Precalculus

Topic: Logarithmic Functions

Instructions

Solve the following problems related to logarithmic functions. Show all work clearly and check your solutions.

Practice Problems

1. **Express the equation in exponential form.**

   (i) $\log_2 25 = 2$
   (ii) $\log_8 2 = \frac{1}{3}$
   (iii) $\log_3 81 = 4$
   (iv) $\ln(x+1) = 2$
   (v) $\ln 5 = x$

2. **Express the equation in logarithmic form.**

   (i) $5^3 = 125$
   (ii) $e^3 = y$
   (iii) $81^{\frac{1}{2}} = 9$
   (iv) $e^x = 2$
   (v) $e^{0.5x} = t$

3. **Evaluate the following logarithmic expressions:**

   (i) $\log_{10} 100$
   (ii) $\log_2 32$
   (iii) $\log_5 5^4$
   (iv) $\ln e^4$
   (v) $\log_{10} \sqrt{10}$

4. **Use the definition of the logarithmic function to find x:**

(i) $\log_2 x = 5$

(ii) $\log_3 243 = x$

(iii) $\log_2 16 = x$

(iv) $\log_{10} x = 2$

(v) $\log_{10} 0.1 = x$

5. **Graph the following logarithmic functions and describe their key features (domain, range, intercepts, asymptotes):**

   (i) $f(x) = \log_2 x$

   (ii) $f(x) = \log_{10} x$

   (iii) $f(x) = \ln x$

   (iv) $f(x) = \log_3 x$

   (v) $f(x) = \log_5 x$

6. **Solve the following exponential and logarithmic application problems:**

   (i) The population of a bacteria culture grows according to the formula $P(t) = 1000e^{0.5t}$, where t is the time in hours. Find the population after 3 hours.

   (ii) The half-life of a substance is 4 hours. How long will it take for 100 grams of the substance to decay to 25 grams?

Multiple-Choice Questions

1. What is the value of $\log_{10} 1$?

   A. 1

   B. 0

   C. ∞

   D. Undefined

2. Which of the following is the equivalent expression for $\log_a b$?

   A. $\frac{1}{\log_b a}$

   B. $\log_b a$

   C. $\ln a$

   D. $\frac{1}{\ln a}$

3. What is the domain of the function $f(x) = \log_3 x$?

   A. $x \in (0, \infty)$

   B. $x \in (-\infty, \infty)$

   C. $x \in [0, \infty)$

   D. $x \in (-\infty, 0)$