13.3 Exercises

Exercise 13.1

Graph the following functions with the calculator.

a) $y = 5^x$ b) $y = 1.01^x$ c) $y = (\frac{1}{3})^x$ d) $y = 0.97^x$
e) $y = 3^{-x}$ f) $y = (\frac{1}{3})^{-x}$ g) $y = e^{x^2}$ h) $y = 0.01^x$
i) $y = 1^x$ j) $y = e^x + 1$ k) $y = \frac{e^x - e^{-x}}{2}$ l) $y = \frac{e^x - e^{-x}}{e^x + e^{-x}}$

The last two functions are known as the *hyperbolic sine*, $\sinh(x) = \frac{e^x - e^{-x}}{2}$, and the *hyperbolic tangent*, $\tanh(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}}$. Recall that the *hyperbolic cosine* $\cosh(x) = \frac{e^x + e^{-x}}{2}$ was already graphed in Example 13.5.

Exercise 13.2

Graph the given function. Describe how the graph is obtained by a transformation from the graph of an exponential function $y = b^x$ (for appropriate base b).

a) $y = 0.1 \cdot 4^x$ b) $y = 3 \cdot 2^x$ c) $y = (-1) \cdot 2^x$
d) $y = 0.006 \cdot 2^x$ e) $y = e^{-x}$ f) $y = e^{-x} + 1$
g) $y = (\frac{1}{2})^x + 3$ h) $y = 2^{x-4}$ i) $y = 2^{x+1} - 6$

Exercise 13.3

Use the definition of the logarithm to write the given equation as an equivalent logarithmic equation.

a) $4^2 = 16$ b) $2^8 = 256$ c) $e^x = 7$ d) $10^{-1} = 0.1$
e) $3^x = 12$ f) $5^{7 \cdot x} = 12$ g) $3^{2a+1} = 44$ h) $\left(\frac{1}{2}\right)^{\frac{x}{h}} = 30$

Exercise 13.4

Evaluate the following expressions *without* using a calculator.

a) $\log_7(49)$ b) $\log_3(81)$ c) $\log_2(64)$ d) $\log_{50}(2500)$
e) $\log_2(0.25)$ f) $\log(1000)$ g) $\ln(e^4)$ h) $\log_{13}(13)$
i) $\log(0.1)$ j) $\log_6(\frac{1}{36})$ k) $\ln(1)$ l) $\log_{\frac{1}{2}}(8)$

Exercise 13.5

Using a calculator, approximate the following expressions to the nearest thousandth.

a) $\log_3(50)$ b) $\log_3(12)$ c) $\log_{17}(0.44)$ d) $\log_{0.34}(200)$

Exercise 13.6

State the domain of the function f and find any vertical asymptote(s) and x-intercept(s). Use the results to sketch the graph.

a) $f(x) = \log(x)$
b) $f(x) = \log(x+7)$
c) $f(x) = \ln(x+5) - 1$
d) $f(x) = \ln(3x-6)$
e) $f(x) = 2 \cdot \log(x+4)$
f) $f(x) = -4 \cdot \log(x+2)$
g) $f(x) = \log_3(7x+5)$
h) $f(x) = \ln(-6x+14)$
i) $f(x) = \log_{0.4}(x)$
j) $f(x) = \log_3(-5x) - 2$
k) $f(x) = \log|x|$
l) $f(x) = \log|x+2|$