BOARD NOTES

5 NOVEMBER 2018

CC PRECALCULUS
CHAPTER 5 –
EXPONENTIAL AND LOGARITHMIC FUNCTIONS

- SECTION 5.6 - LOGARITHMIC AND EXPONENTIAL EQUATIONS

Objectives:

- Solve logarithmic equations
- Solve exponential equations
- Solve logarithmic and exponential equations using a calculator

Laws of Exponents

If s, t, a, and b are real numbers with $a > 0$ and $b > 0$, then

$$a^s \cdot a^t = a^{s+t} \qquad (a^s)^t = a^{st} \qquad (ab)^s = a^s \cdot b^s$$

$$1^s = 1 \qquad a^{-s} = \frac{1}{a^s} = \left(\frac{1}{a}\right)^s \qquad a^0 = 1 \tag{1}$$

Properties of Logarithms

In the list that follows, a, b, M, N, and r are real numbers. Also, $a > 0$, $a \neq 1$, $b > 0$, $b \neq 1$, $M > 0$, and $N > 0$.

Definition $y = \log_a x$ means $x = a^y$

Properties of Logarithms

$\log_a 1 = 0$ $\quad \log_a a = 1$ $\quad \log_a M^r = r \log_a M$

$a^{\log_a M} = M$ $\quad \log_a a^r = r$ $\quad a^r = e^{r \ln a}$

$\log_a(MN) = \log_a M + \log_a N$ $\quad \log_a\left(\frac{M}{N}\right) = \log_a M - \log_a N$

If $M = N$, then $\log_a M = \log_a N$. $\quad$ If $\log_a M = \log_a N$, then $M = N$.

Change-of-Base Formula $\log_a M = \dfrac{\log_b M}{\log_b a}$

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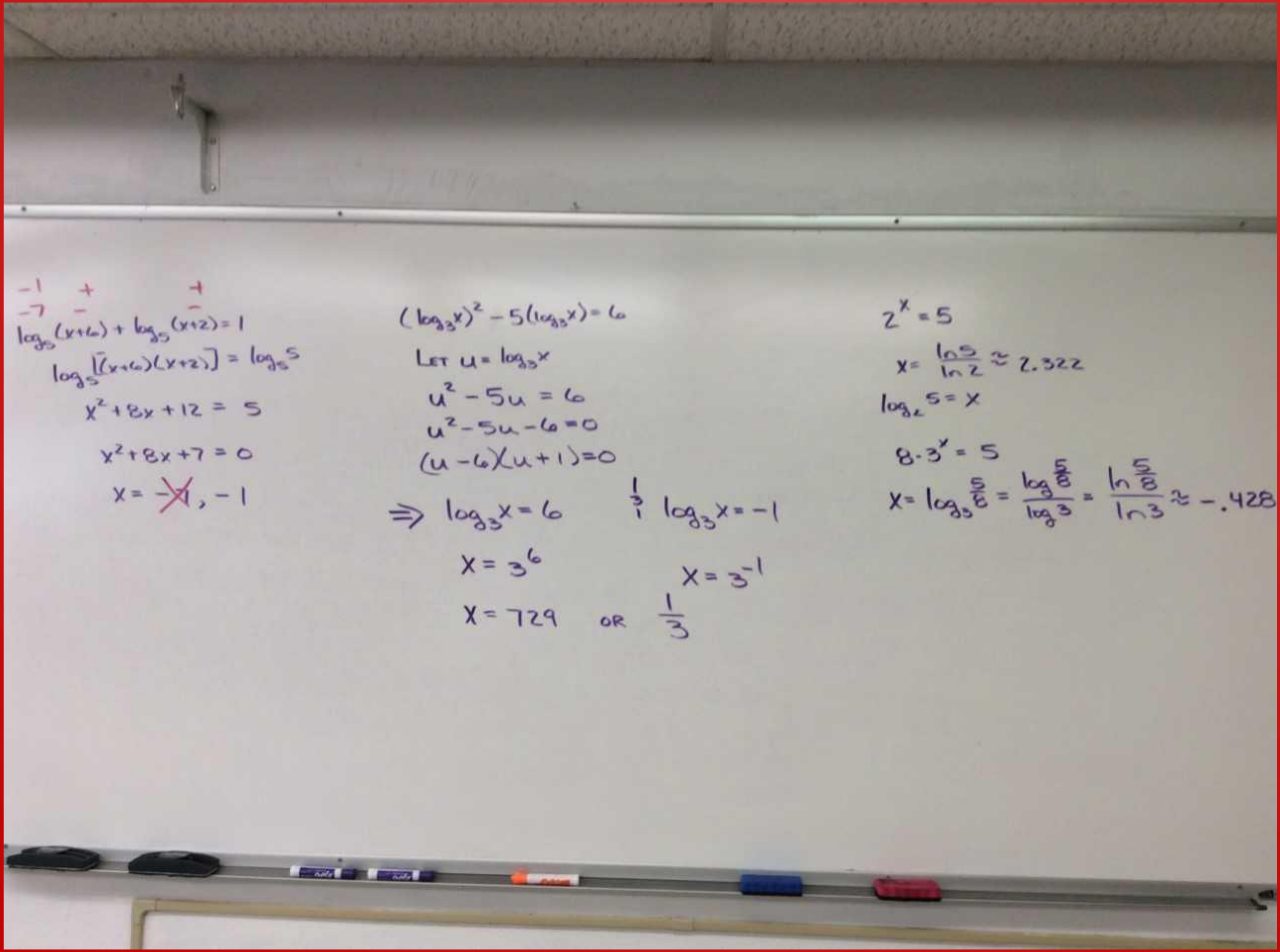
$$\log_2(1-2x)=3$$
$$2^3 = 1-2x$$
$$8 = 1-2x$$
$$7 = -2x$$
$$x = \frac{-7}{2}$$

$$2\log_5 x = \log_5 9$$
$$\log_5 x^2 = \log_5 9$$
$$x^2 = 9$$
$$x = 3, \cancel{-3}$$

$$\log_4(x+2) = \log_4 8$$
$$x+2 = 8$$
$$x = 6$$


log5(x+6) + log5(x+2) = 1
log5[(x+6)(x+2)] = log5 5
x2+8x+12 = 5
x2+8x+7 = 0
x = -7, -1
(log3 x)2 - 5(log3 x) = 6
Let u = log3 x
u2 - 5u = 6
u2 - 5u - 6 = 0
(u-6)(u+1) = 0
⇒ log3 x = 6
log3 x = -1
x = 36
x = 3-1
x = 729 or 1/3
2x = 5
x = ln5/ln2 ≈ 2.322
log2 5 = x
8·3x = 5
x = log3 5/8 = log 5/8 / log 3 = ln 5/8 / ln 3 ≈ -.428

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

$$\ln 5^{x-2} = \ln 3^{3x+2}$$

$$(x-2)\ln 5 = (3x+2)\ln 3$$

$$x\ln 5 - 2\ln 5 = 3x\ln 3 + 2\ln 3$$

$$x\ln 5 - 3x\ln 3 = 2(\ln 3 + \ln 5)$$

$$x(\ln 5 - 3\ln 3) = 2(\ln 3 + \ln 5)$$

$$x = \frac{2(\ln 3 + \ln 5)}{\ln 5 - 3\ln 3} \approx -3.212$$

$$4^x - 2^x - 12 = 0$$

$$(2^2)^x - 2^x - 12 = 0$$

$$2^{2x} - 2^x - 12 = 0$$

$$(2^x)^2 - 2^x - 12 = 0$$

$$u = 2^x$$

$$u^2 - u - 12 = 0$$

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