4.3 - Logarithmic Functions

Review Problems

1. **Working with exponents.** Simplify. Write answers with only positive exponents.
   (a) \(2x^9y^7\) \hspace{1cm} (b) \(8x^3y^6\) \hspace{1cm} (c) \(\frac{1}{27 \cdot 2^9} = \frac{1}{13,824}\)

2. (a) \(f(3) = \frac{3}{16}\), \hspace{1cm} (b) \(f(-2) = \frac{3}{64}\) \hspace{1cm} (c) \(f(0) = 12\) \hspace{1cm} (d) \(f\left(\frac{3}{2}\right) = \frac{3}{2}\)

3. (a) 
   
   ![Graph 1](image1)
   
   (b) 
   
   ![Graph 2](image2)

**Basic Knowledge**

4. Evaluate the following logarithms or state that the value is undefined:
   (a) \(\log_{16} 4 = \frac{1}{2}\) \hspace{1cm} (b) \(\log_{2} \left(\frac{1}{8}\right) = -3\) \hspace{1cm} (c) \(\log(-100)\) undefined \hspace{1cm} (d) \(\log_{6} 1 = 0\)
   (e) \(\log_{-2}(4)\) undefined \hspace{1cm} (f) \(\ln(e) = 1\) \hspace{1cm} (g) \(\log_{32} \left(\frac{1}{2}\right) = -\frac{1}{5}\)

5. (a) \(x = 1, x = 2\) \hspace{1cm} (b) \(x = 1\)

6. Find the domain of each function and sketch its graph. Label the intercepts and asymptote.
   (a) \(f(x) = \ln(x - 5)\) Domain \(x \in (5, \infty)\), x-intercept \((6,0)\)

![Graph 3](image3)
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(b) $g(x) = \log(-x) + 2$ Domain $x \in (-\infty, 0)$, x-intercept $(-\frac{1}{100}, 0)$

(c) $h(x) = -2\log_2(-x + 1)$ Domain $x \in (\infty, 1)$

Intermediate/Advanced Knowledge

7. Evaluate each expression:
   (a) $e^{\ln(2)} = 2$
   (b) $\log_5(5^3) = 3$
   (c) $\log_2(4^9) = 18$
   (d) $\log(\ln(e^{100})) = 2$

8. Sketch the graph of each function. Label intercepts and asymptote.
   (a) $y = \ln(|x - 1|)$
   (b) $y = -|\ln(x)|$