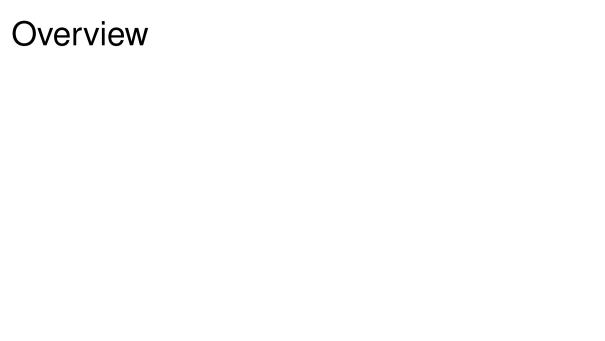# Solving Logarithmic and Exponential Equations

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Success in College Math

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2. Solving Exponential Equations

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Inverse Properties of Logarithms and Exponential Functions

For all x

$$\log_b b^x = x.$$

For $x > 0$

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

How To - Solve Exponential Equations

To solve an equation containing an exponential expression:

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To solve an equation containing an exponential expression:

1. Isolate the exponential expression.
2. Take the logarithm of both sides. Use the same base for the logarithm as the exponential expression.
3. Cancel the logarithm and exponential expression using the Inverse Property.

How To - Solve Exponential Equations

To solve an equation containing an exponential expression:

1. Isolate the exponential expression.
2. Take the logarithm of both sides. Use the same base for the logarithm as the exponential expression.
3. Cancel the logarithm and exponential expression using the Inverse Property.
4. Solve the resulting equation.

Example 1

Solve the equation. Round your answer to three decimal places where appropriate.

$$4 \cdot 9^{2x} = 14$$

Example 1

Solve for the exponential expression.

Example 1

Take the logarithm base 9 of both sides. Cancel the logarithm and exponent.

Example 1

Solve for *x*.
Round your
answer to three
decimal places.

Example 2

Solve the equation. Round your answer to three decimal places where appropriate.

$$10^{2x-18} + 12 = -3$$

Example 2

Solve for the
exponential
expression.

Example 2

Take the common logarithm of both sides.

The common logarithm isn't defined for -15, so the equation does not have (real number) solutions.

How To - Solve Logarithmic Equations

To solve an equation containing a logarithm:

How To - Solve Logarithmic Equations

To solve an equation containing a logarithm:

1. Isolate the logarithmic expression.

How To - Solve Logarithmic Equations

To solve an equation containing a logarithm:

1. Isolate the logarithmic expression.
2. Use both sides as an exponent in an exponential expression. Use the same base for the exponential expression as the logarithm.

How To - Solve Logarithmic Equations

To solve an equation containing a logarithm:

1. Isolate the logarithmic expression.
2. Use both sides as an exponent in an exponential expression. Use the same base for the exponential expression as the logarithm.
3. Cancel the exponential expression and logarithm using the Inverse Property.

How To - Solve Logarithmic Equations

To solve an equation containing a logarithm:

1. Isolate the logarithmic expression.
2. Use both sides as an exponent in an exponential expression. Use the same base for the exponential expression as the logarithm.
3. Cancel the exponential expression and logarithm using the Inverse Property.
4. Solve the resulting equation.

Example 3

Solve the equation. Round your answer to three decimal places where appropriate.

$$2 \cdot \log (6x) + 16 = 14$$

Example 3

Solve for the
logarithm.

Example 3

Use both sides as an exponent with base 10.
Cancel the exponent and logarithm.
The negative exponent is defined, so we know there are solutions.

Example 3

Solve the equation for *x*. Round the answer to three decimal places.

Example 4

Solve the equation. Round your answer to three decimal places where appropriate.

$$\log_8 (3x - 18) = 3$$

Example 4

Use both sides of
the equation as
an exponent with
base 8.
Cancel the
exponent and
logarithm.

Example 4

Solve the equation for *x*. Round your answer to three decimal places.