7.5 Exponential & Logarithmic Equations

CA. 11.1

Ex. 1 A $8^x = 2^{x+6}$

$64 \times 8 = 512$

$(2^3)^x = 2^{x+6}$

$2^{3x} = 2^{x+6}$

2^9

$3x = x+6$

128

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

$2\,2\,2\,2\,2\,2\,2\,2\,2$

256

$x = 3$

1a $3^{2x} = 27$

$3^{2x} = 3^3$

$\sqrt[2]{4^1} = 4^{1/2}$

$\frac{2x}{2} = \frac{3}{2}$

$x = \frac{3}{2}$

$3^{2(\frac{3}{2})}$

$3^3 = 27$

Ex. 1B

$$5^{x-2} = 200$$

$$\log 5^{x-2} = \log 200$$

$$\frac{(x-2)\log 5}{\log 5} = \frac{\log 200}{\log 5}$$

$$x-2 \approx 3.292$$

$$+2 \qquad +2$$

$$x \approx 5.292$$

V16 $7^{-x} = 21$

$\log 7^{-x} = \log 21$

$\frac{-x \cdot \log 7}{\log 7} = \frac{\log 21}{\log 7}$

$-x = \log$

$-x = 1.565$

$x = -1.565$

VIc $2^{3x} = 15$

$$\log 2^{3x} = \log 15$$

$$\frac{3x \cdot \log 2}{\log 2} = \frac{\log 15}{\log 2}$$

$$\frac{3x}{3} \approx \frac{3.907}{3}$$

$$x \approx 1.302$$

Ex. 3

$$\boxed{b^{\log_b x} = x}$$

$$\log_3(x-5) = 2$$

$$3^{\log_3(x-5)} = 3^2$$

$$x-5 = 9$$

$$+5 \quad +5$$

$$x = 14$$

$$\log_6(2x-1) = -1$$

$$6^{\log_6(2x-1)} = 6^{-1}$$

$$2x-1 = \frac{1}{6} \qquad b^{\log_b x} = x$$

$$2x = 1\frac{1}{6}$$

$$\frac{2x}{2} = \frac{7}{6}\cdot\frac{1}{2} = \frac{7}{12}$$

Ex. 3B

$$\log 45x - \log 3 = 1$$

$$\log \frac{45x}{3} = 1$$

$$\log 15x = 1$$

$$10^{\log_{10} 15x} = 10^1 \qquad b^{\log_b x} = x$$

$$\frac{15x}{15} = \frac{10}{15} \qquad x = \frac{2}{3}$$

✓ 3a

$$3 = \log 8 + 3\log x$$

$$3 = \log 8 + \log x^3$$

$$3 = \log 8x^3$$

$$10^3 = 10^{\log_{10} 8x^3} \qquad b^{\log_b x} = x$$

$$\frac{1000}{8} = \frac{8x^3}{8}$$

$$\sqrt[3]{125} = \sqrt[3]{x^3}$$

$$5 = x$$

$$\log_4 100 - \log_4 (x+1) = 1$$

$$\log_4 \frac{100}{x+1} = 1$$

$$4^{\log_4 \frac{100}{x+1}} = 4^1$$

$$\frac{\cancel{(x+1)}}{1} \cdot \boxed{\frac{100}{\cancel{x+1}} = 4}(x+1)$$

$$100 = 4x + 4$$

$$\frac{96}{4} = \frac{4x}{4}$$

$$24 = x$$

3C $\log_4 x^2 = 7$

$$\frac{2 \cdot \log_4 x}{2} = \frac{7}{2}$$

$$\log_4 x = \frac{7}{2}$$

$$4^{7/2} = x$$

3D $\log x + \log(x+9) = 1$

$\log x(x+9) = 1$

$10^{\log x(x+9)} = 10^1$

$x^2 + 9x = 10$

$x^2 + 9x - 10 = 0$

$(x+10)(x-1) = 0$

$x = -10, 1$