Solving Equations Using Logarithms

If $a^b = c$, $\log a^b = \log c$. (Take the log of each side)

$b \log a = \log c$

When you take the log of an expression the exponent becomes the product of the log of the base. We will discuss this further later.

$b = \frac{\log c}{\log a}$ * to solve for b, divide each side by log a

Solve for x – round to the nearest hundredths place.

A) $2^x = 7$

$\log 2^x = \log 7$

$x \log 2 = \log 7$

$x = \frac{\log 7}{\log 2}$

$x = 2.81$

B) $6^{2x} = 123$

$\log 6^{2x} = \log 123$

$2x \log 6 = \log 123$

$2x = \frac{\log 123}{\log 6}$

$2x = 2.686$

$x = 1.34$

C) $4^{2x-1} = 53.2$

$\log 4^{2x-1} = \log 53.2$

$2x-1 \log 4 = \log 53.2$

$2x-1 = \frac{\log 53.2}{\log 4}$

$2x-1 = 2.863$

$2x = 3.863$

$x = 1.93$

D) $2^{6x+2} = 4^{2x}$

$6x+2 \log 2 = 2x \log 4$

$6x+2 = 2x\left(\frac{\log 4}{\log 2}\right)$

$6x+2 = 2x \cdot 2$

$6x+2 = 4x$

$2 = -2x$

$x = -1$

E) $2^{3x+1} = 4^x$

$3x+1 \log 2 = x \log 4$

$3x+1 = x\left(\frac{\log 4}{\log 2}\right)$

$3x+1 = 2x$

$x = -1$

F) $7^{2x+1} = 164$

$2x+1 \log 7 = \log 164$

$2x+1 = \frac{\log 164}{\log 7}$

$2x+1 = 2.621$

$x = 0.81$

G) $4^{3x-1} = 8^{x+2}$

$3x-1 \log 4 = x+2 \log 8$

$3x-1 = x+2\left(\frac{\log 8}{\log 4}\right)$

$3x-1 = 1.5x+3$

$1.5x = 4$

$x = 2.67$

H) $\log_3 4$

$\frac{\log 4}{\log 3}$

$x = 1.26$

I) $\log_7 54$

$\frac{\log 54}{\log 7}$

$x = 2.05$