EXPONENTIAL FUNCTIONS

Graph the following exponential functions.

1. $y=3(2)^{x}-4$
2. $y=\frac{1}{3}(3^{x})$
3. $y=-(2)^{x+3}+5$
4. $y=(3)^{-x+2}$
5. $y=\frac{1}{4}(4^{x})-6$
6. $y=-\left(\frac{1}{2}\right)^{x-5}+8$

Solve the following exponential equations on a separate sheet of paper.

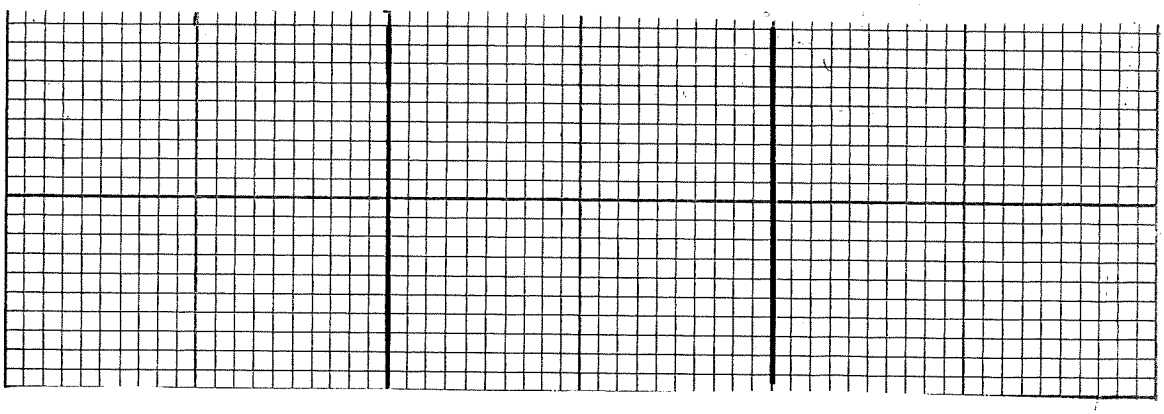
7. $2^{x+3}=\frac{1}{16}$
8. $36^{x}=6^{x^{2}-3}$
9. $\sqrt{5}=25^{x-1}$
10. $\left(\frac{1}{27}\right)^{x+2}=\sqrt[3]{3^{x}}$

Name _____

GRAPHING EXPONENTIAL & LOGARITHMIC FUNCTIONS

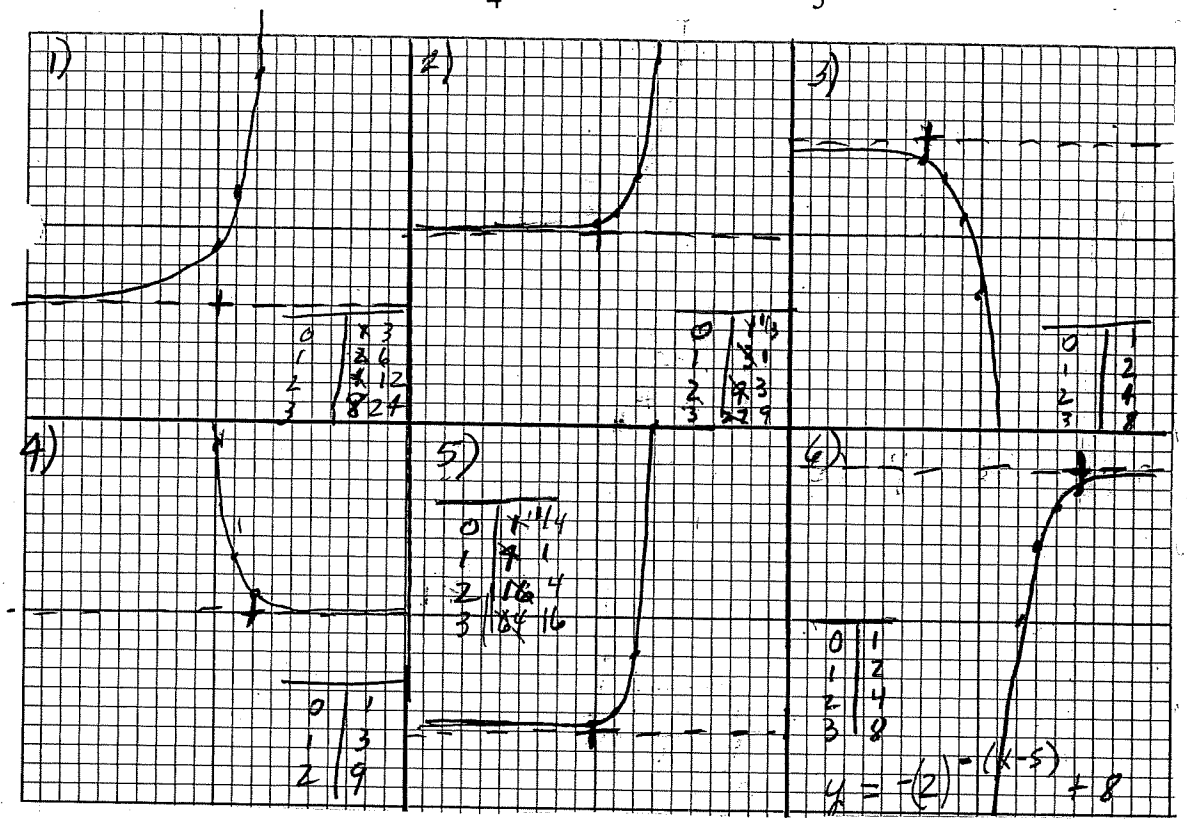
Sketch a graph of each of the following functions. Show all asymptotes and plot at least 3 points accurately if possible.

1. $y=3^{x}$
   $y=\log_{3} x$
2. $y=4^{x-3}-6$
   $y=\log_{4}(x-3)-6$
3. $y=2^{-x}+1$
   $y=\log_{2}(-x)+1$

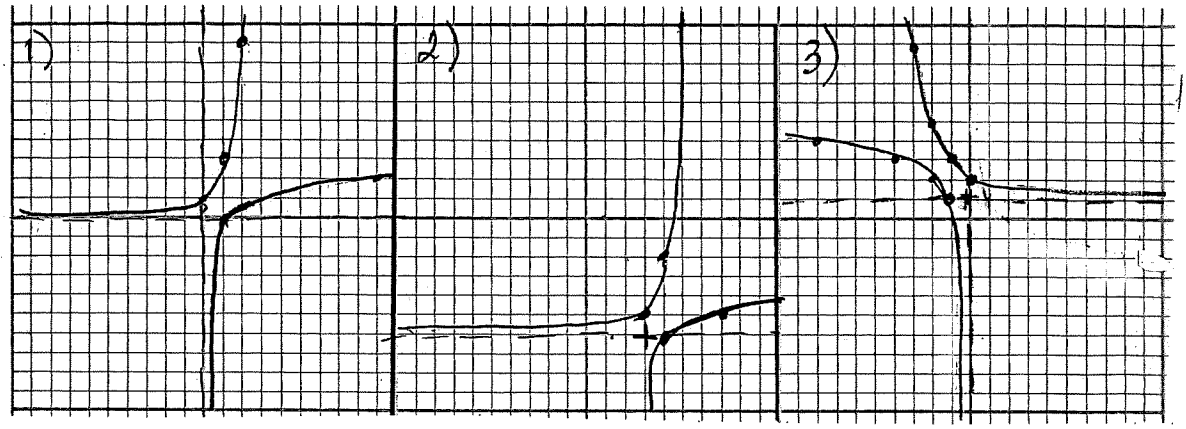


ANSWERS

7. -7 8. -1, 3 9. $\frac{5}{4}$ 10. $-\frac{9}{5}$



ANSWERS



Name_____

LOGARITHMIC EQUATIONS HANDOUT

Solve by exponentiating both sides and then making common bases.

1. $\log_9 27 = x$

2. $\log_{\sqrt{2}} \frac{1}{32} = x$

Use the properties of logarithms to solve each of the following problems.

3. $\log_8 (m+3) - \log_8 m = \log_8 4$

4. $2\ln 6 - \frac{1}{2}\ln 81 = 2\ln x$

5. $\log_4 (x+3) + \log_4 (x-3) = 2$

6. $\ln(5x+2) + \ln(x) = 2\ln(x)$

7. $\log y + \log(y+21) = 2$

8. $\log_2 (y+2) - 1 = \log_2 (y-2)$ *(Hint: Move logs to same side.)*

9. $3\ln x = 8$

10. $\ln 6 + \ln 2x - \ln 3 = 0$

11. $\ln 2 + \ln(x-5) = 3$

12. $\ln(7x+4) - \ln 5 = 2$

13. $4^{3x} = 19$

14. $3^{2x+1} = 838{,}000$

15. $6e^{4x} = 6096$

16. $3e^{2x-5} + 9 = 42$

17. $4e^{8x+2} + 17 = 345$

18. Evaluate with a calculator:
    (a) $\log_3 9862$

    (b) $\log_{12} 741{,}695$

ANSWERS: 1. 3/2 2. -10 3. 1 4. 2 5. 5 6. No solution 7. 4 8. 6 9. 14.39 10. ¼
11. 15.04 12. 4.71 13. 0.71 14. 5.71 15. 1.73 16. 3.70 17. 0.30 18. (a) 8.37 (b) 5.44

Name_____

ALGEBRA II HANDOUT
Applications of Logarithms

1. Mr. and Mrs. Grauser invested $5000 at 6% compounded monthly. When will their investment triple? Round to the nearest tenth.

2. The Thomas family includes several generations of farmers. They have an opportunity to buy 160 acres adjacent to their farm for $5000 per acre. In the past, the price of farmland has gone up 10.8% per year. If this continues, how long will it be before the land is worth $8000 per acre? Round to the nearest tenth.

3. A certain strain of bacteria multiplies at a rate where $k = 0.195$ when time is measured in hours. If the culture contains 250 bacteria, how long (to the nearest tenth of an hour) will it take it to grow to 5000 bacteria?

4. A radioisotope is used as a power source for a satellite. The power output is given by the equation $P = 50e^{-\frac{t}{250}}$, where P is the power in watts and t is the time in days. Ten watts of power are required to operate the equipment in the satellite. For how many days can the satellite continue to operate?

5. A piece of machinery valued at $250,000 depreciates at 12% per year. After how many years will the value have depreciated to $100,000? Round to the nearest tenth.

6. Radium-226 decomposes radioactively. Its half-life is 1800 years. If a researcher has a sample of 100 grams, find the value of the constant of decay accurate to 3 significant digits.

ANSWERS

1. 18.4 years
2. 4.6 years
3. 15.4 hours
4. 402 days
5. 7.2 years
6. -0.000385

Start a new document for each problem!

Name_____

ALGEBRA 2
REGRESSION HANDOUT

1. The table at the right shows the revenue R (in billions of dollars) collected by the Internal Revenue Service (IRS) for selected years from 1960 to 2000.
   (a) Enter the data in a Lists & Spreadsheet page.
   (b) Create a scatter plot of the data.
   (c) Use exponential regression to fit a curve to the graph. Write the equation below.

Year	Revenue, R
1960	91.8
1965	114.4
1970	195.7
1975	293.8
1980	519.4
1985	742.9
1990	1056.4
1995	1375.7
2000	2096.9

   (d) How well does it fit the existing points? How well does it appear to predict the future?

   (e) Return to the spreadsheet and perform an exponential regression again. What is the value of the correlation coefficient (r)?

   (f) Use the Table feature to predict the amount of revenue in 2020.

   (g) Add a graph page. Press Tab and find the equation which should be stored in f1. Press enter to graph it. Zoom as needed. Use the graph to determine the year in which the revenue reached 4000 (billion) dollars?

2. The table at the right shows the yield y (in milligrams) of a chemical reaction after x minutes.
   (a) Enter the data in a Lists & Spreadsheet page.
   (b) Create a scatter plot of the data.
   (c) Use logarithmic regression to fit a curve to the graph. Write the equation below.

Minutes, x	Yield, y
1	1.5
2	7.4
3	10.2
4	13.4
5	15.8
6	16.3
7	18.2
8	18.3

   (d) How well does it fit the existing points? How well does it appear to predict the future?

   (e) Return to the spreadsheet and perform a logarithmic regression again. What is the value of the correlation coefficient (r)?

   (f) Use the Table feature to predict the yield at 10 minutes.

   (g) How many minutes (to the nearest tenth) did it take the yield to reach 9 milligrams?

3. The table at the right gives the mean distance x from the sun (in astronomical units) and the time of one orbit y (in Earth years) of the six planets closest to the sun.

Planet	Mercury	Venus	Earth	Mars	Jupiter	Saturn
x	0.387	0.723	1.000	1.524	5.203	9.539
y	0.241	0.615	1.000	1.881	11.862	29.458

(a) Enter the data in a Lists & Spreadsheet page.
(b) Create a scatter plot of the data.
(c) Use power regression to fit a curve to the graph. Write the equation below.

(d) How well does it fit the existing points? How well does it appear to predict the planets that are located farther from the sun?

(e) Return to the spreadsheet and perform an power regression again. What is the value of the correlation coefficient (r)?

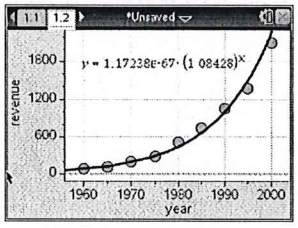
(f) Use the Table feature to estimate the time period of one orbit of Neptune, which has a mean distance from the sun of 30.043 astronomical units. Round to 3 decimal places.

(g) Uranus has a period of 84.068 years. Determine its average distance from the sun.

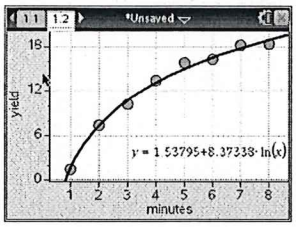
ANSWERS

1. a-c) See graph
   d) strong fit; good for future

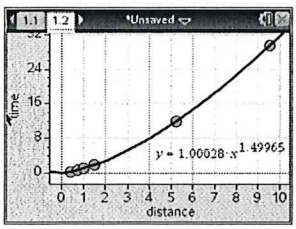
   e) r = 0.996
   f) ~~$12,330 (billion) or $12.3 trillion~~ 11,371.5 billion or 11.4 trillion
   g) 2007



2. a-c) See graph
   d) strong fit; rising a little too quickly
   e) r = 0.997
   f) 20.8 mg
   g) 2.4 minutes



3. a-c) See graph
   d) strong fit; good for planets at greater distances
   e) r = 1 (perfect fit)
   f) 164.519 years
   g) 19.2 astronomical units



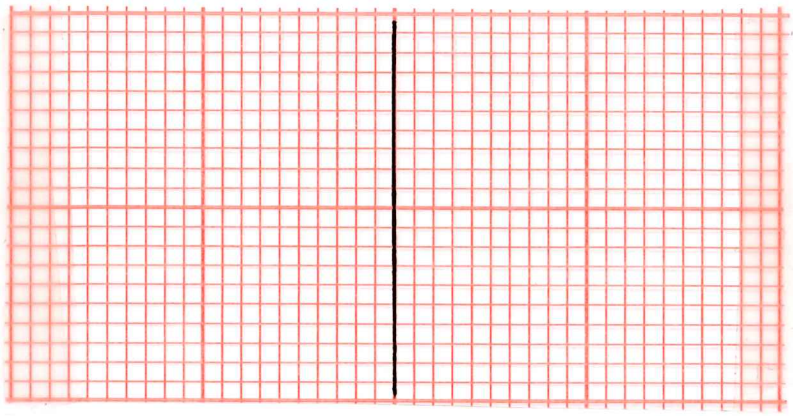
Assignment:
1) 2 pairs 4) 3 7) 4
2) 1 5) 5 8-11) 3
3) 2 ea. row 6) 1 12) All

Name_____

ALGEBRA II REVIEW
Exponential & Logarithmic Functions

Complete problems 1-5 *without* using the log keys on your calculator.

1. Graph each pair of equations. (a) $y=3^{x+4}-2$ (b) $y=\log_3(x+4)-2$ (c) $y=2^{-x+3}$ (d) $y=\log_2(-x+3)$



2. Solve each equation without using logs.
   (a) $\left(\frac{1}{49}\right)^{y}=7^{4y-9}$ (b) $\left(\sqrt{3}^{n+2}\right)=27^{n-3}$

3. Evaluate the following without using a calculator.
   (a) $\log_2\frac{1}{8}$ (b) $\log_5\sqrt[7]{5}$ (c) $\log_3\sqrt[5]{\frac{1}{81}}$

   (d) $\ln e^{191}$ (e) $8^{\log_8 77}$ (f) $e^{\ln 212}$

4. Solve each equation.

(a) $\log_x 3 = \frac{1}{3}$

(b) $\log_6 x = -2$

(c) $\log_{\sqrt{2}} 32 = x$

(d) $\log_{125} \frac{1}{25} = x$

5. Solve each equation.

(a) $\log_3 x - \log_3 4 = 3$

(b) $\ln(x-1) + \ln(x+1) = \ln 8$

(c) $\log_5 7 + \frac{1}{2}\log_5 4 = \log_5 x$

(d) $\log_2(9x+5)-2=\log_2(x^2-1)$

(e) $\frac{1}{2}(2\log 4-3\log 2)=\log x$

(f) $\log_6(r-3)+\log_6(r+2)=1$

Use the log key(s) on your calculator when needed to complete problems 6-12.

6. Evaluate the following:
   (a) $\log_{11} 527$
   (b) $\log_{231} 13,688$

7. Solve each equation. Round to the nearest hundredth.

(a) $4.5^{\frac{1}{2}x} = 36.2$

(b) $2^{5x-1} = 53$

(c) $\ln(2x+1) = 5$

(d) $18 = 6e^{3x+5}$

(e) $\ln(7x+2) + \ln 2 = 9$

Applications of logs. Solve algebraically.

8. A city's population in 1990 was 219,631. If the population increases at an annual rate of 9% per year, when will the population reach 800,000?

9. A pilgrim ancestor of Carrie Seltzer left $10 in a savings account in the Provident Savings Bank. Interest was compounded semi-annually at 4%. The account is now worth $50,000. How long ago was the account started (to the nearest whole number)?

10. In a research experiment, a population of fruit flies is increasing with a constant of growth of 0.5493. If the population currently contains 250 fruit flies, in how many days (to the nearest hundredth) will there be 1000 fruit flies?

11. Pre-historic cave paintings were discovered in a cave in France. The paint contained 12% of the original carbon-14. Estimate the age of the paintings given that the constant $k = -0.000121$.

12. The director of the company that manufactures a certain prescription drug is trying to find an equation that models the decomposition of the drug over time. A prescription contains 400 units of the drug per milliliter. The table below shows the amount of the drug after sitting on the shelf for a specified number of days.

Days	3	6	7	9	11	13	18
Units of prescription	380.1	361.2	355.1	343.3	331.8	320.7	294.6

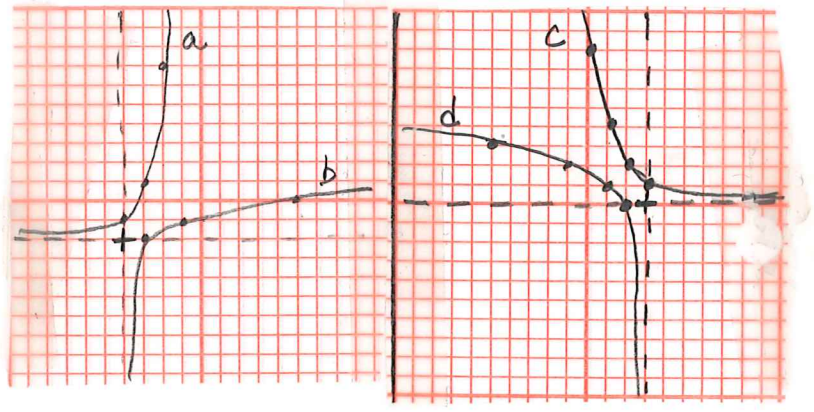
a) Create a scatter plot of the data.

b) Find a model for the data using both an exponential regression and a logarithmic regression. Which one fits better?

c) Graph the equation that fits better. If the drug must have at least 300 units per milliliter to be effective, what is the shelf life of the drug?

ALGEBRA II REVIEW ANSWERS

1.



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

3. (a) –3 (b) $\frac{1}{7}$ (c) $-\frac{4}{5}$ (d) 191 (e) 77 (f) 212

4. (a) 27 (b) $\frac{1}{36}$ (c) 10 (d) $-\frac{2}{3}$

5. (a) 108 (b) 3 (c) 14 (d) 3 (e) $2^{\frac{1}{2}}$ or $\sqrt{2}$ (f) 4

6. (a) 2.61 (b) 1.75

7. (a) $\frac{2\log 36.2}{\log 4.5} \approx 4.77$ (b) $\frac{\frac{\log 53}{\log 2}+1}{5} \approx 1.35$

(c) $\frac{e^5-1}{2} \approx 73.71$ (d) $\frac{\ln 3-5}{3} = -1.30$

(e) $\frac{e^9-4}{14} \approx 578.51$

8. 2005

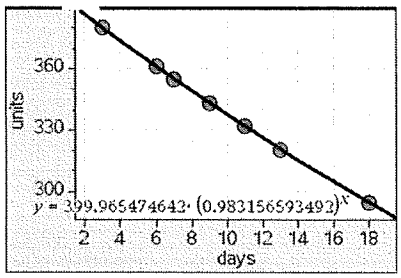
9. 215 years

10. 2.52 days

11. 17,523 years

12.

(a)



(b) Exponential: $y = 399.9655 * .9832^x$

$r = -.9999$

Logarithmic: $y = 440.4731 + -46.7874 \ln x$

$r = -.9692$

Exponential function is best.

(c) Approximately 17 days (Set $y = 300$ & Intersect)