

Solving Exponential and Logarithmic Equations 1

Exponential equations are equations in which variable expressions occur as exponents.
Logarithmic equations are equations that involve logarithms of variable expressions.

Ex. 1 Solve by equating exponents

Solve: $8^x = 4^{x+1}$
 $(2^3)^x = (2^2)^{x+1}$
 $3x = 2x + 2$
 $-2x \quad -2x$
 $\boxed{x = 2}$

Solve: $\frac{1}{5}^x = 25^{x+2}$
 $(5^{-1})^x = (5^2)^{x+2}$
 $-x = 2x + 4$
 $-2x \quad -2x$
 $-3x = 4$
 $\frac{-3x}{-3} = \frac{4}{-3}$
 $\boxed{x = -\frac{4}{3}}$

YOU TRY!

Solve: $64^x = 16^{x+1}$

Solve: $3^{7x-3} = \frac{1}{9}^{12x}$

Ex. 2 Solve by taking a logarithm of each side

Solve: $8^x = 23$ * Change to logarithm
 $\log_8 23 = x$
 Change of Base
 $\frac{\log \#}{\log \text{base}} = \log 23$
 $\frac{\log 23}{\log 8} = 1.507$

Solve: $7^{x-1} = 23$
 $\log_7 23 = x - 1$
 $\frac{\log 23}{\log 7} \rightarrow 1.611 = x - 1$
 $+1 \quad +1$
 $\boxed{2.611 = x}$

YOU TRY!

Solve: $6^x = 27$

Solve: $15 = 11^{2x+1}$

Ex. 3 Solve by taking a logarithm of each side

Solve: $9^{3x+2} - 6 = 5$
 $+6 \quad +6$
 $9^{3x+2} = 11$
 $\log_9 11 = 3x + 2$
 $1.091 = 3x + 2$
 $-2 \quad -2$
 $-.909 = 3x$

Solve: $3(2^x) + 2 = 11$
 $-2 \quad -2$
 $\frac{3(2^x)}{3} = \frac{9}{3}$
 $2^x = 3$
 $\log_2 3 = x$
 $1.585 = x$

YOU TRY!

Solve: $2^{3x+2} - 2 = 7$

$\boxed{-1.303 = x}$

Solve: $2(5^{x-1}) + 1 = 1$

$\boxed{\text{undefined}}$