SOLVING EXPONENTIAL EQUATIONS

To solve an exponential equation, take the log of both sides, and solve for the variable.

Example 1: Solve for x in the equation $e^x = 80$.

Solution:

Step 1: Take the natural log of both sides:

$$Ln\left(e^x\right) = Ln(80)$$

Step 2: Simplify the left side of the above equation using Logarithmic Rule 3:

$$xLn(e) = Ln(80)$$

Step 3: Simplify the left side of the above equation: Since *Ln*(*e*)=1, the equation reads

$$x = Ln(80)$$

Ln(80) is the exact answer and *x*=4.38202663467 is an approximate answer because we have rounded the value of Ln(80)..

Check: Check your answer in the original equation.

$$e^{4.38202663467} = 79.9999999999 \approx 80 .$$

Example 2: Solve for x in the equation $10^{x+5} - 8 = 60$

Solution:

Step 1: Isolate the exponential term before you take the common log of both sides. Therefore, add 8 to both sides: $10^{x+5} = 68$
Step 2: Take the common log of both sides:

$$Log\left(10^{x+5}\right) = Log(68)$$

Step 3: Simplify the left side of the above equation using Logarithmic Rule 3:

$$(x+5)Log(10) = Log(68) .$$

Step 4: Simplify the left side of the above equation: Since Log(10) = 1, the above equation can be written

$$(x+5) = Log(68)$$

Step 5: Subtract 5 from both sides of the above equation:

$$x = Log(68) - 5$$

is the exact answer. x = -3.16749108729 is an approximate answer..

Check: Check your answer in the original equation. Does

$$10^{-3.16749108729+5} - 8 = 60?$$

Yes it does.

Example 3: Solve for x in the equation

$$e^{2x} - 5e^x + 6 = 0 .$$

Solution:

Step 1: When you graph the left side of the equation, you will note that the graph crosses the x-axis in two places. This means the equation has two real solutions.
Step 2: Rewrite the equation in quadratic form:

$$\left(e^x\right)^2 - 5\left(e^x\right) + 6 = 0$$

Step 3: Factor the left side of the equation:

$$\left(e^x\right)^2 - 5\left(e^x\right) + 6 = 0$$

can now be written

$$\left(e^x - 2\right)\left(e^x - 3\right) = 0 .$$

Step 4: Solve for x. Note: The product of two terms can only equal zero if one or both of the two terms is zero.
Step 5: Set the first factor equal to zero and solve for x: If $\left(e^x - 2\right) = 0$, then $e^x = 2$ and $Ln\left(e^x\right) = Ln(2)$ and *x*=*Ln*(2) is the exact answer or $x \approx 0.69314718056$ is an approximate answer.

Step 6: Set the second factor equal to zero and solve for x: If $\left(e^x - 3\right) = 0$, then $e^x = 3$ and $Ln\left(e^x\right) = Ln(3)$ and *x*=*Ln*(3) is the exact answer or $x \approx 1.09861228867$ is an approximate answer. The exact answers are Ln(3) and Ln(2) and the approximate answers are 0.69314718056 and 1.09861228867.

Check: These two numbers should be the same numbers where the graph crosses the x-axis.

Remark: Why did we choose the *Ln* in Example 3? Because we know that *Ln*(*e*) = 1.

If you would like to review another example, click on Example.

Work the following problems. If you want to review the answer and the solution, click on answer.

Problem 1: Solve for x in the equation $8 + 5^{2x+3} = 12$.

Answer

Problem 2: Solve for x in the equation $\dfrac{4000}{2 + 7^{3x}} = 5$.

Answer

Problem 3: Solve for x in the equation $10e^{2x} - 31e^x + 15 = 0$.

Answer

Problem 4: Solve for x in the equation $\left(1 + \dfrac{.10}{12}\right)^{12x} = 2$.

Answer

Problem 5: Solve for x in the equation $400 = 5000\left(1 - \dfrac{4}{4 + e^{-0.002x}}\right)$.

Answer

Problem 6: Solve for x in the equation $5\left(8e^{2x} - 3\right)^3 = 625$.

Answer

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