Exponential and Logarithmic Functions Lesson #9: Practice Test

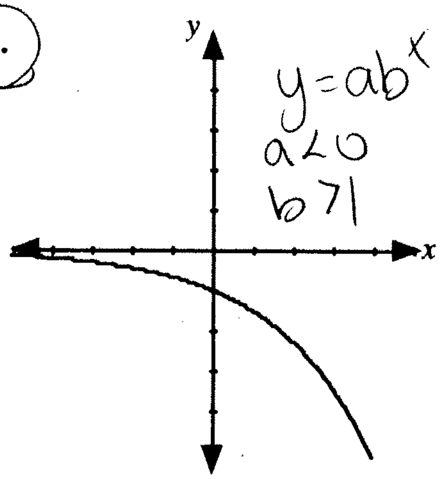
Section A *No calculator may be used for this section of the test.*

a less than 0

1. The graph that best represents $y = ab^x$, where $a < 0$ and $b > 1$, is

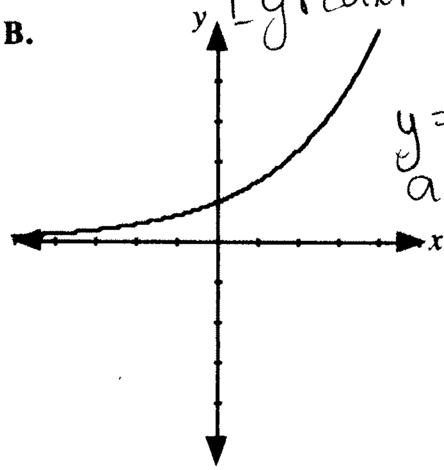
greater than 1

A.



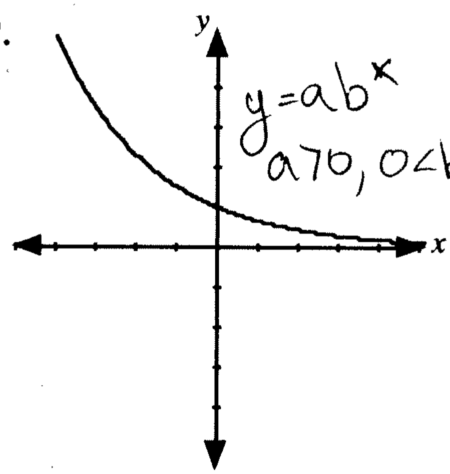
$y = ab^x$
$a < 0$
$b > 1$

B.



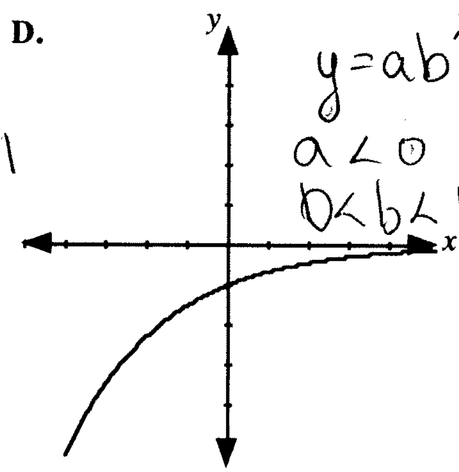
$y = ab^x$
$a > 0, b > 1$

C.



$y = ab^x$
$a > 0, 0 < b < 1$

D.



$y = ab^x$
$a < 0$
$0 < b < 1$

2. The exact value of $\log_4 16$ is

A. 0.5

B. 2

C. 4

D. none of A, B, or C

$\log_4 16 = v$

$16 = 4^v$ or ask $4^x = 16$?

$v = 2$

3. The domain of the function $g(x) = \log_3(x + 4) + 2$ is

HT 4 u left ∴ $x \to x+4$

$x > -4$.

A. $x > 0, x \in R$

B. $x > 2, x \in R$

C. $x > -4, x \in R$

D. $x \in R$

4. The equation of the asymptote of the graph of $y = \log(x - 5) + 6$ is

five units right

A. $x = 6$

B. $x = 5$

C. $x = 0$

D. $x = -5$

5. The approximate value of $\log_5 31$ is

$\log_5 25 = 2$

$\log_5 125 = 3$

A. 0.2

B. 2.1

C. 6.1

D. 26

Numerical Response

1. The diagram shows part of the graph of $y = \log_b(x - a)$ where $a, b \in N$.

method 2: use algebra S1

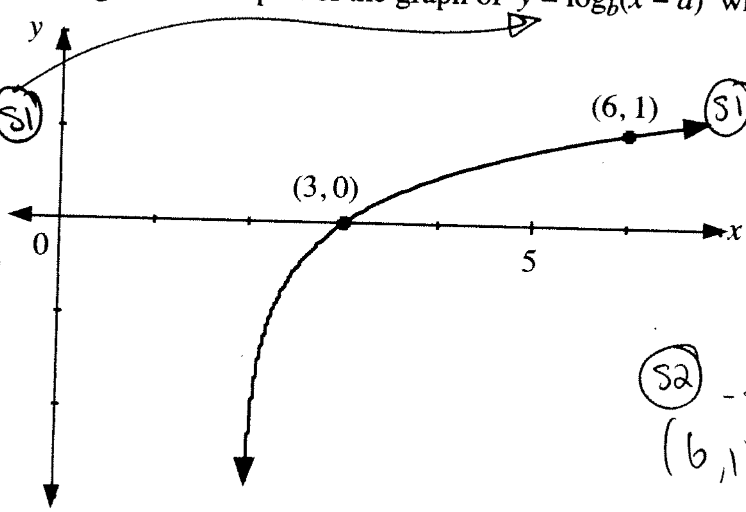
(3,0)

$0 = \log_b(3-a)$

$3-a = b^0$

$3-a = 1$

$a = 2$



method 1:

S1 - know graph is originally X-int @ (1,0) → underwent a HZ Trans 2 units Right to get to (3,0) ∴ a=2

S2 - solve for b, take pt on line (6,1)

$y = \log_b(x-2) \rightsquigarrow 1 = \log_b(6-2)$

$1 = \log_b 4$

$4 = b^1$

$4 = b$

The value of $a + 3b$ is ______.

(Record your answer in the numerical response box from left to right.)

1	4		

$a = 2$

$b = 4$

$2 + 3(4) = 14$.

Section B ***A graphing calculator may be used for the remainder of the test.***

6. Solve for x. $(n^3)^{3x-1} = (\sqrt{n})^{4x+6}$

A. $\frac{9}{7}$

B. 1

C. $\frac{6}{7}$

D. $-\frac{5}{7}$

$$n^{9x-3} = n^{\frac{1}{2}(4x+6)}$$
$$n^{9x-3} = n^{2x+3}$$
$$9x-3 = 2x+3$$
$$7x = 6$$
$$x = \frac{6}{7}.$$

Numerical Response

2. If $\frac{p}{q} = 25$, then the value of $\log_6 p - \log_6 q$, to the nearest tenth, is

(Record your answer in the numerical response box from left to right.)

1	.	8	

$$\log_6\left(\frac{p}{q}\right) = \log_6 25 = \frac{\log 25}{\log 6} = 1.796..$$

7. At which of these points is the relation $\log_3(x+1) + \log_3(x-y) = \log_3 6$ **not defined**. negative "arguments"

→ substitute coordinates for x + y in equation above.

A. $(0, -6)$ $\log_3(0+1) + \log_3(0 - {}^-6) = \log_3 1 + \log_3 6$ → arguments are positive.

B. $(2, 0)$ $\log_3(2+1) + \log_3(2-0)$ – arguments are (+)

C. $(5, 4)$ $\log_3(5+1) + \log_3(5-4)$ – arguments are (+)

D. $(-4, -2)$ $\log_3(-4+1) + \log_3(-4 - {}^-2)$ arguments are (−)

8. The range of the function $f(x) = 3^{x+c} - d$ is

A. $y > c$

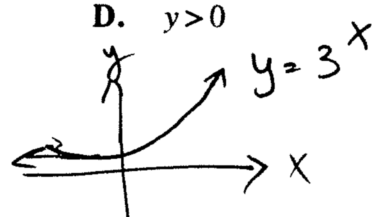
B. $y > -d$

C. $y > d$

D. $y > 0$

$$y = 3^{x+c} - d$$
$$y + d = 3^{x+c}$$

translation of $y = 3^x$
→ c units left + d units down,
range $y > -d$
(negative b/c it is less than 0)



range $y > 0$

9. If $\log_6 y = t$, the value of $\log_6 36y$ is

Product law

$\log_6 36 + \log_6 y$

$= 2 + t$

A. $36t$

B. $t + 36$

C. $2t$

D. $t + 2$

10. Expressed as a single logarithm, $\log P - 4\log Q - \log R$ is

A. $\log \frac{P}{Q^4 R}$

B. $\log \frac{PR}{4Q}$

C. $\log \frac{P}{4QR}$

D. $\log \frac{PR}{Q^4}$

$\log P - (\log Q^4 + \log R)$

$= \log P - \log(Q^4 R)$

$= \log\left(\frac{P}{Q^4 R}\right)$

11. If $\log_6 p = \log_6 q + r$, where $p > 0$ and $q > 0$, then q is equal to

A. $\frac{p}{r^6}$

B. $\frac{6^3}{p}$

C. $\frac{p}{6^r}$

D. $p - r$

$\log_6 p = \log_6 q + r$

$-\log_6 q$

$\log_6 p - \log_6 q = r$

think - need to simplify or combine ....

$\log_6\left(\frac{p}{q}\right) = r$ ← change to exponent

$\frac{p}{q} = 6^r$ ← solve for q, $q = \frac{p}{6^r}$

12. If $3^{\log_2 a + \log_2 6} = \frac{1}{81}$, then a is equal to

product law

$\frac{1}{81} = 3^{-4}$

A. -10

B. $\frac{1}{486}$

C. $\frac{1}{96}$

D. $\frac{8}{3}$

$3^{\log_2 6a} = 3^{-4}$ → solve exponent

$\log_2 6a = -4$ → write in exponential form

$6a = 2^{-4}$

$6a = \frac{1}{16}$

$a = \frac{1}{96}$

Numerical Response **3.** If $\log_b p = 4$ and $\log_b q = 2$, then $\log_b(pq^3)$ is equal to

(Record your answer in the numerical response box from left to right.)

1	0		

$\log_b(pq^3) = \log_b p + \log_b q^3 = \log_b p + 3\log_b q$

$= 4 + 3(2)$

$= 4 + 6$

$= 10$

13. The domain of the function $g(x) = 2 + \log_x(10 - x)$ is

A. $x < 10, x \neq 1, x \in R$

B. $x < 12, x \neq 1, x \in R$

C. $0 < x < 10, x \neq 1, x \in R$

D. $2 < x < 12, x \neq 1, x \in R$

base $x > 0$, $x \neq 1$

argument $10 - x > 0$

$-x > -10$

$x < 10$

$0 < x < 10$, $x \neq 1$

14. If $\log_a\left(\frac{1}{16}\right) = -\frac{1}{4}$, then a is equal to

A. 2 **B.** $\frac{1}{2}$

C. $\frac{1}{65\,536}$ **D.** 65 536

$\frac{1}{16} = a^{-\frac{1}{4}}$

$\left(\frac{1}{16}\right)^{-4} = \left(a^{-\frac{1}{4}}\right)^{-4}$

$16^4 = a$

$a = 65536$

Numerical Response **4.** To the nearest hundredth, the y-intercept, of the graph of $y = \log_5(x + 4)$ is ______ .

(Record your answer in the numerical response box from left to right.)

0	.	8	6

- solve for ~~x~~-int when ~~[illegible]~~ $x = 0$

$y = \log_5(0+4)$

$y = \log_5 4$

$y = \frac{\log 4}{\log 5} = 0.86..$

15. If $\log_{16} x = A$, then $\log_2 x =$

A. $4A$ **B.** $\frac{1}{4}A$

C. $8A$ **D.** $\frac{1}{8}A$

$\log_{16} x = A$

$x = 16^A$

$\log_2 x$

$= \log_2 16^A = A\log_2 16$

$\log_2 16 = 4$

$= A \cdot 4$

16. If $\frac{2}{3}\log_n x = 5$, then x^2 is equal to → solve for x, then substitute in x^2

A. n^{15}

B. 15^n

C. $n^{\frac{20}{3}}$

D. $n^{\frac{5}{3}}$

$\frac{2}{3}\log_n x = 5$

$\log_n x = \frac{5 \cdot 3}{2}$

$\log_n x = \frac{15}{2}$

$x = n^{15/2}$

→ $x^2 = (n^{15/2})^2 = n^{15}$

17. $12\log_{64} x - 6\log_{16} x$ is equivalent to

remember $y = \log_b x$ can be expressed as $y = \log_{b^n} x$ which $= \frac{1}{n}\log_b x$

simplify, find common base

A. $\log_2 x$

B. $\log_4 x$

C. $\log_{16} x$

D. $\log_{64} x$

$\log_{64} x = \log_{2^6} x = \frac{1}{6}\log_2 x$

$\log_{16} x = \log_{2^4} x = \frac{1}{4}\log_2 x$

→ now rework into original equation.

$12\left(\frac{1}{6}\log_2 x\right) - 6\left(\frac{1}{4}\log_2 x\right)$

$= 2\log_2 x - \frac{6}{4}\log_2 x$

$2 - \frac{6}{4} = \frac{1}{2}$

same base - subtract

$= \frac{1}{2}\log_2 x$

→ no answer so you have to think what is it equal to?

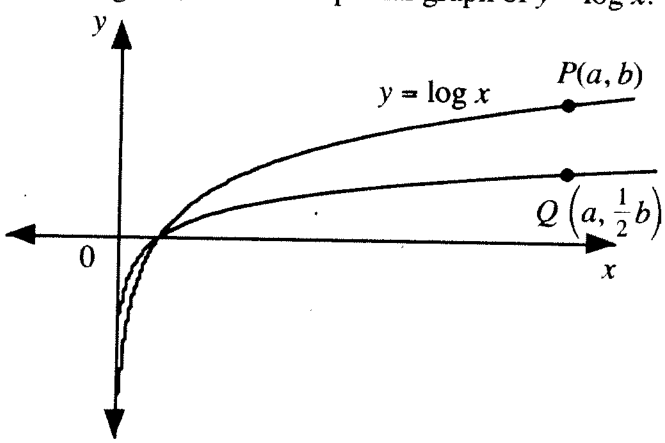
$\log_{b^n} x = \frac{1}{n}\log_b x$

so...

$\frac{1}{2}\log_2 x = \log_{2^2} x$

$= \log_4 x$

18. In the diagram, P is on the partial graph of $y = \log x$.



The point Q is on the partial graph of

A. $y = \log x^{\frac{1}{2}}$

B. $y = (\log x)^{\frac{1}{2}}$

C. $y = \log \frac{1}{2}x$

D. $y = \log x^2$

→ vertical stretch by a factor of $\frac{1}{2}$.

$y = \frac{1}{2}\log x$

→ no answer so ...

$y = \log x^{\frac{1}{2}}$

Numerical Response **5.** In the equation $\log_x 64 = \frac{2}{3}$, the value of x, to the nearest whole number, is _____.

(Record your answer in the numerical response box from left to right.)

5	1	2	

$64 = x^{2/3}$

$64^{3/2} = x^{\cancel{2/3 \cdot 3/2}}$

$(\sqrt{64})^3 = x$ $= 512$

19. When solving the equation $\log_x(2x+3) + \log_x(x-2) = 2$, an equation that could arise is

A. $2x^2 - x - 6 = 0$

B. $2x^2 - x - 8 = 0$

C. $x^2 + x - 6 = 0$

D. $x^2 - x - 6 = 0$

product law (FOIL!!) :)

$\log_x[(2x+3)(x-2)] = 2.$

$\log_x(2x^2 - 4x + 3x - 6) = 2$

$\log_x(2x^2 - x - 6) = 2$ ← write as an exponent

$2x^2 - x - 6 = x^2 \rightarrow x^2 - x - 6 = 0$

20. The expression $\log_{\frac{1}{2}} x$ is equivalent to which one or more of the following expressions

I. $\log_2\left(\frac{1}{x}\right)$ **II.** $-\log_2 x$

A. I only

B. II only

C. I and II

D. neither I nor II

$\log_{\frac{1}{b}} x = -\log_b x$

so $\log_{\frac{1}{2}} x = -\log_2 x$

$= \cancel{\log_2 x}^{-1} \log_2 x^{-1}$

$= \log_2\left(\frac{1}{x}\right)$

Numerical Response **6.** If $\log_5 x = -0.02$, then the exact value of $\log_{\frac{1}{5}} x$ is equal to _____.

(Record your answer in the numerical response box from left to right.)

0	.	0	2

$\log_{\frac{1}{b}} x = -\log_b x$

$\log_{\frac{1}{5}} x = -\log_5 x$

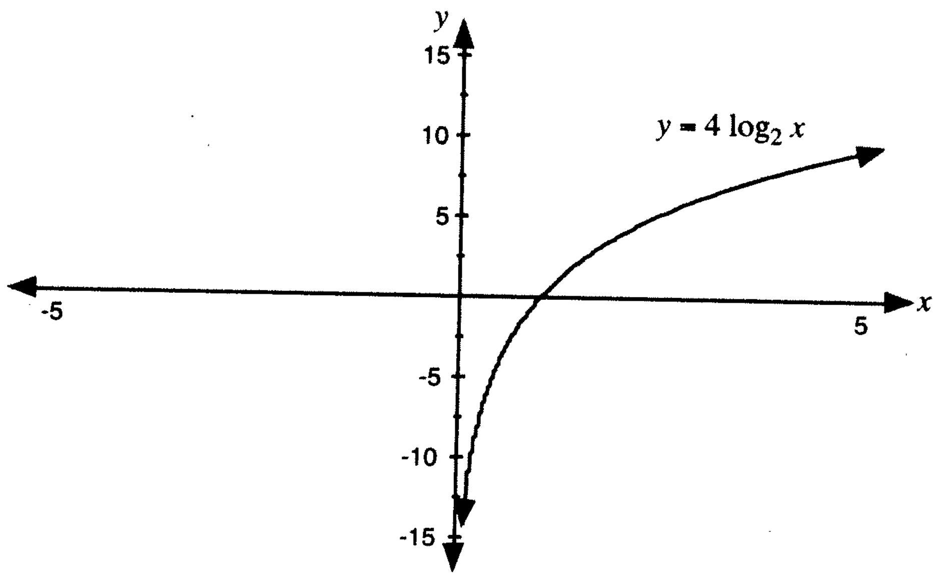
$= -(-0.02)$

$= 0.02$

Written Response

Students are investigating logarithmic functions with base 2.

- The graph of $y = 4\log_2 x$ is shown.



Complete the table which describes some of the features of the graph of $y = 4\log_2 x$.

Domain	$x \mid x > 0,\ x \in R$
Range	$y \in R$
***x*-intercept**	1
***y*-intercept**	none

- Determine, in the form $y = \ldots .$, the equation of the inverse of the graph of $y = 4\log_2 x$.

$x = 4\log_2 y$

$\frac{x}{4} = \log_2 y$

$2^{x/4} = y$

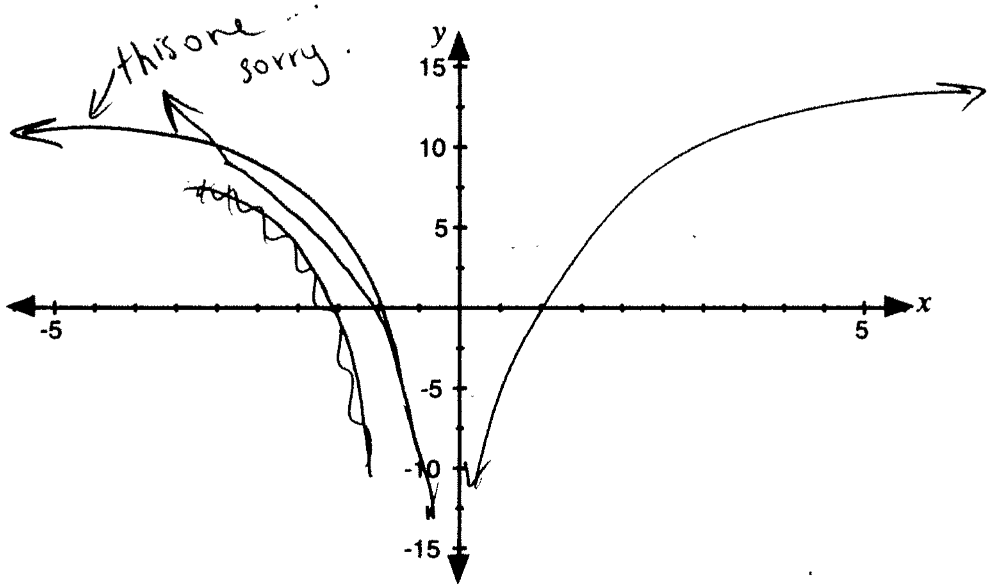
$y = 2^{x/4}$

- A student identifies the following law of logarithms on the formula sheet:

$$\log_a M^n = n \log_a M.$$

The student assumes that, because of this law, the graph of $y = \log_2 x^4$ will be identical to the graph of $y = 4 \log_2 x$.

Sketch a partial graph of $y = \log_2 x^4$ on the grid below to show that the student's assumption is **not** correct.



Explain why the difference occurs.

The domain of $y = 4\log x$ is $x > 0$, $\in R$.

The domain of $y = \log x^4$ is $x \neq 0$, $x \in R$ (allows it to have +/- values for x).

- If $\log_2 x = P$, write expressions for $\log_{\frac{1}{2}} x$, $\log_2 x^2$, and $\log_8 x$.

$\log_{\frac{1}{2}} X = -\log_2 X = -P$

$\log_2 X^2 = 2\log_2 X = 2P$

$\log_8 X = \log_{2^3} X = \frac{1}{3}\log_2 X = \frac{1}{3}P$