Checkpoint 2: Assess Your Understanding, pages 413–416

5.4

1. **Multiple Choice** Given that $\log_m n = p$, which statement is correct?

A. $m^n = p$ **B.** $n = m^p$ **C.** $n^p = m$ **D.** $n = p^m$

2. Write each exponential expression as a logarithmic expression.

a) $8^3 = 512$

The base is 8.

The logarithm is 3.

So, $3 = \log_8 512$

b) $36^{\frac{1}{2}} = 6$

The base is 36.

The logarithm is $\frac{1}{2}$.

So, $\frac{1}{2} = \log_{36} 6$

3. Use benchmarks to estimate the value of each logarithm to the nearest tenth.

a) $\log_4 60$

Identify powers of 4 close to 60.
$4^2 = 16$ and $4^3 = 64$
So, $2 < \log_4 60 < 3$
An estimate is: $\log_4 60 \doteq 2.9$
Check.
$4^{2.9} \doteq 55.71523605$
$4^3 = 64$
So, $\log_4 60 \doteq 3.0$

b) $\log_9 8$

Identify powers of 9 close to 8.
$9^0 = 1$ and $9^1 = 9$
So, $0 < \log_9 8 < 1$
An estimate is: $\log_9 8 \doteq 0.9$
Check.
$9^{0.9} \doteq 7.224674056$
So, $\log_9 8 \doteq 0.9$

4. Evaluate each logarithm.

a) $\log_2 64$

$= \log_2 2^6$
$= 6$

b) $\log_9 243$

$= \log_9 3^5$
$= \log_9 \left(9^{\frac{1}{2}}\right)^5$
$= \log_9 \left(9^{\frac{5}{2}}\right)$
$= \frac{5}{2}$

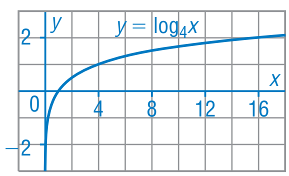
c) $\log_2 \left(\frac{1}{128}\right)$

$= \log_2 2^{-7}$
$= -7$

5. a) Graph $y = \log_4 x$.

Determine values for $y = 4^x$, then interchange the coordinates for the table of values for $y = \log_4 x$.

x	$y = \log_4 x$
0.25	-1
1	0
4	1
16	2



b) Identify the intercepts and the equation of the asymptote of the graph, and the domain and range of the function.

The graph does not intersect the y-axis, so it does not have a y-intercept.
The graph has x-intercept 1.
The y-axis is a vertical asymptote; its equation is $x = 0$.
The domain of the function is $x > 0$.
The range of the function is $y \in \mathbb{R}$.

5.5

6. Multiple Choice Which expression is equal to $\log_3\left(\frac{x}{y}\right)$?

A. $\log_3 x + \log_3 y$

B. $\log_3 x - \log_3 y$

C. $\frac{\log_3 x}{\log_3 y}$

D. $3(\log_3 x - \log_3 y)$

7. Write each expression as a single logarithm.

a) $4 \log x - \frac{1}{2}\log y$

$= \log x^4 - \log y^{\frac{1}{2}}$

$= \log\left(\frac{x^4}{y^{\frac{1}{2}}}\right)$

b) $3 \log x + 5 \log y$

$= \log x^3 + \log y^5$

$= \log x^3y^5$

c) $\log x + 3$

$= \log x + \log 1000$

$= \log 1000x$

5.6

8. Multiple Choice How is the graph of $y = \log_3 x$ transformed to obtain the graph of $y = \log_3 2x - 3$?

A. a horizontal stretch by a factor of 2 and a translation of 3 units down

B. a vertical stretch by a factor of 2 and a translation of 3 units down

C. a vertical stretch by a factor of 2 and a translation of 3 units up

D. a horizontal compression by a factor of $\frac{1}{2}$ and a translation of 3 units down

9. Use technology to graph $y = \log_9 x$. Identify the intercepts and the equation of the asymptote of the graph, and the domain and range of the function.

Graph: $y = \frac{\log x}{\log 9}$

From the graph, the x-intercept is 1. There is no y-intercept.

The equation of the asymptote is $x = 0$.

The domain of the function is $x > 0$. The range of the function is $y \in \mathbb{R}$.

10. Approximate the value of each logarithm, to the nearest thousandth.

a) $\log_2 35$

$= \frac{\log 35}{\log 2}$

$\doteq 5.129$

b) $\log_3\left(\frac{3}{4}\right)$

$= \frac{\log 0.75}{\log 3}$

$\doteq -0.262$

11. Graph $y = 3\log_2(-x + 4)$, then state the characteristics of the function.

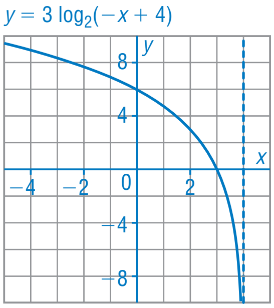
Write $y = 3\log_2(-x + 4)$ as $y = 3\log_2[-(x - 4)]$, then compare with $y - k = c\log_2 d(x - h)$:

$k = 0$, $c = 3$, $d = -1$, and $h = 4$

Use (x, y) corresponds to $\left(\frac{x}{d} + h, cy + k\right)$.

(x, y) on $y = \log_2 x$ corresponds to $(-x + 4, 3y)$ on $y = 3\log_2[-(x - 4)]$.

(x, y)	$(-x + 4, 3y)$
$(0.25, -2)$	$(3.75, -6)$
$(0.5, -1)$	$(3.5, -3)$
$(1, 0)$	$(3, 0)$
$(2, 1)$	$(2, 3)$
$(4, 2)$	$(0, 6)$
$(8, 3)$	$(-4, 9)$



The x-intercept is 3. The y-intercept is 6.
The equation of the asymptote is $x = 4$.
The domain of the function is $x < 4$.
The range of the function is $y \in \mathbb{R}$.