

# Exponential and Logs Test Study Guide

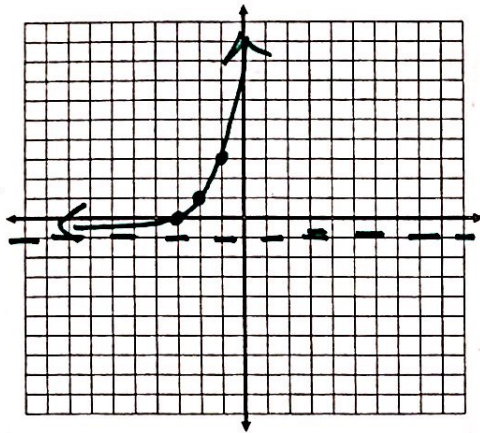
Directions: State whether the following is exponential growth or decay.

1)  $f(x) = \left(\frac{7}{8}\right)^x$  Decay

Graph the following functions.

3)  $y = 2^{x+3} - 1$

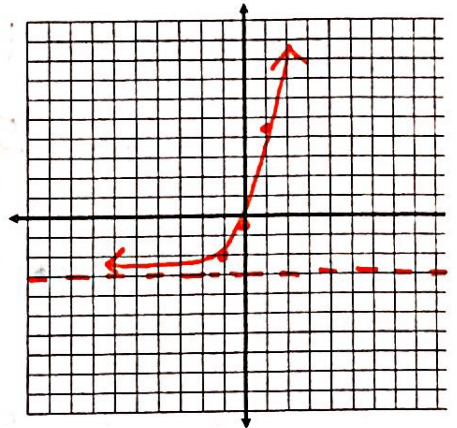
x	y
-3	0
-2	1
-1	3



2)  $f(x) = 4^{-x}$   
 $f(x) = \frac{1}{4^x}$  Decay

4)  $y = e^{x+1} - 3$

x	y
-1	-2
0	-0.3
1	4.4

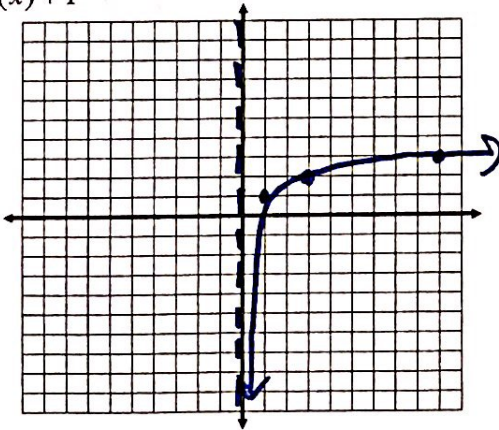


Growth or Decay? Growth  
 Transformations: Left 3, Down 1  
 Domain:  $(-\infty, \infty)$  Range:  $(-1, \infty)$   
 Asymptote:  $y = -1$   
 Increasing or Decreasing? Increasing  
 X-intercept:  $(-3, 0)$  Y-intercept:  $(0, 7)$   
 End Behavior: As  $x \rightarrow \infty$ ,  $f(x) \rightarrow \infty$   
 As  $x \rightarrow -\infty$ ,  $f(x) \rightarrow -1$

Growth or Decay? Growth  
 Transformations: Left 1, Down 3  
 Domain:  $(-\infty, \infty)$  Range:  $(-3, \infty)$   
 Asymptote:  $y = -3$   
 Increasing or Decreasing? Increasing  
 X-intercept:  $(0.01, 0)$  Y-intercept:  $(0, -0.3)$   
 End Behavior: As  $x \rightarrow \infty$ ,  $f(x) \rightarrow \infty$   
 As  $x \rightarrow -\infty$ ,  $f(x) \rightarrow -3$

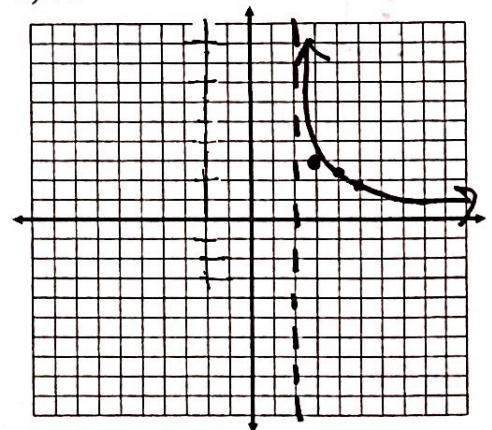
5)  $y = \log_3(x) + 1$

x	y
1	1
3	2
9	3



6)  $y = -\ln(x-2) + 3$

x	y
3	3
4	2.3
5	1.9



Transformations: Up 1  
 Domain:  $(0, \infty)$  Range:  $(-\infty, \infty)$   
 Asymptote:  $x = 0$   
 Increasing or Decreasing? Increasing  
 X-intercept:  $(\frac{1}{3}, 0)$  Y-intercept: None  
 End Behavior: As  $x \rightarrow \infty$ ,  $f(x) \rightarrow \infty$   
 As  $x \rightarrow 0$ ,  $f(x) \rightarrow -\infty$

Transformations: Reflect x-axis, Right 2, Up 3  
 Domain:  $(2, \infty)$  Range:  $(-\infty, \infty)$   
 Asymptote:  $x = 2$   
 Increasing or Decreasing? Decreasing  
 X-intercept:  $(2.1, 0)$  Y-intercept: None  
 End Behavior: As  $x \rightarrow \infty$ ,  $f(x) \rightarrow -\infty$   
 As  $x \rightarrow 2$ ,  $f(x) \rightarrow \infty$

Describe following transformations from the parent function.

7)  $y = 4(2)^{x+5} - 7$   
 Stretch of 4, Left 5, Down 7

8)  $y = 5(.67)^{x-7} + 9$   
 Stretch of 5, Right 7  
 Up 9

Solve.  
 9) The population of a hamster farm was 120 hamsters in 2003. The population grows 3.3% per year. What is the population of the hamster farm in 15 years? Round answer to the nearest hamster.

$$y = 120(1 + 0.033)^{15}$$

$$y = 195.29$$

195 hamsters

10) In 2007, you deposit \$1,230 in a bank account that compounds interest continuously at 5.3%. How long will it take you to save \$7,000?

$$7000 = \frac{1230e^{.053t}}{1230}$$

$$5.69 = e^{.053t}$$

$$\ln 5.69 = .053t$$

32.8 yrs = t

Rewrite the equation in exponential form.

11)  $\log_9 59049 = x$   

$9^x = 59049$

12)  $\log_6 \frac{1}{36} = -2$   

$6^{-2} = \frac{1}{36}$

13)  $\log_{512} \frac{1}{8} = -\frac{1}{3}$   

$512^{-\frac{1}{3}} = \frac{1}{8}$

14)  $\ln 12.2 = 2.5$   

$e^{2.5} = 12.2$

Rewrite the equation in logarithmic form.

15)  $5^4 = 625$   

$\log_5 625 = 4$

16)  $6^x = 1296$   

$\log_6 1296 = x$

17)  $v^{9x+7} = 43$   

$\log_v 43 = 9x+7$

18)  $e^3 = 20.1$   

$\ln 20.1 = 3$

Evaluate without using a calculator.

19)  $\log_3 27$   

3

20)  $\ln e^{12}$   

12

21)  $\ln \sqrt[4]{e}$   
 $\ln e^{\frac{1}{4}}$   

$\frac{1}{4}$

22)  $\ln \frac{1}{e^5}$   
 $\ln e^{-5}$   

-5

23)  $4^{\log_4 15}$   

15

24)  $\log_5 \frac{1}{125}$   
 $\log_5 5^{-3}$   

-3

25)  $e^{\ln 2x}$   

2x

26)  $3^{\log_3 2x}$   

2x

Write each expression as a single logarithm. Then simplify, if possible.

27)  $\ln 44 - \ln 12$   
 $\ln \frac{44}{12}$   

$\ln \frac{11}{3}$

28)  $\log_3 x - (5 \log_3 y + 7 \log_3 z)$   
 $\log_3 x - (\log_3 y^5 + \log_3 z^7)$   
 $\log_3 x - \log_3 (y^5 z^7)$   

$\log_3 \frac{x}{y^5 z^7}$

Expand each logarithmic expression.

29)  $\log \frac{x^2}{4y^7}$

$$\log x^2 - \log 4 - \log y^7$$

$$\boxed{2\log x - \log 4 - 7\log y}$$

30)  $\ln \frac{12x^4y^2}{5z^6}$

$$\ln 12 + \ln x^4 + \ln y^2 - \ln 5 - \ln z^6$$

$$\boxed{\ln 12 + 4\ln x + 2\ln y - \ln 5 - 6\ln z}$$

Solve the exponential equations

31)  $3^{-2m} = 3^{3m+2}$

$$-2m = 3m + 2$$

$$\begin{array}{r} -2m \\ -3m \end{array} = \begin{array}{r} 3m + 2 \\ -3m \end{array}$$

$$\frac{-5m}{-5} = \frac{2}{-5}$$

$$\boxed{m = -\frac{2}{5}}$$

33)  $216^a = 36^{2a-2}$

$$6^{3a} = 6^{2(2a-2)}$$

$$3a = 4a - 4$$

$$\begin{array}{r} 3a \\ -4a \end{array} = \begin{array}{r} 4a - 4 \\ -4a \end{array}$$

$$-a = -4$$

$$\boxed{a = 4}$$

35)  $3(2^{x+4}) = 350$

$$(2^{x+4}) = 116.7$$

$$\log_2 116.7 = x + 4$$

$$6.9 = x + 4$$

$$\boxed{2.9 = x}$$

Solve the logarithmic equations

37)  $\log 5x = \log(2x + 9)$

$$5x = 2x + 9$$

$$\begin{array}{r} 5x \\ -2x \end{array} = \begin{array}{r} 2x + 9 \\ -2x \end{array}$$

$$\frac{3x}{3} = \frac{9}{3}$$

$$\boxed{x = 3}$$

$$\begin{array}{r} -3 \\ -3 \\ \hline -2 \end{array}$$

32)  $3^{3x-2} = 81$

$$3^{3x-2} = 3^4$$

$$3x - 2 = 4$$

$$\boxed{x = 2}$$

$$\begin{array}{r} 3x - 2 \\ + 2 \end{array} = \begin{array}{r} 4 \\ + 2 \end{array}$$

34)  $2^{-p+1} = 1$

$$2^{-p+1} = 2^0$$

$$-p + 1 = 0$$

$$\begin{array}{r} -p + 1 \\ -1 \end{array} = \begin{array}{r} 0 \\ -1 \end{array}$$

$$\frac{-p}{-1} = \frac{-1}{-1}$$

36)  $2e^x + 5 = 115$

$$\frac{2e^x}{2} = \frac{110}{2}$$

$$e^x = 55$$

$$\ln 55 = x$$

$$\boxed{4.007 \approx x}$$

38)  $\ln x + \ln(x - 2) = \ln 3$

$$\ln(x^2 - 2x) = \ln 3$$

$$x^2 - 2x = 3$$

$$\begin{array}{r} x^2 - 2x \\ -3 \end{array} = \begin{array}{r} 3 \\ -3 \end{array}$$

$$x^2 - 2x - 3 = 0$$

$$(x - 3)(x + 1) = 0$$

$$\boxed{x = 3}, -1$$