% compounded monthly until she can buy the car?

5. What is the average rate of inflation if a desk that cost $250 in 1990 cost $275 in 1997? (Note: Inflation is compounded continuously)

6. The world population is approximately 6.9 Billion people and growing at 1.1% compounded continuously. In what year will the population reach 9 Billion people?

WS- Effective Annual Yield (Part 1 of 2)

Do all work neatly on a separate sheet of paper.

Find the effective annual yield for each investment. Then find the value of a $1000 investment after 5 years for each situation.

1. 10% compounded quarterly

2. 8.5% compounded monthly

3. 9.25% compounded continuously

4. 7.75% compounded continuously

5. 6.5% compounded daily (365 day year)

6. Which investment yields more interest – 9% compounded continuously or 9.2% compounded quarterly?

Go on to the next column…

WS- Effective Annual Yield (Part 2 of 2)

Also complete the following (Taken from Page 751: 31-51 odd)

Write the expression in exponential form.

31. $\log_8 4 = \dfrac{2}{3}$

Write the expression in logarithmic form.

33. $5^{-2} = \dfrac{1}{25}$

Evaluate each expression.

35. $\log_{10} 0.001$

37. $\log_2 0.5$

39. $\log_9 \dfrac{1}{9}$

41. $\log_8 512$

Solve each equation.

43. $\log_{0.5} x = -4$

45. $2\log_6 4 - \dfrac{1}{3}\log_6 8 = \log_6 x$

Given that $\log 3 = 0.4771$ and $\log 14 = 1.1461$, evaluate each logarithm.

49. $\log 0.0003$

51. $\log 0.014$

WS- Future Value

Do all work neatly on a separate sheet of paper.

1. A chemist deposits $300 in a savings account that pays 4% interest compounded annually and adds $300 at the end of each year for 4 years. How much money does she have at the end of 5 years?

2. Grandparents of a 4th grader decided to start a college fund so that in 8 years their grandchild will have $40,000 saved toward college tuition. What monthly payments must they make if they find a bank paying 8% interest?

3. A 55-yr old man would like to have $100,000 in his account when he retires in 10 yrs. What monthly payments should he make to an account that pays 6% monthly?

4. A math teacher deposits $1000 in a savings account at the end of each quarter for 10 yrs. How much money does she have at the end of 10 yrs if the account pays 8.25% compounded quarterly?

5. In 5 yrs, a company wants to buy a new computer system costing $100,000. They establish a sinking fund that pays 6% compounded semiannually. To accumulate $100,000 in 5 yrs, what is the payment every 6 months?

6. A manufacturer deposits $1000 each month into an account that pays 5.5% compounded monthly. He plans to do this for 7 years, how much money will be in the account at the end of that time period?

WS- Present Value

Do all work neatly on a separate sheet of paper.

1. What amount of money must be invested today at 6% compounded monthly so that payments of $100 per month can be made from this fund for 5 years?

2. A television is purchased for $100 down and $30 a month for 12 months. If the finance charge is 15% compounded monthly, find the original price of the set.

3. What are the monthly payments to finance a $12,000 car at 13% interest for 5 years? How much interest was paid? What is the total price of the car?

4. What is the highest priced price a person can afford if he is willing to pay monthly car payments of $350 for the next 5 years with the interest rate at 12%?

5. You decide to purchase a house for $450,000. Your parents give you the 20% down payment. Find the monthly house payments if you are able to get a 30-year loan at 5 ½% compounded monthly. How much interest was paid? What was the total cost of the house?

6. In order for you not to work while in college, a fund is set up to pay you $500 a month for 4 years. How much should be deposited in the fund which is paying 6% compounded monthly to achieve this goal? How many months were you able to "live" off your interest?

WS- Review- Day 1

**Do all work neatly on a separate sheet of paper.**

1. Radon has a half-life of 3.8 days. How long would it take 2 grams of decay to 0.4 grams?
2. How much should you deposit initially in an account paying 10% compounded semi-annually in order to have $25,000 in 10 years?
3. Which is the better investment and why: 9% compounded quarterly or 9.25% compounded annually?
4. A company establishes a sinking fund to replace equipment in 6 years at an estimated cost of $50,000. They plan to make monthly payments that pay 6% compounded monthly. How much should each payment be?
5. If an account has $20,000, after an initial investment of $5000, how long did it take to accumulate this amount at 12% with simple interest?
6. You can afford monthly deposits of $200 into an account that pays 7.98% compounded monthly. How long will it be until you have $2500 to purchase a used car?
7. At noon, a culture of bacteria has 2.5×10^6 members and at 3:00pm the culture had grown to 4.5×10^6. When will the population be 8.0×10^6?
8. You decide to buy a house for $250,000 and are able to make a 10% down payment. What is your monthly payment if the loan is 7% compounded monthly for 30 years? How much did you pay in total? How much interest?

WS- Review- Day 2

Do all work neatly on a separate sheet of paper.

9. What is the interest rate if $3500 grew to $10,000 over 3 years, compounded quarterly?
10. A city's population grew from 50,000 to 90,000 from 1970-1980. How many people will there be in 2015? In what year will the population be 2,000,000?
11. The half-life of a substance is 80 days. How much remains after 25 days?
12. An account has $20,000 after an initial investment of $3000. How long was the account open if the money was compounded continuously at 5%?
13. What is the inflation rate if a car cost $15,500 in 1986 and now costs $23,000?
14. At what interest rate would you need to have your money double in 5 years compounded daily?
15. A scholarship committee wishes to establish a scholarship that will pay $1500 per quarter to a student for two years. How much should be deposited now, at 8% compounded quarterly, to establish this scholarship? How much will the student receive in two years?
16. Find an exponential function of the form $y = ab^x$ whose graph passes through the points $(2, 4)$ and $(6, 8)$
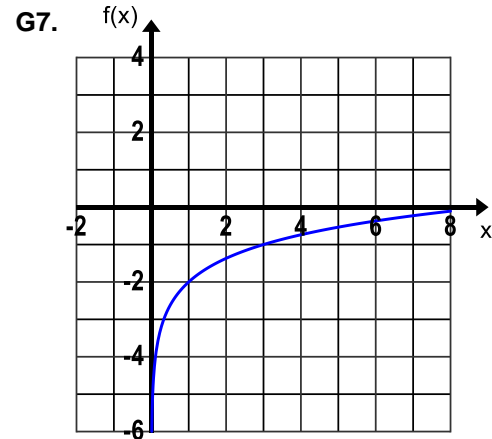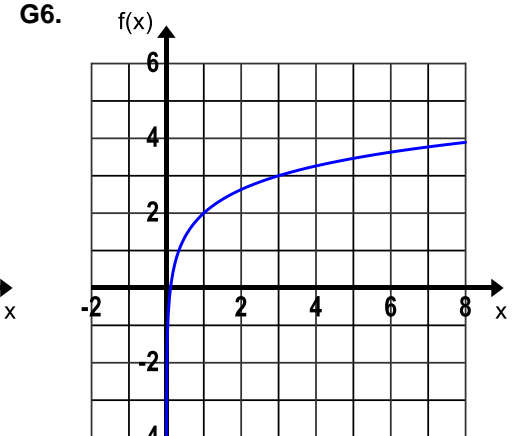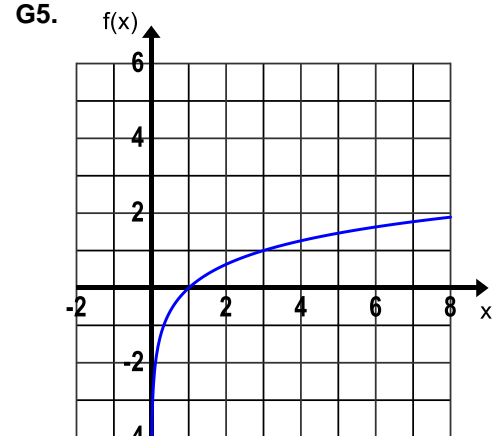
WS- Exponent/Log Review Day 1 ANSWERS

1. $x=3$	2. $y=3$	3. $n=4$	4. $2^{2\sqrt{3}}$ or $4^{\sqrt{3}}$
5. $5^{2\sqrt{3}}$ or $25^{\sqrt{3}}$	6. $2^{3\sqrt{3}-4\sqrt{2}}$	7. $\log_5 25 = 2$	8. $\log_2 32 = 5$
9. $\log_3 \dfrac{1}{9} = -2$	10. $\log_5 \dfrac{1}{125} = -3$	11. $3^4 = 81$	12. $9^2 = 81$
13. $4^{3/2} = 8$	14. $10^{-2} = 0.01$	15. $x=8$	16. $x=\sqrt{2}$
17. $x=64$	18. $x=\dfrac{1}{3}$	19. $\dfrac{1}{2}$	20. -1
21. 9	22. 3		
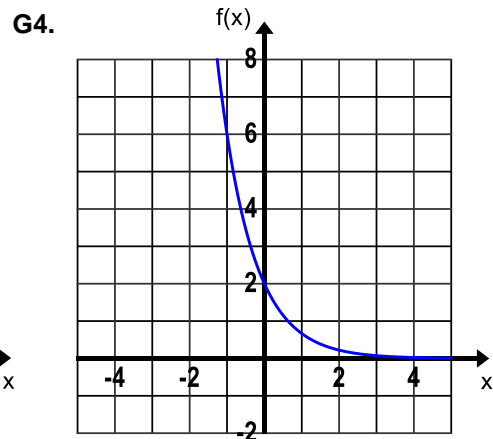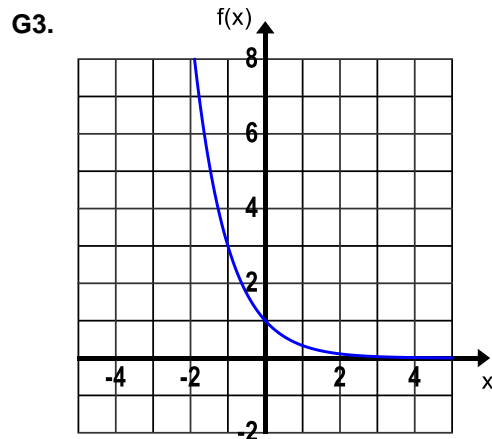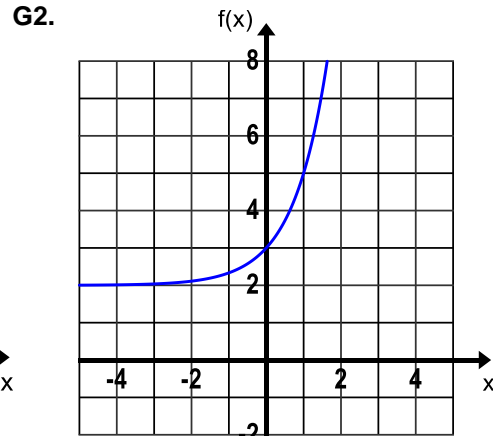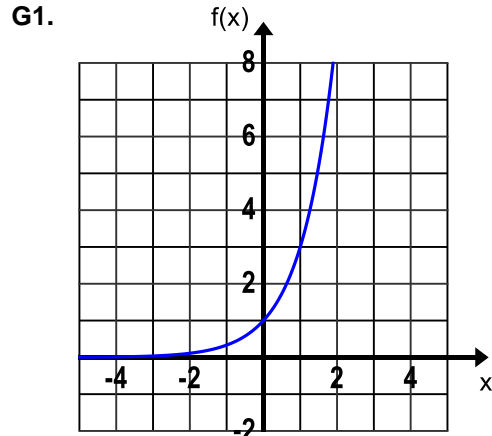
WS- Exponent/Log Review Day 2 ANSWERS

23. $x=5$	24. $y=8$	25. $x=-3, 2$	26. $x=3$
27. 1.1761	28. 0.2219	29. 1.8751	30. $x=108$
31. $x=\dfrac{4}{3}$	32. $x=\dfrac{1+3\sqrt{5}}{2}$	33. $x=3$	34. $\dfrac{\log 15}{\log 2}$
35. $\dfrac{\log 9}{\log 1/3}$	36. $\dfrac{\log 0.25}{\log 8}$	37. 3	38. 2
39. 10	40. No Sol	41. $x=\ln 4$	42. $\dfrac{e^4 - 2}{5}$

G1.

G2.

G5.

G6.

G3.

G4.

G7.

WS- Radioactive Decay and Logistics Day 1 ANSWERS

$8 = 16(b)^{10};\quad b = 0.9330$

1. $y = 16(.9330)^{29}$
$y = 2.1435$ grams

$50 = 100(b)^{5730};\quad b = 0.999879$

3. $15 = 100(.999879)^{t}$
$t = 15{,}682.8129$ yrs

$1000 = 1400(r)^{5}\quad r = 0.9349$

5. $y = 1400(0.9349)^{t}$
$t = 39.2166$ years

$35{,}000 = 1000(r)^{6}\quad r = 1.0525$

7. $3000 = 1000(1.0525)^{t}$
$t = 1.8540$ hours

$8 = 16(b)^{25000};\quad b = 0.999972$

2. $y = 16(0.999972)^{80000}$
$y = 1.7411$ grams

$50 = 100(b)^{5730};\quad b = 0.999879$

4. $88 = 100(0.999879)^{t}$
$t = 1056.7528$ years

$10000 = 5000(b)^{5};\quad b = 1.1487$

6. $25{,}000 = 5000(1.1487)^{t}$
$t = 11.6096$ years

$4000 = 2500(r)^{3}\quad r = 1.1696$

8. $y = 2500(1.1696)^{8}$
$t = 8755.0768$ bacteria

WS- Radioactive Decay and Logistics Day 2 ANSWERS

1. $y = \dfrac{7561.9744}{1 + 172.8664e^{-0.8401x}};$ Week 16-17

2. $y = \dfrac{91.4170}{1 + 203.2834e^{-0.1115x}};$ 27.2930%

3. $y = \dfrac{12.8547}{1 + 4.2134e^{-0.0261x}}$

Miscarriages in Women-

Number of Illegal Immigrants-

Households with Pets-

Internet Connection-

Alcohol Use-

WS- Compound Interest Review ANSWERS

1. $y = 18{,}000(1 - 0.12)^{2};$ $13939.20

2. $y = 1000\left(1 + \dfrac{0.05}{n}\right)^{3n}$

   a. Yearly? $y = 1000\left(1 + \dfrac{0.05}{1}\right)^{1 \times 3};$ $1157.63

   b. Quarterly? $y = 1000\left(1 + \dfrac{0.05}{4}\right)^{4 \times 3};$ $1160.75

   c. Monthly? $y = 1000\left(1 + \dfrac{0.05}{12}\right)^{12 \times 3};$ $1161.47

   d. Continuously? $y = 1000e^{0.05 \times 3};$ $1161.83

3. $20{,}000 = 15{,}000\left(1 + \dfrac{0.10}{4}\right)^{4t};\quad t = 2.9126$ years

4. $9000 = 7000\left(1 + \dfrac{0.09}{12}\right)^{12t};\quad t = 2.8028$ years

5. $275 = 250e^{7r};\quad r = 1.3616\%$

6. $9 = 6.9e^{0.011t};\quad t = 24.1548$ years from now

WS- Effective Annual Yield ANSWERS

1. $E = \left(1 + \dfrac{0.10}{4}\right)^{4} - 1;$ 10.3813%; $1638.62

2. $E = \left(1 + \dfrac{0.085}{12}\right)^{12} - 1;$ 8.8391%; $1527.30

3. $E = e^{0.0925} - 1;$ 9.6913%; $1588.04

4. $E = e^{0.0775} - 1;$ 8.0582%; $1473.29

5. $E = \left(1 + \dfrac{0.065}{365}\right)^{365} - 1;$ 6.7153%; $1383.99

6. a) $E = e^{0.09} - 1;$ 9.4174%; $1568.31

6. b) $E = \left(1 + \dfrac{0.092}{4}\right)^{4} - 1;$ 9.5223%; $1575.84

WS- Future Value ANSWERS

Problem	1	2	3	4	5	6
N=	5	96	120	40	10	84
I%=	4	8	6	8.25	6	5.5
PV=	0	0	0	0	0	0
PMT=	-300	-298.80	-610.21	-1000	-8723.05	-1000
FV=	1624.90	40,000	100,000	61277.15	100,000	102,179.39
P/Y=	1	12	12	4	2	12
C/Y=	1	12	12	4	2	12
END/BEGIN	END	END	END	END	END	END

WS- Present Value ANSWERS

Problem	1	2	3	4	5	6
N=	60	12	60	60	360	48
I%=	6	15	13	12	5.5	6
PV=	5172.56	332.38	12000	15734.26	360000	21290.16
PMT=	-100	-30	-273.04	-350	-2044.04	-500
FV=	0	0	0	0	0	0
P/Y=	12	12	12	12	12	12
C/Y=	12	12	12	12	12	12
END/BEGIN	END	END	END	END	END	END

2. $332.38 + $100 = $432.38   3. Total: $16382.40   Interest: $4382.40
5. Total: $2044.04 * 360 + $90000 = $825854.40   Interest: $375854.40
6. Interest: $2709.84   Time: 5.4197 months

WS- Review- Day 1 ANSWERS

1. $1 = 2(b)^{3.8}$; $b = 0.8333$

   $0.4 = 2(0.8333)^x$; $t = 8.8233$ years

2. $25,000 = P\left(1 + \dfrac{0.10}{2}\right)^{2 \times 10}$; $\$9422.24$

3. $\left(1 + \dfrac{0.09}{4}\right)^4 - 1 = 9.3083\%$ EPY better than 9.25%

4. $\$578.64$

5. $A = P(1 + rt)$ $20000 = 5000(1 + 0.12t)$;   25 Years

6. 12.0475 months

7. $4.5 = 2.5(r)^{3-0}$; $r = 1.2164$

   $8.0 = 2.5(1.2164)^t$;   5.9366 hours, so 5:56pm

8. $\$1496.93$; $\$563,894.80$ Total; $\$313,894.80$ Interest

WS- Review- Day 2 ANSWERS

9. $10,000 = 3500\left(1 + \dfrac{r}{4}\right)^{4 \times 3}$;   36.5704%

   $90,000 = 50,000(r)^{10-0}$; $r = 1.0605$

10. 704,200 People in 2015
    2,000,000 in 2032 (62.7588 years later)

11. $50 = 100(b)^{80}$; $b = 0.9914$

    $y = 100(.9914)^{25}$;   80.5245% of original

12. $20,000 = 3000e^{0.05 \times t}$; $t = 37.9424$ years

13. $23,000 = 15,500e^{r \times 25}$; $r = 1.5786\%$ in 2011

14. $2 = 1\left(1 + \dfrac{r}{365}\right)^{365 \times 5}$;   13.8656%

15. $\$10,988.22$; $\$12,000.00$

16. $8 = 4(b)^{6-2}$; $b = 1.1892$

    $y = 4(1.1892)^{x-2}$ or $y = 8(1.1892)^{x-6}$

Problem	4	6	8	15
N=	72	12.0475	360	8
I%=	6	7.98	7	8
PV=	0	0	225000	10988.22
PMT=	-578.644	-200	-1496.93	-1500
FV=	50000	2500	0	0
P/Y=	12	12	12	4
C/Y=	12	12	12	4
END/BEGIN	END	END	END	END