Logarithmic Puzzles

Section 1 — Log Laws (Single-Step): *Apply product, quotient, and power laws.*

1. If $\log_5 9 = k$, find $\log_5(9^4)$

2. If $\log_n a = 5$ and $\log_n b = 3$, find $\log_n(ab^2)$

3. If $\log_5 x = 25$, find $\log_5\left(\frac{x}{25}\right)$

Section 2 — Evaluate Using Definitions: *Convert between logarithmic and exponential form.*

4. If $\log x = 2$, evaluate $\log_{100}(x^4)$ in simplest form.

5. If $\log_x 8 = 3$, find $\log_x 32$ **without solving for x.**

Section 3 — Base Conversions: *Rewrite logs using equivalent bases.*

6. If $\log_{36} x = A$, find $\log_6 x$

7. If $\log_{27} x = y$, find $\log_9 x$

8. If $\log_a b = m$**,** what is $\log_b a$

Section 4 — Algebra with Logs (Abstract): *Work symbolically with logarithmic expressions.*

9. If $\log_a x = b$, find $\log_a\left(\frac{a}{x^3}\right)$

10. If $\log k = c\log v + \log p$, write k as a single expression without logarithms.

Section 5 — Multi-Step Problems: *Combine multiple ideas.*

11. If $x = \log_2 5$, find $\log_2 200$

12. If $\log_3 x = 4$, find $\log_9 x$

Section 6 — Challenge: *Full synthesis.*

13. If $\log_4 x = 3$, find $\log_2(x^2)$

14. If $\log_a b = m$ and $\log_a c = n$, express $\log_a\left(\frac{b^2\sqrt{c}}{a}\right)$