Name: _____ Date: _____ Calc. #: _____
Period: _____

Review Logs

Write the inverse. 1) $f(x)=\log_3 x$ 2) $f(x)=4^x$

3) $f(x)=2^x$ 4) $f(x)=\log_8 x$

Write as a single log.

5) $\left(\log x+\frac{1}{2}\log y\right)-\log z$ 6) $(\log x+2\log y)-\frac{1}{2}\log z$ 7) $\frac{1}{3}(2\ln x+\ln y)-3\ln z$

Expand each log.

8) $\log\frac{(xy)^2}{z}$ 9) $\ln\frac{x}{\sqrt{yz}}$ 10) $\log\frac{x\sqrt{y}}{z}$

Algebraically solve for x:

11) $\log_9 81=2x+3$ 12) $\log_{64} x=\frac{-1}{3}$ 13) $\log_3 27=x+1$

14) $\log_{32}\frac{1}{8}=x-1$ 15) $\log_{125} x=\frac{2}{3}$ 16) $\log_2\frac{1}{16}=x+4$

Solve the equation for x, Round *to the nearest hundredth*, if necessary.

17) $\log_x(4x+12)=2$ 18) $\log_{(x-1)}36=2$

19) $\log(x)+\log(x-9)=1$ 20) $\log_3(x+4)+\log_3(x-2)=3$

21) $\log_6(x-3)+\log_6(x+2)=1$ 22) $\log_2(x+4)-\log_2(x-3)=3$

23) $7^{3x}=20$ 24) $9^{2x+1}=15$

25) $5(4)^{3x-1}=60$ 26) $e^{x-4}=8$

27) $2e^{x+5}=14$ 28) $5e^{x-2}+10=55$

Solve for x:

29) $a(e)^{bx}=c$ 30) $y=m(e)^{x+a}$

Algebraically solve the following:

31) How long will it take, to *the nearest tenth of a year*, $2000 to double if it is in invested at 4% if it is compounded semi-annually?

32) In how many years, *to the nearest tenth of a year*, will $500 amount to $750 at 3% compounded monthly?

33) A flock of birds has been exposed to a bad virus in 1987. Since that time the flock has diminished according to the equation $N = 4200(.72)^t$, where *N* is the number of birds and *t* is the time in years since 1987. During which year to the *nearest year* would you expect to find the flock to been reduced to 1500?

34) A radioactive substance decays according to the equation $Q = Q_o(.93)^{2t}$, where *t* is hours. If there is 100 grams of the original substance, find the when half of the substance remains, *to the nearest tenth.*

35) A colony of bacteria doubles in size every 30 min. How long will it take for a colony of 50 bacteria to grow to a population of 8,000 to the *nearest minute*?

36) Strontium-90 has a half-life of 25 years. How long to the *nearest tenth* of a year would it take for 50 mg of it to decay to 3.5 mg

37) Steve invests $8,000 at an annual rate of 6% compounded continuously, according to the formula $A=Pe^{rt}$, where A is the amount, P is the principal, r is the rate of interest and t is the time in years.

a) Determine, the amount on interest, *to the nearest cent*, will he have after 4 years.

b) Determine how many years, *to the nearest year*, it will take for his initial investment to double.

38) Frida receives $8920 and invests it for 8 years compounded continuously. Find the rate needed to the *nearest tenth* of a percent for her investment to reach $12,000?

For the given information find the following:

a) Describe the transformational shift from the parent function.
b) Find the y-intercept.
c) Write the domain in *interval notation*.
d) Write an equation for the asymptote.
e) Find the x-intercept.
f) Based on the information, sketch the graph.

39) $y = \log_4(x+4) - 2$ 40) $y = \log_2(x+8) + 3$ 41) $y = \log_3(x+9) - 2$

42) Jean invested $380 in stocks. Over the next 5 years, the value of her investment grew, as shown in the accompanying table.

a) Write the exponential regression equation for this set of data, rounding all values to the *nearest hundredth*.

b) Using this equation, find the value of her stock, to the *nearest dollar*, 10 years' after her initial purchase.

Years Since Investment (x)	Value of Stock, in Dollars (y)
0	380
1	395
2	411
3	427
4	445
5	462

c) To the *nearest year*, when will Jean's stock be worth $5000?

If a = log 2 and b = log 3, write the expression in terms of a and b.

43) log 18 44) log 72 45) $\log\frac{6}{27}$

Name: _____ Date: _____ Calc #: _____
Period: _____

Review Logs

Write the inverse.

1) $f(x)=\log_3 x$

$x=\log_3 y$

$y=3^x$

2) $f(x)=4^x$

$x=4^y$

$y=\log_4 x$

3) $f(x)=2^x$

$x=2^y$

$y=\log_2 x$

4) $f(x)=\log_8 x$

$x=\log_8 y$

$y=8^x$

Write as a single log.

5) $\left(\log x+\frac{1}{2}\log y\right)-\log z$

$\log \frac{x\sqrt{y}}{z}$

6) $(\log x+2\log y)-\frac{1}{2}\log z$

$\log \frac{xy^2}{\sqrt{z}}$

7) $\frac{1}{3}(2\ln x+\ln y)-3\ln z$

$\ln \frac{\sqrt[3]{x^2y}}{z^3}$

Expand each log.

8) $\log\frac{(xy)^2}{z}$

$2(\log x+\log y)-\log z$

9) $\ln\frac{x}{\sqrt{yz}}$

$\ln x-\frac{1}{2}(\ln y+\ln z)$

10) $\log\frac{x\sqrt{y}}{z}$

$(\log x+\frac{1}{2}\log y)-\log z$

Algebraically solve for x:

11) $\log_9 81=2x+3$

$9^{2x+3}=81$

$3^{2(2x+3)}=3^4$

$4x+6=4$

$-6\ \ -6$

$\frac{4x}{4}=\frac{-2}{4}$

$x=-\frac{1}{2}$

12) $\log_{64} x=\frac{-1}{3}$

$64^{-\frac{1}{3}}=x$

$.25=x$

13) $\log_3 27=x+1$

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

$x+1=3$

$-1\ \ -1$

$x=2$

14) $\log_{32}\frac{1}{8}=x-1$

$32^{x-1}=\frac{1}{8}$

$(2^5)^{x-1}=2^{-3}$

$5x-5=-3$

$+5\ \ +5$

$\frac{5x}{5}=\frac{2}{5}$

$x=\frac{2}{5}$

15) $\log_{125} x=\frac{2}{3}$

$125^{\frac{2}{3}}=x$

$25=x$

16) $\log_2\frac{1}{16}=x+4$

$2^{x+4}=\frac{1}{16}$

$2^{x+4}=2^{-4}$

$x+4=-4$

$-4\ \ -4$

$x=-8$

(Answers on separate sheet)

Solve the equation for x, Round to the nearest hundredth, if necessary.

17) $\log_x(4x+12)=2$

$x=6$

18) $\log_{(x-1)}36=2$

$x=7$

19) $\log(x)+\log(x-9)=1$

$x=10$

20) $\log_3(x+4)+\log_3(x-2)=3$

$x=5$

21) $\log_6(x-3)+\log_6(x+2)=1$

$x=4$

22) $\log_2(x+4)-\log_2(x-3)=3$

$x=4$

23) $7^{3x}=20$

$x=.51$

24) $9^{2x+1}=15$

$x=.12$

25) $5(4)^{3x-1}=60$

$x=.93$

26) $e^{x-4}=8$

$x=6.08$

27) $2e^{x+5}=14$

$x=-3.05$

28) $5e^{x-2}+10=55$

$x=4.20$

Solve for x:

29) $\frac{a(e)^{bx}}{a}=\frac{c}{a}$

$e^{bx}=\frac{c}{a}$

$\frac{bx\ln e}{b}=\frac{\ln(\frac{c}{a})}{b}$

$x=\frac{\ln(\frac{c}{a})}{b}$

30) $\frac{y}{m}=\frac{m(e)^{x+a}}{m}$

$\frac{y}{m}=e^{x+a}$

$\ln\frac{y}{m}=x+a\ln e$

$-a\ \ -a$

$\ln\frac{y}{m}-a=x$

Algebraically solve the following:

31) How long will it take, to *the nearest tenth of a year*, $2000 to double if it is in invested at 4% if it is compounded semi-annually?

$t = 17.5$ yrs.

32) In how many years, *to the nearest tenth of a year*, will $500 amount to $750 at 3% compounded monthly?

$t = 13.5$ yrs.

33) A flock of birds has been exposed to a bad virus in 1987. Since that time the flock has diminished according to the equation $N = 4200(.72)^t$, where N is the number of birds and t is the time in years since 1987. During which year to the *nearest year* would you expect to find the flock to been reduced to 1500?

1990

34) A radioactive substance decays according to the equation $Q = Q_o(.93)^{2t}$, where t is hours. If there is 100 grams of the original substance, find the when half of the substance remains, *to the nearest tenth.*

$t = 4.8$ yrs.

35) A colony of bacteria doubles in size every 30 min. How long will it take for a colony of 50 bacteria to grow to a population of 8,000 to the *nearest minute*?

$t = 270$ min.

36) Strontium-90 has a half-life of 25 years. How long to the *nearest tenth* of a year would it take for 50 mg of it to decay to 3.5 mg

$t = 95.9$ yrs.

37) Steve invests $8,000 at an annual rate of 6% compounded continuously, according to the formula $A=Pe^{rt}$, where A is the amount, P is the principal, r is the rate of interest and t is the time in years.

a) Determine, the amount on interest, *to the nearest cent*, will he have after 4 years.

$10169.99

b) Determine how many years, *to the nearest year*, it will take for his initial investment to double.

$t = 12$ yrs.

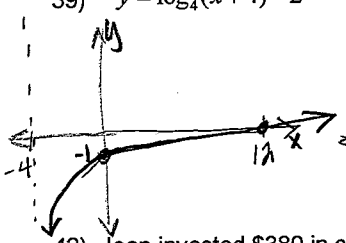
38) Frida receives $8920 and invests it for 8 years compounded continuously. Find the rate needed to the *nearest tenth* of a percent for her investment to reach $12,000?

3.7%

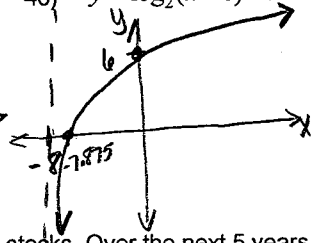
For the given information find the following:

a) Describe the transformational shift from the parent function.
b) Find the y-intercept.
c) Write the domain in *interval notation*.
d) Write an equation for the asymptote.
e) Find the x-intercept.
f) Based on the information, sketch the graph.

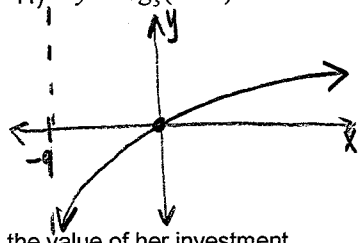
39) $y = \log_4(x+4) - 2$



40) $y = \log_2(x+8) + 3$



41) $y = \log_3(x+9) - 2$



42) Jean invested $380 in stocks. Over the next 5 years, the value of her investment grew, as shown in the accompanying table.

Years Since Investment (x)	Value of Stock, in Dollars (y)
0	380
1	395
2	411
3	427
4	445
5	462

a) Write the exponential regression equation for this set of data, rounding all values to the *nearest hundredth*.

$y = 379.92(1.04)^x$

b) Using this equation, find the value of her stock, to the *nearest dollar*, 10 years' after her initial purchase.

$y = 379.92(1.04)^{10} = \$562.37$

c) To the *nearest year*, when will Jean's stock be worth $5000?

$\frac{5000}{379.92} = \frac{379.92(1.04)^x}{379.92}$

$13.1606 = (1.04)^x$

$\log 13.1606 = x \log 1.04$

$\frac{\log 13.1606}{\log 1.04} = \frac{x \log 1.04}{\log 1.04}$

$66 \text{ yrs.} = x$

If a = log 2 and b = log 3, write the expression in terms of a and b.

43) log 18

$\log 3^2 \cdot 2$

$2\log 3 + \log 2$

$2b + a$

44) log 72

$\log 3^2 \cdot 2^3$

$2\log 3 + 3\log 2$

$2b + 3a$

45) $\log \frac{6}{27}$

$\log \frac{2 \cdot 3}{3^3}$

$\log 2 + \log 3 - 3\log 3$

$a + b - 3b$

$a - 2b$

17. $x^2 = 4x + 12$

$-4x - 12 \quad -4x - 12$

$x^2 - 4x - 12 = 0$

$(x - 6)(x + 2) = 0$

$\boxed{x = 6} \quad x = -2$

18. $\sqrt{(x-1)^2} = \sqrt{36}$

$x - 1 = \pm 6$

$+1 \quad +1$

$\boxed{x = 7} \quad -5$

19. $\log_{10}(x)(x-9) = 1$

$10^1 = (x)(x-9)$

$10 = x^2 - 9x$

$-10 \quad -10$

$0 = x^2 - 9x - 10$

$0 = (x - 10)(x + 1)$

$\boxed{x = 10} \quad x = -1$

20. $\log_3(x+4)(x-2) = 3$

$3^3 = (x+4)(x-2)$

$27 = x^2 - 2x + 4x - 8$

$27 = x^2 + 2x - 8$

$-27 \quad -27$

$0 = x^2 + 2x - 35$

$0 = (x + 7)(x - 5)$

$x = -7 \quad \boxed{x = 5}$

21. $\log_6(x-3)(x+2) = 1$

$6^1 = (x-3)(x+2)$

$6 = x^2 + 2x - 3x - 6$

$6 = x^2 - 1x - 6$

$-6 \quad -6$

$0 = x^2 - 1x - 12$

$0 = (x - 4)(x + 3)$

$\boxed{x = 4} \quad x = -3$

22. $\log_2(x+4)(x-3) = 3$

$2^3 = (x+4)(x-3)$

$8 = x^2 - 3x + 4x - 12$

$8 = x^2 + 1x - 12$

$-8 \quad -8$

$0 = x^2 + 1x - 20$

$0 = (x + 5)(x - 4)$

$x = -5 \quad \boxed{x = 4}$

23. $7^{3x} = 20$

$\frac{3x \log 7}{3 \log 7} = \frac{\log 20}{3 \log 7}$

$\boxed{x = .51}$

24. $9^{2x+1} = 15$

$\frac{(2x+1)\log 9}{\log 9} = \frac{\log 15}{\log 9}$

$2x + 1 = 1.2325$

$-1 \quad -1$

$\frac{2x}{2} = \frac{.2325}{2}$

$\boxed{x = .12}$

25. $\frac{5(4)^{3x-1}}{5} = \frac{60}{5}$

$(4)^{3x-1} = 12$

$\frac{(3x-1)\log 4}{\log 4} = \frac{\log 12}{\log 4}$

$3x - 1 = 1.7925$

$+1 \quad +1$

$\frac{3x}{3} = \frac{2.7925}{3}$

$\boxed{x = .93}$

26. $e^{x-4} = 8$

$x - 4 \ln e = \ln 8$

$+4 \quad +4$

$\boxed{x = 6.08}$

27. $\frac{2e^{x+5}}{2} = \frac{14}{2}$

$e^{x+5} = 7$

$x + 5 \ln e = \ln 7$

$-5 \quad -5$

$\boxed{x = -3.05}$

28. $5e^{x-2} + 10 = 55$

$-10 \quad -10$

$\frac{5e^{x-2}}{5} = \frac{45}{5}$

$e^{x-2} = 9$

$x - 2 \ln e = \ln 9$

$+2 \quad +2$

$\boxed{x = 4.20}$

31. $\frac{4000}{2000} = \frac{2000}{2000}\left(1 + \frac{.04}{1}\right)^{2t}$

$2 = (1.02)^{2t}$

$\frac{\log 2}{2\log 1.02} = \frac{2t \log 1.02}{2\log 1.02}$

$17.5_{\text{yrs}} = t$

32. $\frac{750}{500} = \frac{500}{500}\left(1 + \frac{.03}{12}\right)^{12t}$

$1.5 = (1.0025)^{12t}$

$\frac{\log 1.5}{12\log 1.0025} = \frac{12t \log 1.0025}{12\log 1.0025}$

$13.5_{\text{yrs}} = t$

33. $\frac{1500}{4200} = \frac{4200(.72)^t}{4200}$

$.3571 = (.72)^t$

$\frac{\log .3571}{\log .72} = \frac{t \log .72}{\log .72}$

$3_{\text{yrs}} = t \rightarrow 1990$

34. $\frac{50}{100} = \frac{100(.93)^{2t}}{100}$

$.5 = (.93)^{2t}$

$\frac{\log .5}{2\log .93} = \frac{2t \log .93}{2\log .93}$

$4.8_{\text{yrs}} = t$

35. $\frac{8000}{50} = \frac{50(2)^{\frac{t}{30}}}{50}$

$160 = (2)^{\frac{t}{30}}$

$\frac{\log 160}{\log 2} = \frac{\frac{t}{30}\log 2}{\log 2}$

$\frac{7.3219}{1} = \frac{t}{30}$

$t = 220$ min.

36. $\frac{3.5}{50} = \frac{50(.5)^{\frac{t}{25}}}{50}$

$.07 = (.5)^{\frac{t}{25}}$

$\frac{\log .07}{\log .5} = \frac{\frac{t}{25}\log .5}{\log .5}$

$\frac{3.8365}{1} = \frac{t}{25}$

$t = 95.9$ yrs.

37. a. $A = 8000e^{.06(4)}$

$= \boxed{\$10169.99}$

b. $\frac{16000}{8000} = \frac{8000e^{.06t}}{8000}$

$2 = e^{.06t}$

$\frac{\ln 2}{.06} = \frac{.06t \ln e}{.06}$

$\boxed{12 \text{ yrs} = t}$

38. $\frac{12000}{8920} = \frac{8920e^{r(8)}}{8920}$

$1.3453 = e^{8r}$

$\frac{\ln 1.3453}{8} = \frac{8r \ln e}{8}$

$.0371 = r \rightarrow \boxed{3.7\%}$

39. a. left 4, down 2

b. $y = \log_4(0+4) - 2$

$\boxed{y = -1}$

c. $\boxed{(-4, \infty)}$

d. $\boxed{x = -4}$

e. $0 = \log_4(x+4) - 2$

$+2 \quad +2$

$2 = \log_4(x+4)$

$4^2 = x+4$

$-4 \quad -4$

$\boxed{12 = x}$

40. a. left 8, up 3

b. $y = \log_2(0+8)+3$

$\boxed{y = 6}$

c. $\boxed{(-8, \infty)}$

d. $\boxed{x = -8}$

e. $0 = \log_2(x+8)+3$

$-3 \quad -3$

$-3 = \log_2(x+8)$

$2^{-3} = x+8$

$-8 \quad -8$

$\boxed{-7.875 = x}$

41. a. left 9, down 2

b. $y = \log_3(0+9) - 2$

$y = \log_3(9) - 2$

$\boxed{y = 0}$

c. $\boxed{(-9, \infty)}$

d. $\boxed{x = -9}$

e. $0 = \log_3(x+9) - 2$

$+2 \quad +2$

$2 = \log_3(x+9)$

$3^2 = x+9$

$9 = x+9$

$-9 \quad -9$

$\boxed{0 = x}$