

# Review Set 4A \*Non-calculator\*

1. a)  $4^x = 64$   
 $x = 3$

b)  $\log_2 256 = \log_2 (16 \cdot 16)$   
 $= \log_2 16 + \log_2 16$   
 $= 4 + 4$   
 $= 8$

c)  $\log_2 \left(\frac{1}{4}\right)$   
 $2^x = \frac{1}{4}$   
 $x = -2$

d)  $\log_{25} 5$   
 $25^x = 5$   
 $x = \frac{1}{2}$

e)  $\log_8 1$   
 $8^x = 1$   
 $x = 0$

f)  $\log_{81} 3$   
 $81^x = 3$   
 $x = \frac{1}{4}$

g)  $\log_9 (.1)$   
 $9^x = .1$   
 $x = -1$

h)  $\log_K K^{1/2}$   
 $K^x = K^{1/2}$   
 $x = \frac{1}{2}$

2. a)  $\log 10^{1/2}$   
 $10^x = 10^{1/2}$   
 $x = 1/2$

b)  $\log 10^{-1/3}$   
 $10^x = 10^{-1/3}$   
 $x = -1/3$

c)  $\log (10^a \cdot 10^{b+1})$   
 $\log 10^a + \log 10^{b+1}$   
 $a + b + 1$

3. a)  $\ln 2^4 + \ln 3^2$   
 $\ln (16 \cdot 8)$   
 $\ln 128$

b)  $\ln 9^{1/2} - \ln 2$   
 $\ln \left(\frac{3}{2}\right)$

c)  $\ln 5^2 - \ln e$   
 $\ln \left(\frac{25}{e}\right)$

d)  $\ln 81^{1/4} = \ln 3$

4. a)  $\ln e + \ln e^{1/2}$   
 $1 + \frac{1}{2}$   
 $\boxed{\frac{3}{2}}$

b)  $\ln e^{-3}$   
 $\boxed{-3}$

c)  $2x \ln e$   
 $\boxed{2x}$

d)  $\ln e - \ln e^x$   
 $\boxed{1-x}$

5. a)  $\log 16 + \log 3^2$   
 $\log(16 \cdot 9)$   
 $\log 144$

b)  $\log_2 16 - \log_2 9$   
 $\log_2 \left(\frac{16}{9}\right)$

c)  $2 \log_4 4 + \log_4 5$   
 $\log_4 16 + \log_4 5$   
 $\log_4 (16 \cdot 5)$   
 $\log_4 (80)$

6. a)  $b^x = P - 3$   
 $\log_b (P - 3) = x$   
 -or-  
 $\log P = \log 3 + x \log b$

b)  $\log m = \log \left(\frac{n^3}{p^2}\right)$   
 $\log m = \log n^3 - \log p^2$   
 $\log m = 3 \log n - 2 \log p$

7.  $\log_3 7 \times 2 \log_7 x = 2 \log_3 x$   
 $\log_3 7 \times 2 \left(\frac{\log_3 x}{\log_3 7}\right) =$

(use change of base formula)

$2 \log_3 x = 2 \log_3 x$

8. a)  $\log T = \log \left(\frac{x^2}{y}\right)$   
 $T = \frac{x^2}{y}$

b)  $\log_2 K = \log_2 n + \log_2 t^{1/2}$   
 $\log_2 K = \log_2 (n \cdot t^{1/2})$   
 $K = n \sqrt{t}$

9. a)  $\ln 32$   
 $= \ln 2^5$   
 $= 5 \ln 2$

b)  $\ln 125$   
 $= \ln 5^3$   
 $= 3 \ln 5$

c)  $\ln 729$   
 $= \ln 3^6$   
 $= 6 \ln 3$

10.	$y = \log_2 x$	$y = \ln(x+5)$
Domain	$x > 0$	$x > -5$
Range	$\mathbb{R}$	$\mathbb{R}$

$$\begin{aligned}
 11. \text{ a) } \log_5 6^2 & \\
 &= 2 \log_5 6 \\
 &= 2 (\log_5 (2 \cdot 3)) \\
 &= 2 (\log_5 2 + \log_5 3) \\
 &= 2 \log_5 2 + 2 \log_5 3 \\
 &= 2A + 2B
 \end{aligned}$$

$$\begin{aligned}
 \text{b) } \log_5 54 & \\
 &= \log_5 (2 \cdot 3^3) \\
 &= \log_5 2 + \log_5 3^3 \\
 &= A + 3B
 \end{aligned}$$

$$\begin{aligned}
 \text{c) } \log_5 (2^3 \cdot 3^{1/2}) & \\
 &= \log_5 2^3 + \log_5 3^{1/2} \\
 &= 3A + \frac{1}{2}B
 \end{aligned}$$

$$\begin{aligned}
 \text{d) } \log_5 \left( \frac{81}{4} \right) & \\
 &= \log_5 81 - \log_5 4 \\
 &= \log_5 3^4 - \log_5 2^2 \\
 &= 4B - 2A
 \end{aligned}$$

$$\begin{aligned}
 \text{e) } \log_5 \left( \frac{8}{9} \right) & \\
 &= \log_5 2^3 - \log_5 3^2 \\
 &= 3A - 2B
 \end{aligned}$$

$$\begin{aligned}
 12. \text{ a) } 3e^x - 5 &= \frac{-2}{e^x} \\
 3e^{2x} - 5e^x &= -2 \\
 3e^{2x} - 5e^x + 2 &= 0 \\
 (3e^x - 2)(e^x - 1) &= 0 \\
 e^x = \frac{2}{3} & \quad e^x = 1 \\
 \ln \frac{2}{3} = x & \quad \ln 1 = x \\
 & \quad 0 = x
 \end{aligned}$$

$$\begin{aligned}
 \text{b) } \ln x^2 - \ln \left( \frac{1}{x} \right)^3 &= 10 \\
 \ln \left( \frac{x^2}{x^3} \right) &= 10 \\
 e^{10} &= \frac{1}{x} \\
 x &= e^{-10}
 \end{aligned}$$