Logarithms – A refresher

Here are the things to remember about logarithms:

Logarithms are exponents! Which means that $\log_b n = a$ can be re-written as $b^a = n$

Properties of logs to remember:

$$\log ab = \log a + \log b$$

$$\log \frac{a}{b} = \log a - \log b$$

$$\log a^b = b \log a$$

If $a = b$ *then* $\log a = \log b$ and vice versa

$\log a$ means $\log_{10} a$ (and is called the common log)

$\ln a$ means $\log_e a$ (and is called the natural log)

To change any log into a common log, you can use the change of base formula:

$$\log_b a = \frac{\log a}{\log b}$$

Logarithmic functions and exponential functions are inverses of each other. So, for example, $f(x) = 2^x$ and $f^{-1}(x) = \log_2 x$ are inverses. The inverse of $g(x) = e^x$ is $g^{-1}(x) = \ln x$

To solve an equation with logs, condense both sides of the equation and either re-write in exponential form (i.e. $\log_b n = a$ becomes $b^a = n$) or, if you have $\log a = \log b$, then you can state that $a = b$ and solve it that way.

Let's try some problems!

Log Refresher Practice

1) If $\log_x 9 = -2$, what is the value of x?

A) $\frac{1}{3}$ B) 3 C) $\frac{1}{81}$ D) 81

2) The value of $e^{3 \ln 4}$ is

A) 12 B) 64 C) e^{12} D) $\ln 12$

3) Which logarithmic equation is equivalent to $L^m = E$?

A) $\log_E L = m$ B) $\log_E m = L$ C) $\log_m E = L$ D) $\log_L E = m$

4) Find the value of $\log_3 \frac{1}{3}$.

5) Find the value of x: $\log_9 (x) = \frac{3}{2}$

6) Find the value of x: $\log_4 (3x + 1) = 2$

7) Solve for x: $\log_x 3 = \frac{1}{2}$

8) Solve for x: $\log_x \frac{1}{16} = -2$

Questions 9 and 10 refer to the following:

Evaluate the given expression without using a calculator.

9) $\log_2 64 \cdot \log_9 27$

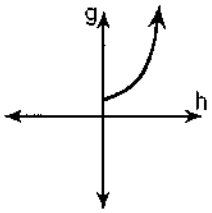
10) $2 \ln e - \ln \frac{1}{e}$

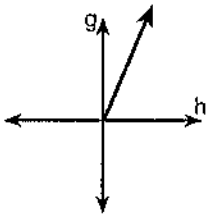
11) Find the value of the given expression correct to the nearest hundredth.

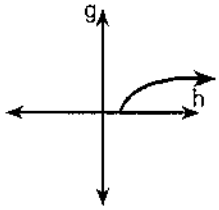
$$\frac{2 \ln 21 - \ln \sqrt{7}}{\ln 4}$$

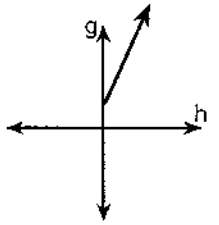
12) If $\log_{(a+1)} 27 = 3$, find the value of a.

13) The cells of a particular organism increase logarithmically. If g represents cell growth and h represents time, in hours, which graph *best* represents the growth pattern of the cells of this organism?

A) 

B) 

C) 

D) 

14) Which of the following is the inverse relation of $y = \log_4 x$?

A) $y^4 = x$ B) $x^4 = y$ C) $4^y = x$ D) $4^x = y$

15) An asymptote for the graph of $f(x) = \ln x$ is

A) $y = -x$ B) $y = x$ C) $x = 0$ D) $y = 0$

16) The expression $\log 12$ is equivalent to

A) $\log 3 + 2 \log 2$ B) $\log 3 \cdot \log 4$ C) $\log 3 - 2 \log 2$ D) $\log 6 + \log 6$

17) The expression $\ln(\sqrt{x}\,\sqrt[3]{y})$ is equivalent to

A) $\frac{1}{2}\ln x + \frac{1}{3}\ln y$ B) $\frac{1}{6}(\ln x + \ln y)$ C) $\frac{1}{2}\ln x - \frac{1}{3}\ln y$ D) $\frac{1}{6}\ln(xy)$

18) The expression $\log a + \frac{1}{2}\log b$ is equivalent to

A) $\log (a + \sqrt{b})$

B) $\log a\sqrt{b}$

C) $(\log a)(\frac{1}{2}\log b)$

D) $\log \sqrt{ab}$

19) The expression $\ln (\frac{6}{e^{3x}})$ is equivalent to

A) $\frac{\ln 6}{3x}$

B) $\ln 6 - x^3$

C) $\ln 6 - 3x$

D) $6 - 3x$

20) The expression $\log_5 \sqrt{\frac{M^3}{N}}$ is equivalent to

A) $\frac{3}{2}(3 \log_5 M - \log_5 N)$

B) $\frac{1}{2}\log_5 M - 3 \log_5 N$

C) $\frac{3}{2} 3 \log_5 M - \log_5 N$

D) $\frac{1}{2}(3 \log_5 M - \log_5 N)$

21) The expression $\frac{1}{3}\log (a) - 3 \log (b)$ is equivalent to

A) $\log \frac{\sqrt[3]{a}}{b^3}$

B) $\log \frac{a}{3b^3}$

C) $\log (\sqrt[3]{a} - b^3)$

D) $\log \frac{\sqrt[3]{a}}{3b}$

22) Which of the following equations is equivalent to $x \log 3 + 7 \log 3 = 3 \log 5$?

A) $3^{7x} = 5^3$

B) $3^{x+7} = 5^3$

C) $(x + 7)^3 = 125$

D) $3x + 21 = 15$

23) Given that $\log_2 3 = x$, $\log_2 5 = y$, and $\log_2 7 = z$, what is $\log_2 \frac{15}{7}$ expressed in terms of x, y, and z?

A) $1 + x - z$

B) $\frac{xy}{z}$

C) $x + y - z$

D) $2^x \cdot 2^y \div 2^z$

24) If $\log a = x$ and $\log b = y$, what is $\log a\sqrt{b}$?

A) $x + 2y$ B) $\frac{x+y}{2}$ C) $2x + 2y$ D) $x + \frac{y}{2}$

25) If $\log a = 2$ and $\log b = 3$, what is the numerical value of $\log \frac{\sqrt{a}}{b^3}$?

A) 25 B) -25 C) -8 D) 8

26) Which of the following statements are true?

I. $\log(3 \cdot 5) = 3 \log 5$
II. $\log(3 \cdot 5) = \log 3 + \log 5$
III. $\log(3 \cdot 5) = \log 3 \cdot \log 5$
IV. $\log(3 \cdot 5) = \log 15$

A) *I*, only
B) *II*, *III*, and *IV*, only
C) *I*, *II*, and *III*, only
D) *II* and *IV*, only

27) Solve for x: $\log_x 4 + \log_x 9 = 2$

A) 6 B) 6.5 C) 18 D) $\sqrt{13}$

28) Solve for x: $\log(x - 3) = (\log x - \log 2)$

A) $\frac{3+\sqrt{11}}{2}$ B) $\frac{5}{2}$ C) 6 D) (2, 1)

29) Solve for x: $\log_2 (x - 3) + \log_2 (x + 1) = 5$

A) {-7, 5} B) 7, only C) {-5, 7} D) 5, only

30) If $\log(x - 3) + \log(x + 4) - \log x = \log 5$, then the solution set for x is

A) $\{-2, 6\}$ B) $\{-6, 2\}$ C) $\{2, 6\}$ D) $\{6\}$

31) Solve for x to the nearest tenth: $4^x = 28$

32) Solve for x to the nearest tenth: $6^{2x-1} = 73$

33) Solve for x: $\log_3(x^2 - 4) - \log_3(x + 2) = 2$

34) Solve the given equation for x. [*Express the solution correct to the nearest hundredth.*]

$\ln(2x) = 5$

1) A 2) B 3) D

4) -1

5) 27

6) 5

7) 9

8) 4

9) 9

10) **3**

11) 3.69

12) 2

13) C 14) D 15) C 16) A 17) A

18) B 19) C 20) D 21) A 22) B

23) C 24) D 25) C 26) D 27) A

28) C 29) B 30) D

31) 2.4

32) 1.7

33) 11

34) 74.21