Lesson 5.3

Objectives: To solve an exponential equation by writing it in logarithmic form.
To know and use the change of base formula.
To solve logarithmic and exponential equations.
To solve logarithmic and exponential inequalities.

Exponential equation is an equation that has a variable in the exponent.

Method 1 (most effective for a base of *e* or 10)

1. Isolate the base with the exponential variable
2. Divide by the coefficient of the exponential variable – if necessary
3. Change the equation to logarithmic form.
4. Solve for the variable.

EXAMPLES: Solve

1. $4000 = 200(10^{4x})$ 2. $3000 = 500(e^{4x})$

YOU TRY: 1. $600 = 30\,(10^{3x})$ 2. $80 = 4(e^{2x})$

Method 2

1. Isolate the base with the exponential variable by dividing by the coefficient of the exponential variable - if necessary
3. Take the log of both sides (log or ln)
4. Solve for the variable.

Solve

1. $4^x = 65$

2. $6400 = 32(2^{4x})$

YOU TRY: 1. $5^x = 80$ 2. $300 = 20(3^{2x})$

Applications

EXAMPLE)#42 The demand function for a dining room table is given by $p = 4000(3^{-q})$ dollars per table, where *p* is the price and *q* is the quantity, in thousands of tables, demanded at that price. What quantity will be demanded if the price per table is $256.60?

Let's look at a formula to help solve $4^x = 65$.

Change of base formula:

If $a > 0,\ a \neq 0,$ and $x > 0$, then

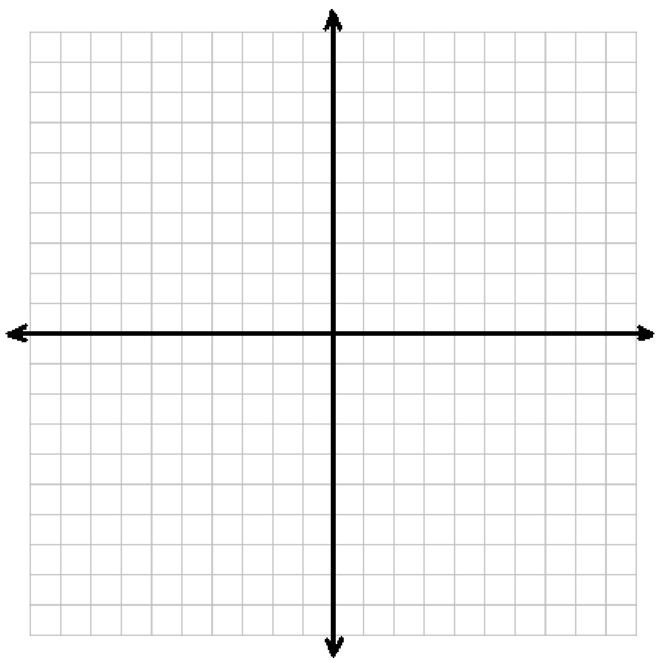
$$\log_a x = \frac{\log x}{\log a} \quad \text{and} \quad \log_a x = \frac{\ln x}{\ln a}$$

Therefore $4^x = 65$. Becomes x = $\log_4 65 = \dfrac{\log 65}{\log 4} =$ ________

#12 Use a change of base formula to evaluate

$\log_7(215)$

Graph y = $\log_4 (3x)$ by using a change of base formula.



Solving Logarithmic Equations

EXAMPLE: Solve (remember to isolate the log first)

1. $6 + 3 \ln x = 15$

2. $4 + 2 \ln x = 6$

3. $\log_4 (3x - 5) = 3$

4. $\log_5(x+4) - \log_5 x = 2$

Solving Inequalities

1. $15(4^x) \leq 15{,}360$

EXAMPLE #80 The concentration of a drug in the bloodstream from the time the drug is administered until 8 hours later is given by $y = 100(1 - e^{-0.312(8-t)})$ percent, where the drug is administered at time $t = 0$. For what time period is the amount of drug present more than 60%?

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