## Unit 4 Lesson 14: Solving Exponential Equations

### 1 A Valid Solution? (Warm up)

#### Student Task Statement

To solve the equation $5⋅e^{3a}=90$, Lin wrote the following:

$\begin{matrix}5⋅e^{3a}&=90\\e^{3a}&=18\\3a&=log\_{e}18\\a&=\frac{log\_{e}18}{3}\end{matrix}$

Is her solution valid? Be prepared to explain what she did in each step to support your answer.

### 2 Natural Logarithm

#### Student Task Statement

1. Complete the table with equivalent equations. The first row is completed for you.

| *
 | * exponential form
 | * logarithmic form
 |
| --- | --- | --- |
| * a.
 | * $e^{0}=1$
 | * $ln1=0$
 |
| * b.
 | * $e^{1}=e$
 | *
 |
| * c.
 | * $e^{-1}=\frac{1}{e}$
 | *
 |
| * d.
 | *
 | * $ln\frac{1}{e^{2}}=-2$
 |
| * e.
 | * $e^{x}=10$
 | *
 |

1. Solve each equation by expressing the solution using $ln$ notation. Then, find the approximate value of the solution using the “ln” button on a calculator.
	1. $e^{m}=20$
	2. $e^{n}=30$
	3. $e^{p}=7.5$

### 3 Solving Exponential Equations

#### Student Task Statement

Without using a calculator, solve each equation. It is expected that some solutions will be expressed using log notation. Be prepared to explain your reasoning.

1. $10^{x}=10,​000$
2. $5⋅10^{x}=500$
3. $10^{\left(x+3\right)}=10,​000$
4. $10^{2x}=10,​000$
5. $10^{x}=315$
6. $2⋅10^{x}=800$
7. $10^{\left(1.2x\right)}=4,​000$
8. $7⋅10^{\left(0.5x\right)}=70$
9. $2⋅e^{x}=16$
10. $10⋅e^{3x}=250$



© CC BY 2019 by Illustrative Mathematics®