

# MATH 123

# Exponential and Logarithmic Functions

1. Simplify the given expression.

(a)  $2^x 2^y$

(b)  $\frac{3^x}{3^y}$

(c)  $(5^x)^y$

(d)  $\frac{2}{2^x}$

(e)  $\sqrt{2^x}$

(f)  $7^x \cdot 49^{3x}$

2. Solve the following equations for x.

(a)  $2^x = 4$

(b)  $2^x = 4^{2x+5}$

(c)  $9^{x-3} = 27^{2x+4}$

(d)  $\left(\frac{1}{2}\right)^{2x-5} = 4^{3-x}$

(f)  $5^{x^2} = 5$

(g)  $e^{3(1+x)} = e^{-8}$

(h)  $125^x = 5$

(i)  $x^{\frac{5}{2}} = 32$

(j)  $5^{2x+1} = 25$

(k)  $216^{3-x} = 36^x$

(l)  $\left(\frac{2}{3}\right)^{x-1} = \left(\frac{81}{16}\right)^{x+1}$

(m)  $\left(\frac{2}{5}\right)^{3x-2} = \frac{4}{25}$

(n)  $\frac{1}{81} = x^{-4}$

3. Simplify the following expressions.

(a)  $\log_2 8$

(b)  $\log_5 125$

(c)  $\log_7 1$

(d)  $\log_{\frac{1}{3}} 9$

(e)  $e^{\ln 2}$

(f)  $e^{(\ln x - \ln y)}$

(g)  $\ln x e^{\sqrt{x}} - \ln x$

$\ln x e^{x^2}$

(h)  $e^{x - \ln x}$

(i)  $\log_{10} 1000$

(j)  $\log_8 2$

(k)  $\log_2 \sqrt{8}$

(l)  $\log_4 8$

(m)  $\log_5 \left(\frac{1}{125}\right)$

(n)  $\log_{343} 7$

(o)  $\log_3 81$

(p)  $\log_6 \left(\frac{1}{216}\right)$

(q)  $\log_e e^x$

(r)  $\log_3 \left(\frac{\sqrt[4]{27}}{3}\right)$

(s)  $\log_5 \sqrt[3]{125^2}$

4. Solve the following equations for x.

(a)  $\log_x 16 = 4$

(b)  $\log_{\frac{1}{2}} x = 2$

(c)  $\log_x 27 = \frac{3}{2}$

(d)  $\log_x \left(\frac{1}{16}\right) = -2$

(e)  $\log_{125} x = \frac{2}{3}$

(f)  $\ln x = 2$

(g)  $\ln x^2 = 9$

(h)  $\log_8 4 = x$

(i)  $(\log_2 x)^2 - 8 \log_2 x = -15$

(j)  $(\log_3 x)^2 + \log_3 x = 6$

5. Determine y if  $e^{x-y} = x + 3$ .

6. Determine y if  $e^{(y-1)^2} = x^4 + 1$ ,  $y > 1$ .

7. Solve for x.  $\log_2 (2x - 1) = 5$

8. Solve for x.  $\log_3 (\log_2 x) = 1$

9. Solve for x.  $\ln(x + 2) = 3$

10. Solve for x.  $\log_9 \left( \log_7 \left( 7 \log_3 \left( \log_2 (3x - 5) \right) \right) \right) = 0$

11. Solve for x.  $e^{2x} - 2e^x + 1 = 0$

12. Solve for x.  $\log_2 x + \log_2 (x - 6) = 4$

13. Solve for x.  $\log_2 x + \log_2 (x - 6) = 4$

14. Solve for x.  $\log_3 (x + 1) - \log_3 x = 2$