p. 34-35 Solving Log Equations by Rewriting Day 2 7.5

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Warm-up:

Solve the following equation for x.

$$5\log_2(x+3)=15$$

$$\frac{5\log_2(x+3)}{5}=\frac{15}{5}$$

$$\log_2(x+3)=3$$

$$2^3=x+3$$

$$8=x+3$$

$$-3 \quad -3$$

$$5=x$$

We have solved simple equations by

✓ Writing Logarithm Form to Exponential Form.

Today we will learn how to solve equations by writing Exponential Form to Logarithm Form.

In order to solve these types of equations we will first learn **how to evaluate logarithm expressions.**

A simple example:

Evaluate: $\log_3 9 = ?$

According to our definition of a logarithm, we may say that "$\log_3 9$" can be found by asking yourself: "what power do I raise the number 3 to in order to get 9?"

What is the answer?

$\log_3 9 =$ 2

A *not* so simple example: p. 35

Evaluate: $\log_3 200$ between 4 & 5

According to our definition of a logarithm, we may say that "$\log_3 200$" can be found by asking yourself: "what power do I raise the number 3 to in order to get 200?"

Could we use mental math to evaluate this log expression?

We will use the Change of Base Formula:

$$\log_b x = \frac{\log x}{\log b}$$

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$$\log_b x = \frac{\log x}{\log b}$$

Evaluate the logarithms using the Change of Base Formula. Round to the nearest hundredths when necessary.

1) $\log_3 9$ 2) $\log_3 200$ 3) $\log_4 308$

$\frac{\log 9}{\log 3} = 2$ $\frac{\log 200}{\log 3}$ $\boxed{4.82}$ $\frac{\log 308}{\log 4}$ $\boxed{4.13}$

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$$\log_b x = \frac{\log x}{\log b}$$

Solve the following for x. Round to the nearest hundredths when necessary.

4) $9^x = 585$

$\log_9 585 = x$

log expression evaluate using CHANGE of BASE

$\frac{\log 585}{\log 9} = x$

$\boxed{x = 2.90}$

5) $2^x + 10 = 100$

$-10 \quad -10$

$2^x = 90$

$\log_2 90 = x$

$\frac{\log 90}{\log 2} = x$

$\boxed{6.49 = x}$

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$$\log_b x = \frac{\log x}{\log b}$$

6) $\frac{2 \cdot 4^x}{2} = \frac{800}{2}$

$4^x = 400$

log

$\log_4 400 = x$

$\frac{\log 400}{\log 4} = x$

$4.32 = x$

7) $7^{x-11} = 290$

log

$\log_7 290 = x - 11$

$\frac{\log 290}{\log 7} = x - 11$

$2.91 = x - 11$

$+11 \quad +11$

$13.91 = x$

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Use your solving methods to answer the questions. Round to the nearest hundredths.

8) The present balance of your bank account can be modeled by the following equation:

$$y = 250(1.0125)^{4t}$$

Where t represents the number of years that have passed.
How many years will it take for your bank account balance to reach $4,000?

t ?

$\frac{4000}{250} = \frac{250(1.0125)^{4t}}{250}$

4t

$(1.0125)^{4t} = 16$

$\log_{1.0125} 16 = 4t$

$\frac{\log 16}{\log 1.0125} = 4t$

$\frac{223.19}{4} = \frac{4t}{4}$

$55.8 = t$ years

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9) The number of bunnies can be found using the following equation:

$$y = 15(1.08)^t$$

Where t represents the number of years that have passed.
How many years will it take for the number of bunnies to reach 120?

$\frac{120}{15} = \frac{15(1.08)^t}{15}$

$8 = 1.08^t$

$\log_{1.08} 8 = t$

$\frac{\log 8}{\log 1.08} = t$

$t = 27$ years

Homework!

Solving Log/Exp Equations – Day 2