

**Calculator Allowed.** Answer the following questions in the space provided. Show all work for full credit. You may use your calculator.

1. Evaluate the logarithm:  $\log(1241) = \underline{3.094}$

2. Evaluate the logarithm:  $\log_5(38) = \underline{2.26}$

3. Evaluate the logarithm:  $\ln(35) = \underline{3.555}$

4. Solve for  $x$  algebraically and show all work. Round your answers to three decimal places.

A)  $2^{3x-5} + 200 = 1000$

4

$$2^{3x-5} = 800$$

$$\log_2(800) = 3x-5$$

$$9.644 = 3x-5$$

$$x = 4.881$$

B)  $2(10)^{x-3} - 4 = 50$

4

$$2(10)^{x-3} = 54$$

$$10^{x-3} = 27$$

$$\log(27) = x-3$$

$$1.431 = x-3$$

$$x = 4.431$$

C)  $\ln(2x+5) = 3$

4

$$2x+5 = e^3$$

$$2x+5 = 20.0855$$

$$x = 7.543$$

D)  $\log_5(4x+11) - \log_5(x) = 3$

4

$$\log_5\left(\frac{4x+11}{x}\right) = 3$$

$$125 = \frac{4x+11}{x}$$

$$125x = 4x+11$$

$$121x = 11$$

$$x = \frac{11}{121}$$

5. During a vigorous spraying program the mosquito population was reduced to  $3/4$  of its previous size every three weeks. If the original mosquito population was estimated at 300,000 mosquitoes, answer the following.

A) Write an equation for the number of mosquitoes after  $t$  weeks have passed.

4

$$P = 300000\left(\frac{3}{4}\right)^{t/3}$$

B) How many mosquitoes remained after 5 weeks of spraying?

2

$$P = 300000\left(\frac{3}{4}\right)^{5/3} = 185,733$$

6. Write the equation of the exponential function with points (2, 4) and (5, 256)

4

$$3 < \frac{2}{5} > 64$$

$$P = a(64)^{x/3}$$

$$4 = a(64)^{2/3}$$

$$a = \frac{1}{4}$$

$$P = \frac{1}{4}(64)^{x/3}$$

7. In 2001, the average annual cost of a public college was \$12,075 and the costs were rising 6% a year.

A) Complete the table, assuming  $t$  represents the number of years after 2001 ( $t=0$  represents 2001).

$t$	0	1	2	3
$C(t)$	12075	12799.50	13567.47	14381.52

B) Write a formula for  $C(t)$ , the average annual cost of college  $t$  years after 2001.

$$C = 12075(1.06)^t$$

C) If the trend continued, what would be the average annual cost in 2017?

$$\$ 30674.75$$

8. A car's value, in dollars, after  $t$  years is given by the exponential function,  $V(t) = 32000\left(\frac{4}{5}\right)^t$ .

A) What is the original value of the car? (or, what was its value when brand new?)

$$\$ 32000$$

B) Find  $V(2)$ . Explain what this point represents in this problem situation.

$$24180 \text{ after 2 years, value is } \$20480$$

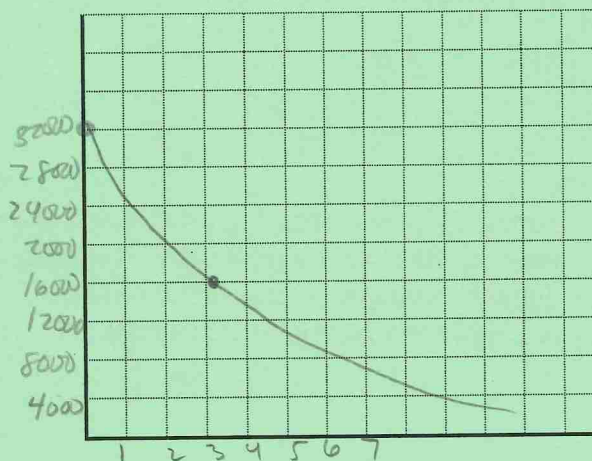
C) When will the car be worth half of its original value?

$$16000 = 32000\left(\frac{4}{5}\right)^t$$

$$\frac{1}{2} = \left(\frac{4}{5}\right)^t$$

$$t = \log_{\left(\frac{4}{5}\right)} \frac{1}{2} \quad \frac{4}{5} = 0.8$$

D) Sketch the graph of the function.



9. You invest \$7500 in an account paying 4% interest compounded continuously. ( $A = Pe^{rt}$ )

A) Find the amount in your account after 3 years.

$$A = 7500e^{.04(3)} = \$8456.23$$

B) How long will it take for you to have \$10000 in your account?

$$10000 = 7500e^{.04t}$$

$$t = 7.19 \text{ years}$$

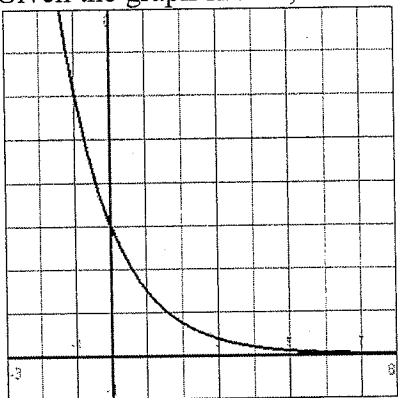
**NO CALCULATOR:** Answer the following questions in the space provided. Show all work for full credit.

- 3 1. Does the equation  $y = 10(\frac{1}{2})^x$  represent exponential growth or decay? decay

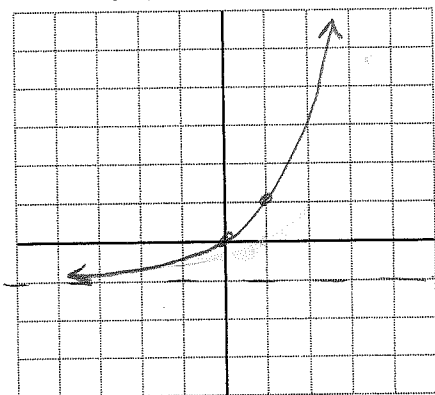
Why?  $b < 1$

- 2 2. What is the y-intercept of  $y = 10(\frac{1}{2})^x$ ?  $(0, 10)$

- 3 3. Given the graph shown, what is the equation of the graph?  $y = 3(\frac{1}{2})^x$



- 3 4. Sketch a graph of  $y = 2^x - 1$ .



- 2 5. Rewrite  $\log_t(8) = m$  in exponential form.  $t^m = 8$

- 2 6. Rewrite  $8^5 = 32768$  in logarithmic form.  $\log_8(32768) = 5$

- 2 7. Evaluate the logarithm:  $\ln(1) =$  0

- 2 8. Evaluate the logarithm:  $\log_4(64) =$  3

- 3 9. Solve algebraically:  $\log_3(5x - 4) = 4$

$$3^4 = 5x - 4$$

$$81 = 5x - 4$$

$$85 = 5x$$

$$17 = x$$

10. A) Use the properties of logarithms to rewrite  $\log(4h) + 3\log(d)$  as a single logarithm.

3

$$\log(4hd^3)$$

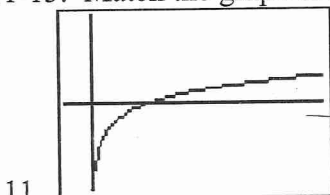
- B) Use the properties of logarithms to expand  $\log_2\left(\frac{x}{y^5}\right)$

3

$$\log_2(x) - 5\log_2(y)$$

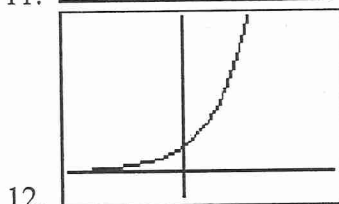
- 11-13. Match the graph to its equation by drawing a line between them.

3



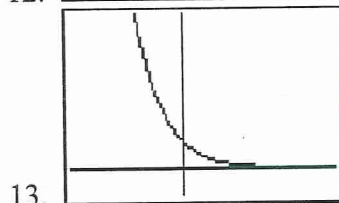
A

A)  $f(x) = \ln(x)$



C

B)  $f(x) = (0.25)^x$



B

C)  $f(x) = (2.5)^x$

- 3 14-16. Match each scenario to the appropriate graph by drawing a line between them.

14. The decibel level of sound is a logarithmic function of its intensity.

C

A)

15. The value of a vehicle depreciates every year by 11%.

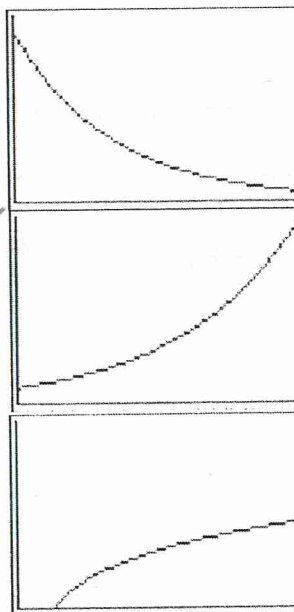
A

B)

16. The cost of a gallon of milk has grown exponentially since 1980. ( $t=0$  represents 1980)

B

C)



17. At a large community college, six students start a rumor that final exams have been cancelled. The number of students who have heard the rumor **triples** every 30 minutes. Write an equation that gives the number of students who have the rumor in terms of the time (in minutes) that has passed.

$$P = 6(3)^{t/30}$$

18. Determine whether each is a one-to-one function. If yes, find the inverses of the following:

3 A)  $g(x) = \frac{x^3 - 2}{4}$

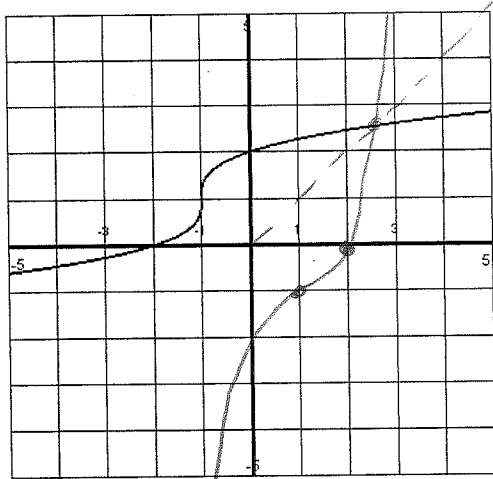
$$g^{-1}(x) = \sqrt[3]{4x + 2}$$

3 B)

x	F(x)
2	-6
-7	0
-5	3
1	9

x	$F^{-1}(x)$
-6	2
0	-7
3	-5
9	1

3 C)







56  
47  
103

**Calculator Allowed.** Answer the following questions in the space provided. Show all work for full credit. You may use your calculator.

1. Evaluate the logarithm:  $\log(2140) = \underline{3.33}$

2. Evaluate the logarithm:  $\log_5(78) = \underline{2.707}$

3. Evaluate the logarithm:  $\ln(135) = \underline{4.905}$

4. Solve for x algebraically and show all work. Round your answers to three decimal places.

4 A)  $2^{3x+1} + 20 = 200$

$2^{3x+1} = 180$

$\log_2(180) = 3x+1$

$7.492 = 3x+1$

$x = 2.164$

4 B)  $3(10)^{x-2} + 4 = 58$

$3(10)^{x-2} = 54$

$10^{x-2} = 18$

$\log(18) = x-2$

$x = 3.255$

4 C)  $\ln(2x+5) = 4$

$2x+5 = e^4$

$2x+5 = 54.598$

$2x = 49.598$

$x = 24.799$

4 D)  $\log_5(4x+7) - \log_5(x) = 2$

$\log_5\left(\frac{4x+7}{x}\right) = 2$

$25 = \frac{4x+7}{x}$

$25x = 4x+7$

$21x = 7$

$x = \frac{1}{3}$

5. During a vigorous spraying program the mosquito population was reduced to  $\frac{3}{4}$  of its previous size every four weeks. If the original mosquito population was estimated at 200,000 mosquitoes, answer the following.

4 A) Write an equation for the number of mosquitoes after t weeks have passed.

$P = 200000\left(\frac{3}{4}\right)^{t/4}$

2 B) How many mosquitoes remained after 5 weeks of spraying?

$P = 200000\left(\frac{3}{4}\right)^{5/4} = 139,591$

4 6. Write the equation of the exponential function with points (5, 3) and (10, 18)

$\frac{5}{10} \mid \frac{3}{18} \times 6$

$P = a(6)^{x/5}$

$3 = a(6)$

$a = \frac{1}{2}$

$P = \frac{1}{2}(6)^{x/5}$

7. In 2010, the average annual cost of a public college was \$14,550 and the costs were rising 7% a year.

A) Complete the table, assuming  $t$  represents the number of years after 2010 ( $t=0$  represents 2010).

3

$t$	0	1	2	3
$C(t)$	14550	15568.5	16658.30	17824.38

B) Write a formula for  $C(t)$ , the average annual cost of college  $t$  years after 2010.

3

$$C(t) = 14550(1.07)^t$$

C) If the trend continued, what would be the average annual cost in 2017?

2

$$C = 14550(1.07)^7 = \$23,364.12$$

8. A car's value, in dollars, after  $t$  years is given by the exponential function,  $V(t) = 36000\left(\frac{4}{5}\right)^t$ .

A) What is the original value of the car? (or, what was its value when brand new?)

2

$$\$36000$$

B) Find  $V(3)$ . Explain what this point represents in this problem situation.

3

$$V(3) = 36000\left(\frac{4}{5}\right)^3 = \$18432$$

after 3 years, value was \$18432.

C) When will the car be worth half of its original value?

3

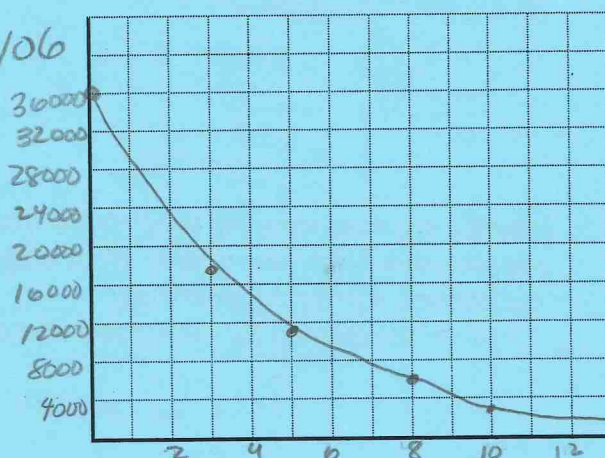
$$18000 = 36000\left(\frac{4}{5}\right)^t$$

$$\frac{1}{2} = \left(\frac{4}{5}\right)^t$$

$$t = \log_{\frac{4}{5}}\left(\frac{1}{2}\right) = 3.106$$

D) Sketch the graph of the function.

3



9. You invest \$9500 in an account paying 3% interest compounded continuously. ( $A = Pe^{rt}$ )

A) Find the amount in your account after 4 years.

2

$$A = 9500e^{.03(4)} = \$10711.22$$

B) How long will it take for you to have \$11000 in your account?

3

$$11000 = 9500e^{.03t}$$

$$1.1579 = e^{.03t}$$

$$\ln(1.1579) = .03t$$

$$t = 4.89 \text{ years}$$



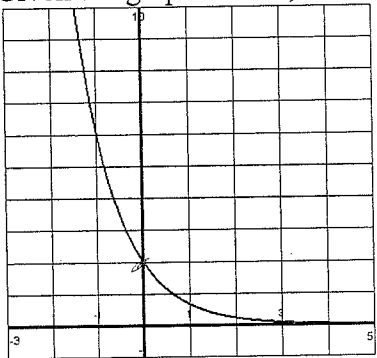
**NO CALCULATOR:** Answer the following questions in the space provided. Show all work for full credit.

1. Does the equation  $y = 40(5)^x$  represent exponential growth or decay? growth

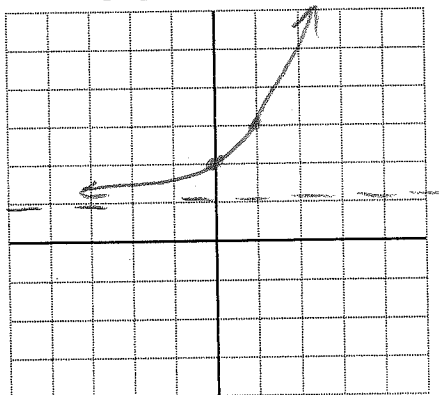
Why?  $b > 1$

2. What is the y-intercept of  $y = 40(5)^x$ ?  $(0, 40)$

3. Given the graph shown, what is the equation of the graph?  $y = 2\left(\frac{1}{3}\right)^x$



4. Sketch a graph of  $y = 2^x + 1$ .



5. Rewrite  $\log_m(8) = p$  in exponential form.  $m^p = 8$
6. Rewrite  $7^4 = 2401$  in logarithmic form.  $\log_7(2401) = 4$
7. Evaluate the logarithm:  $\log_6(36) =$  2
8. Evaluate the logarithm:  $\log(1) =$  0
9. Solve algebraically:  $\log_4(5x - 7) = 2$

$$\begin{aligned} 4^2 &= 5x - 7 \\ 16 &= 5x - 7 \\ 23 &= 5x \\ \frac{23}{5} &= x \end{aligned}$$

10. A) Use the properties of logarithms to rewrite  $2\ln(x) + \ln(3y)$  as a single logarithm.

3

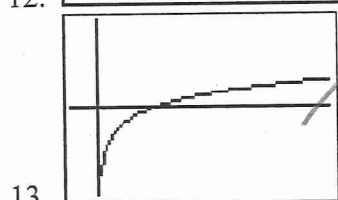
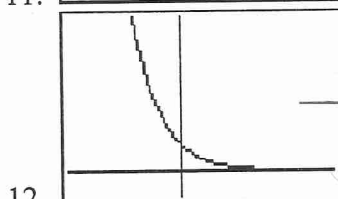
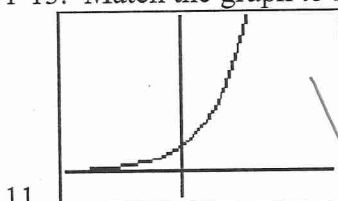
$$\ln(3x^2y)$$

- 3 B) Use the properties of logarithms to expand  $\log_4\left(\frac{m}{n^2}\right)$

$$\log_4(m) - 2\log_4(n)$$

- 11-13. Match the graph to its equation by drawing a line between them.

3



A)  $f(x) = \ln(x)$

B)  $f(x) = (0.25)^x$

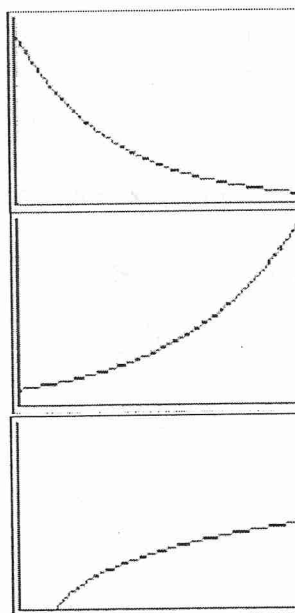
C)  $f(x) = (2.5)^x$

- 14-16. Match each scenario to the appropriate graph by drawing a line between them.

- 3 14. The percentage of American homes with computers has grown exponentially since 1994. ( $t=0$  represents 1994)

15. The value of a farm tractor depreciates every year by 9%.

16. The decibel level of sound is a logarithmic function of its intensity.



17. At a large community college, seven students start a rumor that final exams have been cancelled. The number of students who have heard the rumor **triples** every 40 minutes.  
 4 Write an equation that gives the number of students who have the rumor in terms of the time (in minutes) that has passed.

$$P = 7(3)^{t/40}$$

18. Determine whether each is a one-to-one function. If yes, find the inverses of the following:

A)  $g(x) = 3x^3 + 8$

3  $g^{-1}(x) = \sqrt[3]{\frac{x-8}{3}}$

B)

x	F(x)
-6	2
0	-7
-5	3
1	9

x	$F^{-1}(x)$
2	-6
-7	0
3	-5
9	1

C)

3

