

Warm Up 11/17

Solve.

$$1) 2x - 6 = 6 \quad 2) 2x + 5x - 3 = 9 \quad 3) 4x^2 = 100$$

$$4) \frac{x}{6} = 8$$

$$5) \frac{4}{x} = 2$$

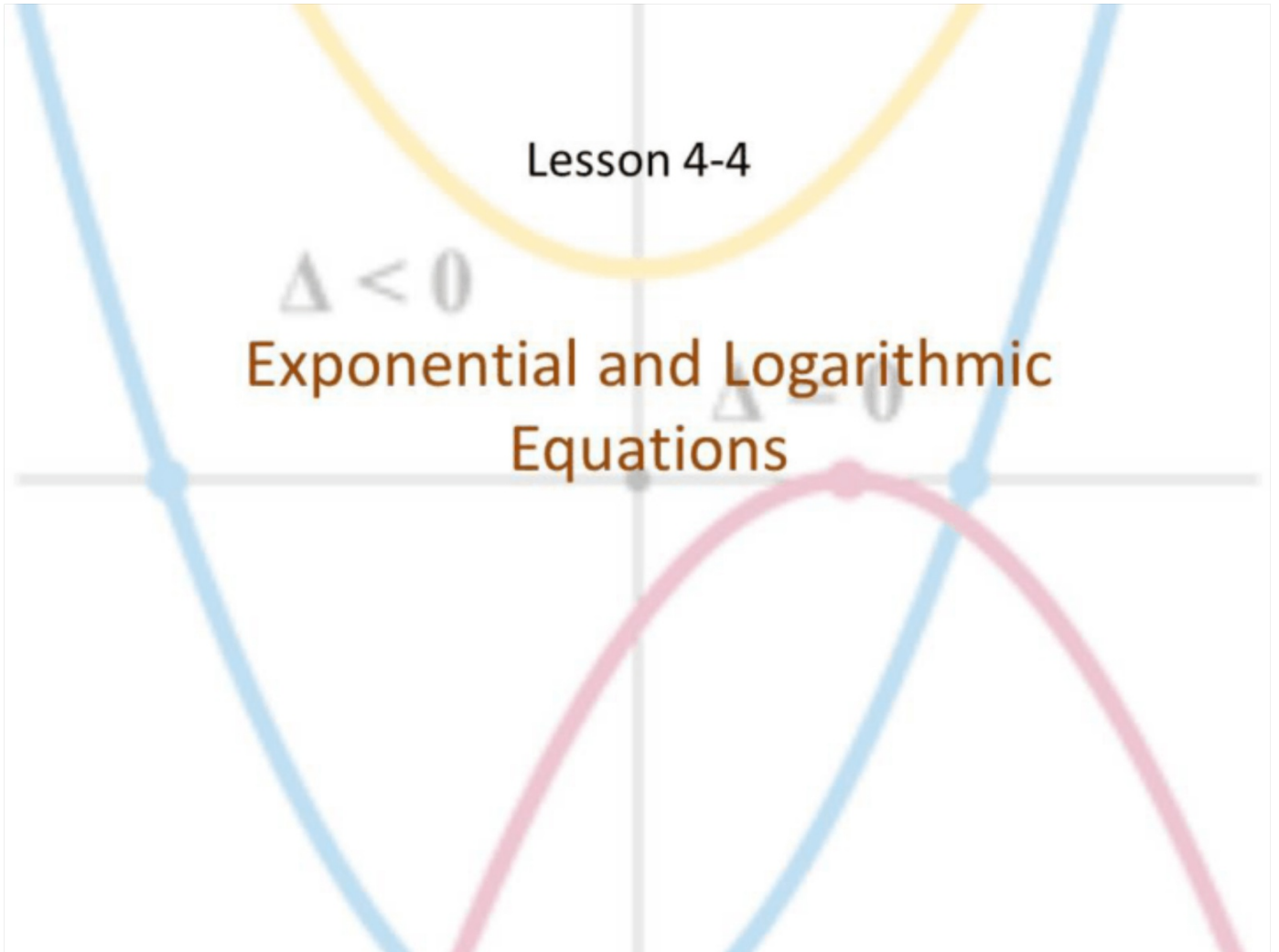
$$6) \log_x 9 = 2$$

Lesson 4-4

$\Delta < 0$

Exponential and Logarithmic
Equations

$\Delta = 0$



Objective

Students will...

- Be able to apply the inverse relationship between exponential and logarithmic functions and solve their equations algebraically.

Solving Exponential and Logarithmic Equations

So far in this chapter, we've learned various components and techniques involving exponential and logarithmic functions. Knowing about these characteristics and techniques can be useful when it comes to solving equations.

An **exponential equation** is one in which the variable occurs in the exponent. For example, $2^x = 7$.

A **logarithmic equation** is one in which a logarithm of the variable occurs. For example, $\log_2(x + 2) = 5$

Although solving these equations may appear to be difficult, if we simply use their inverse relationship, they become quite easy.

$$\log_3 7 = \frac{\log 7}{\log 3} \text{ or } \frac{\ln 7}{\ln 3}$$

$$\log_3 5 = \frac{\ln 5}{\ln 3}$$

Examples

$$1. 3^{x+2} = 7$$

$$\log_3(3^{x+2}) = \log_3(7)$$

$$x+2 = \log_3(7)$$

$$x = \frac{\log 7}{\log 3} - 2 \approx -0.2288$$

$$3. 8e^{2x} = 20$$

$$e^{2x} = \frac{5}{2}$$

$$\ln(e^{2x}) = \ln\left(\frac{5}{2}\right)$$

$$2x = \ln\left(\frac{5}{2}\right)$$

$$x = \frac{\ln(5/2)}{2}$$

$$x \approx 0.4581$$

$$2. 3^{x+3} = 5$$

$$\log_3(3^{x+3}) = \log_3 5$$

$$x+3 = \log_3 5$$

$$x = \frac{\ln 5}{\ln 3} - 3 \approx -1.5$$

$$3. 10^{56x} = 7$$

$$\log(10^{56x}) = \log(7)$$

$$56x = \log 7$$

$$x = \frac{\log 7}{56} \approx 0.01$$

"1"

Examples

5. $\log_2(x+2) = 5$
~~2~~ 2^5 2^5
 $x+2 = 32$
 $x = 30$

6. $\ln x = 8$
~~e~~ e^8
 $x = e^8$

7. $\log_2(25-x) = 3$
~~2~~ 2^3 2^3
 $x = 17$

8. $\log_2(22-x) = 3$
~~2~~ 2^3 2^3
 $22-x = 8$
 $x = 14$

Examples

9. $\log(x+2) + \log(x-1) = 1$

Law 1st

$$X = \log_{10}((x+2)(x-1)) = 1$$

$$= x^2 + x - 2 = 10^1$$

$$= x^2 + x - 12 = 0$$

$$= (x+4)(x-3) = 0$$

$$\text{AP. } e^{2x} - e^x - 6 = 0$$

$$\frac{3}{-1} = (x-3)(e^x+2) = 0 \Rightarrow$$

$$e^x - 3 = 0 \quad \text{or} \quad e^x + 2 = 0$$

$$\ln(e^x + 3)$$

$$x = \ln 3 \approx 1.099$$

10. $3xe^x + x^2e^x = 0$

$$xe^x(3+x) = 0$$

$$x = 0$$

$$e^x = 0$$

$$x = \ln 0$$

$$x = 0$$

$$3+x = 0$$

$$x = -3$$

$$e^x = 0$$

$$e^x - 2 = 0$$

In Closing

Expand or combine the following using the laws of logarithms and check your answers with a partner.

1) $\log_4 \frac{x}{2}$

2) $\log 12 + \frac{1}{2} \log 7 - \log 2$

Homework 11/17

TB pg. 366-367 #1-13(e.o.o), 25, 31, 35, 39, 43, 49