

Name: _____

Date: _____ Block: _____

Class Examples: Exponential and Logarithmic Equations

Honors PreCalculus

Solve each equation. Check for extraneous solutions when necessary.

1) $3^{-3x+1} = 3^{x-9}$

$$-3x+1 = x-9$$

$$1 = 4x-9$$

$$10 = 4x$$

$$\frac{10}{4} = x$$

$$\boxed{\frac{5}{2} = x}$$

2) $9^{2x+1} = 27^{x-5}$

$$(3^2)^{2x+1} = (3^3)^{x-5}$$

$$3^{4x+2} = 3^{3x-15}$$

$$4x+2 = 3x-15$$

$$\boxed{x = -17}$$

3) $10^{x-3} = 100^{4x-5}$

$$10^{x-3} = (10^2)^{4x-5}$$

$$10^{x-3} = 10^{8x-10}$$

$$x-3 = 8x-10$$

$$7 = 7x$$

$$\boxed{1 = x}$$

4) $4(1 + 10^{5x}) = 9$

$$1 + 10^{5x} = \frac{9}{4}$$

$$10^{5x} = \frac{5}{4}$$

$$\log \frac{5}{4} = 5x$$

$$.09691 = 5x$$

$$\boxed{.01938 = x}$$

5) $\frac{2}{3}e^{4x} + \frac{1}{3} = 4$

$$\frac{2}{3}e^{4x} = \frac{11}{3}$$

$$e^{4x} = \frac{11}{2}$$

$$\ln \frac{11}{2} = 4x$$

$$1.7047 = 4x$$

$$\boxed{.42619 = x}$$

6) $4^{x-3} = \frac{1}{16}$

$$\log_4 \frac{1}{16} = x-3$$

$$-2 = x-3$$

$$\boxed{x = 1}$$

7) $4(e^{3-5x}) = 64$

$$e^{3-5x} = 16$$

$$\ln 16 = 3-5x$$

$$2.7726 = 3-5x$$

$$-.2274 = -5x$$

$$\boxed{.04548 = x}$$

8) $10^{2x} + 3 = 8$

$$10^{2x} = 5$$

$$\log 5 = 2x$$

$$.69897 = 2x$$

$$\boxed{.34949 = x}$$

$$9) 1.2e^{-5x} + 2.6 = 3$$

$$1.2e^{-5x} = .4$$

$$e^{-5x} = \frac{1}{3}$$

$$\ln \frac{1}{3} = -5x$$

$$-1.0986 = -5x$$

$$\boxed{.2197 = x}$$

$$11) 2 \log_5 x = \log_5 9$$

$$\log_5 x^2 = \log_5 9$$

$$x^2 = 9$$

$$x = \pm 3$$

$$\boxed{x=3} \quad x=-3$$

✓
x

$$13) \ln(x+5) = \ln(x-1) - \ln(x+1)$$

$$\ln(x+5) = \ln\left(\frac{x-1}{x+1}\right)$$

$$x+1 \cdot x+5 = \frac{x-1}{x+1} \cdot x+1$$

$$x^2 + 6x + 5 = x - 1$$

$$x^2 + 5x + 6 = 0$$

$$(x+3)(x+2) = 0$$

$$x \neq -3 \quad \boxed{x=2}$$

$$15) \log(x-4) = 3$$

$$10^3 = x-4$$

$$1000 = x-4$$

$$\boxed{1004 = x}$$

$$17) 2 \ln(-x) + 7 = 14$$

$$2 \ln(-x) = 7$$

$$\ln(-x) = \frac{7}{2}$$

$$e^{\frac{7}{2}} = -x$$

$$33.1155 = -x$$

$$\boxed{-33.1155 = x}$$

$$10) \log_5(2x+3) = \log_5 3$$

$$2x+3=3$$

$$2x=0$$

$$\boxed{x=0}$$

$$12) \log_7 3 + \log_7 x = \log_7 32$$

$$\log_7 3x = \log_7 32$$

$$3x=32$$

$$\boxed{x = \frac{32}{3}}$$

$$14) \frac{1}{3} \log_2 x + 5 = 7$$

$$\frac{1}{3} \log_2 x = 2$$

$$\log_2 x = 6$$

$$2^6 = x$$

$$\boxed{64 = x}$$

$$16) \log_2(x^2 - x - 2) = 2$$

$$2^2 = x^2 - x - 2$$

$$4 = x^2 - x - 2$$

$$0 = x^2 - x - 6$$

$$0 = (x-3)(x+2)$$

$$\boxed{x=3 \quad x=-2}$$

$$18) \ln \sqrt{x+2} = 1$$

$$e^1 = \sqrt{x+2}$$

$$2.71828 = \sqrt{x+2}$$

$$7.389 = x+2$$

$$\boxed{5.389 = x}$$

$$19) \log_5(x+6) + \log_5(x+2) = 1$$

$$\log_5[(x+6)(x+2)] = 1$$

$$5^1 = (x+6)(x+2)$$

$$5 = x^2 + 8x + 12$$

$$0 = x^2 + 8x + 7$$

$$0 = (x+7)(x+1)$$

$$x \neq -7 \quad \boxed{x = -1}$$

$$20) 2 \log_4 x - \log_4(x-1) = 1$$

$$\log_4 \frac{x^2}{x-1} = 1$$

$$x-1 \cdot 4^1 = \frac{x^2}{x-1} \cdot x-1$$

$$4x-4 = x^2$$

$$0 = x^2 - 4x + 4$$

$$0 = (x-2)(x-2)$$

$$\boxed{x = 2}$$

$$21) 2e^{2x} - 5e^x - 3 = 0$$

$$-b \times 1 = -b$$

$$-b + 1 = -5$$

$$\frac{2e^x}{-b} - \frac{e^x}{-3} - \frac{3}{1}$$

$$(e^x - 3)(2e^x + 1) = 0$$

$$e^x - 3 = 0$$

$$2e^x + 1 = 0$$

$$e^x = 3$$

$$e^x = -\frac{1}{2}$$

$$\ln 3 = x$$

$$\ln(-\frac{1}{2}) = x$$

$$\boxed{1.0986 = x}$$

no solution

$$22) 2^{2x} + 2^{x+3} - 12 = 0$$

$$a = 1 \quad b = 1 \quad c = -12$$

$$(2^x + 4)(2^x - 3) = 0 \quad \frac{4}{4} \frac{x-3}{-3} = -12$$

$$2^x + 4 = 0 \quad 2^x - 3 = 0 \quad \frac{4}{4} + \frac{-3}{-3} = 1$$

$$2^x = -4 \quad 2^x = 3 \quad \frac{2^x}{4} \quad \frac{2^x}{-3}$$

$$\log_2(-4) = x \quad \log_2 3 = x$$

no solution

$$\boxed{1.58496 = x}$$

$$23) \log_7(2^x - 1) + \log_7(2^x - 7) = 1$$

$$\log_7[(2^x - 1)(2^x - 7)] = 1$$

$$7^1 = (2^x - 1)(2^x - 7)$$

$$7 = 2^{2x} - 8(2^x) + 7$$

$$0 = 2^{2x} - 8(2^x)$$

$$0 = 2^x(2^x - 8)$$

$$0 = 2^x \quad 0 = 2^x - 8$$

$$\log_2 0 = x$$

$$8 = 2^x$$

no solution

$$\log_2 8 = x$$

$$\boxed{3 = x}$$

$$24) \log_4(x^2 - 9) - \log_4(x - 3) = 3$$

$$\log_4 \frac{x^2 - 9}{x - 3} = 3$$

$$4^3 = \frac{x^2 - 9}{x - 3}$$

$$64 = \frac{(x-3)(x+3)}{x-3}$$

$$64 = x - 3$$

$$\boxed{67 = x}$$

