74 a) $p(x) = .7(x) = x - .3(x)$

$s(x) = 1.0575x = x + .0575x$

b) $p(s(x)) = .7(1.0575x)$
$s(p(x)) = 1.0575(.7x)$ $= .74025x$

c) $.74025(149) = \$110.30$

73. $F(x) = \frac{9}{5}x + 32$

$y = \frac{9}{5}x + 32$

$x = \frac{9}{5}y + 32$

$-32 \qquad -32$

$\frac{5}{9}(x - 32) = \left(\cancel{\frac{9}{5}}y\right)\cancel{\frac{5}{9}}$

$\frac{5}{9}(x-32) = F^{-1}(x)$

0-2 +
3-4 ✓
5↑ -

3-2 Study Guide and Intervention

Logarithmic Functions

Logarithmic Functions and Expressions The inverse relationship between logarithmic functions and exponential functions can be used to evaluate logarithmic expressions.

If $b > 0$, $b \neq 1$, and $x > 0$, then

Logarithmic Form		**Exponential Form**
$\log_b x = y$	if and only if	$b^y = x$
base exponent		base exponent

The following properties are also useful.

$\log_b 1 = 0$ $\log_b b = 1$ $\log_b b^x = x$ $b^{\log_b x} = x, x > 0$

$\log = \log_{10}$

Ex: $\log 5 \approx .69$

natural log: $\ln = \log_e$

Ex: $\ln 5 \approx 1.6$

$\ln 1 = 0$ $\ln e = 1$ $\ln e^x = x$ $e^{\ln x} = x$

Example 1 **Evaluate each logarithm.**

a. $\log_5 \frac{1}{25}$

$\log_5 \frac{1}{25} = y$ Let $\log_5 \frac{1}{25} = y$.

$5^y = \frac{1}{25}$ Write in exponential form.

$5^y = 5^{-2}$ $\frac{1}{25} = 5^{-2}$

$y = -2$ Equality Prop. of Exponents

Therefore, $\log_5 \frac{1}{25} = -2$ because $5^{-2} = \frac{1}{25}$.

b. $\log_3 \sqrt{3}$

$\log_3 \sqrt{3} = y$ Let $\log_3 \sqrt{3} = y$.

$3^y = \sqrt{3}$ Write in exponential form.

$3^y = 3^{\frac{1}{2}}$ $3^{\frac{1}{2}} = \sqrt{3}$

$y = \frac{1}{2}$ Equality Prop. of Exponents

Therefore, $\log_3 \sqrt{3} = \frac{1}{2}$ because $3^{\frac{1}{2}} = \sqrt{3}$.

Example 2 **Evaluate each expression.**

a. $\ln e^7$

$\ln e^7 = 7$ $\ln e^x = x$

b. $e^{\ln 5}$

$e^{\ln 5} = 5$ $e^{\ln x} = x$

c. $10^{\log 13}$

$10^{\log 13} = 13$ $10^{\log x} = x$

Exercises

Evaluate each logarithm.

1. $\log_7 7 = 1$

$7^y = 7$

2. $10^{\log 5x} = 5x$

3. $3^{\log_3 2}$

4. $\log_6 36 = y$

$6^y = 36$

$y = 2$

5. $\log_3 \frac{1}{81}$

$3^y = \frac{1}{81}$

$\boxed{y = -4}$

6. $e^{\ln x^2}$

Logarithmic Functions

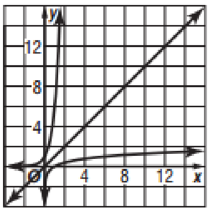
Graphs of Logarithmic Functions The inverse of $f(x) = b^x$ is called the logarithmic function with base b, or $f(x) = \log_b x$, and read *f of x equals the log base b of x.*

Example **Sketch and analyze the graph of $f(x) = \log_6 x$. Describe its domain, range, intercepts, asymptotes, end behavior, and where the function is increasing or decreasing.**

Create a table of values for the inverse of the function, the exponential function $f^{-1}(x) = 6^x$.

x	−2	−1	0	1	2
$f^{-1}(x)$	0.028	0.17	1	6	36

Since the functions are inverses, you can obtain the graph of $f(x)$ by plotting the points $(f^{-1}(x), x)$.



Domain: $(0, \infty)$

Range: $(-\infty, \infty)$

x-intercept: $(1, 0)$

Asymptote: y-axis

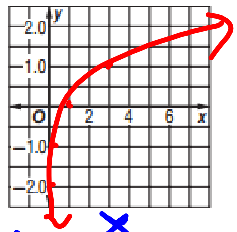
End behavior: $\lim_{x \to 0^+} f(x) = -\infty$ and $\lim_{x \to \infty} f(x) = \infty$

Increasing: $(0, \infty)$

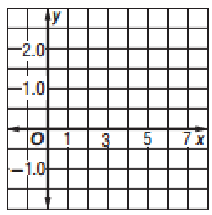
Exercises

Sketch and analyze the graph of each function below. Describe its domain, range, intercepts, asymptotes, end behavior, and where the function is increasing or decreasing.

1. $g(x) = \log_3 x$



2. $h(x) = -\log_3 (x - 2)$



$g^{-1}(x) = 3^x$

x	-2	-1	0	1	2
$g^{-1}(x)$	.1	.3	1	3	9

$(.1, -2)\ (.3, -1)$

D: $(0, \infty)$

R: $(-\infty, \infty)$

x-int: $(1, 0)$

y-int: none

asymptote: $x = 0$

$\lim_{x \to -\infty} f(x) = -\infty$

$\lim_{x \to \infty} f(x) = \infty$

increasing $(0, \infty)$

HW: p. 178, #1-25 odd, 29, 35, 41, 45, 47, 51, 63