BOARD NOTES

30 OCTOBER 2018

CC PRECALCULUS
CHAPTER 5 –
EXPONENTIAL AND LOGARITHMIC FUNCTIONS

- SECTION 5.3 - EXPONENTIAL FUNCTIONS

Objectives:

- Evaluate exponential functions
- Graph exponential functions
- Define the number e
- Solve exponential equations

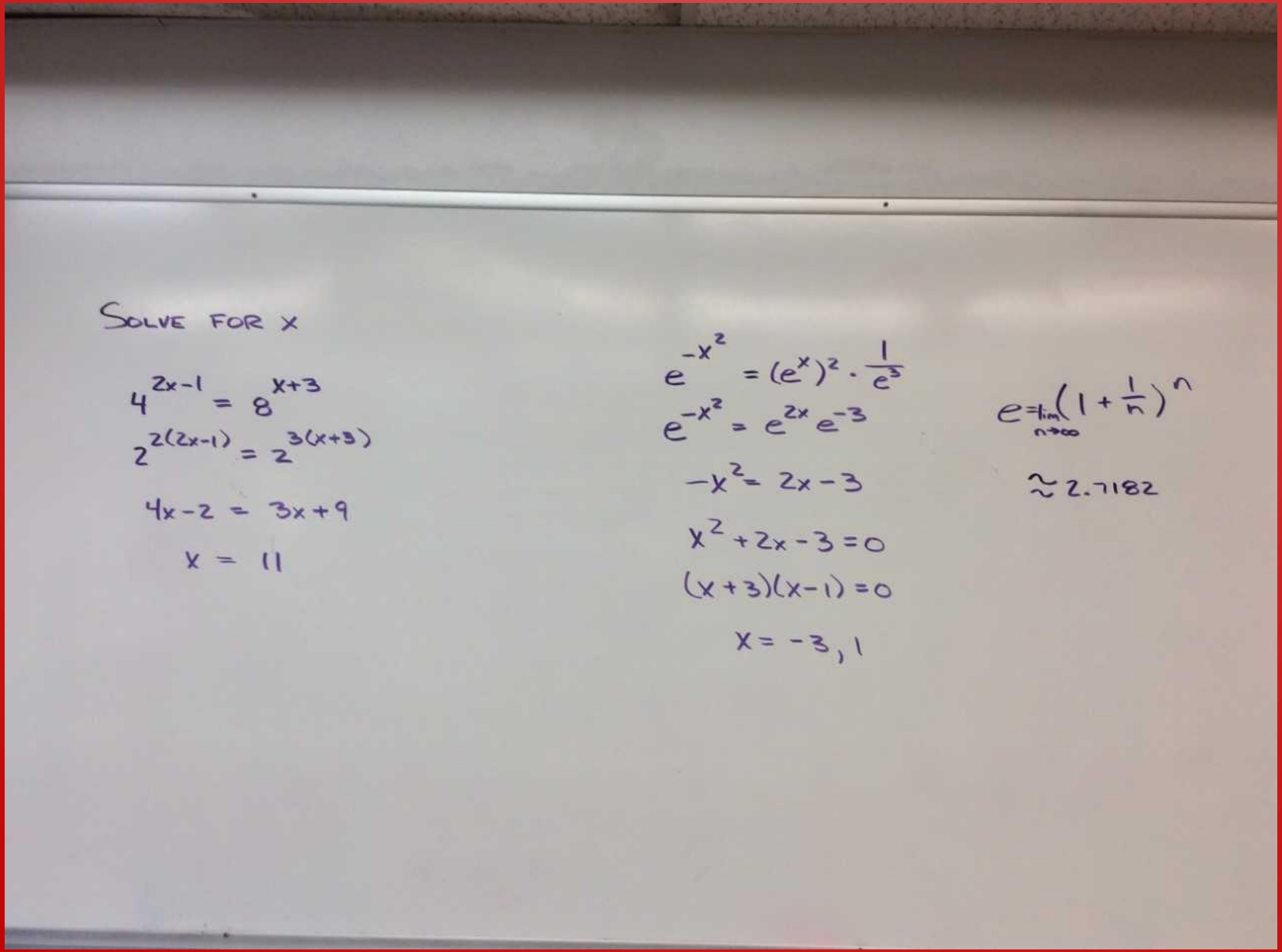
Euler's Number

The **number** ***e*** is defined as the number that the expression

$$\left(1+\frac{1}{n}\right)^n \qquad \textbf{(2)}$$

approaches as $n \to \infty$. In calculus, this is expressed, using limit notation, as

$$e = \lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n$$


SOLVE FOR X
$4^{2x-1} = 8^{x+3}$
$2^{2(2x-1)} = 2^{3(x+3)}$
$4x-2 = 3x+9$
$x = 11$
$e^{-x^2} = (e^x)^2 \cdot \frac{1}{e^3}$
$e^{-x^2} = e^{2x}e^{-3}$
$-x^2 = 2x-3$
$x^2+2x-3=0$
$(x+3)(x-1)=0$
$x = -3, 1$
$e = \lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n$
≈ 2.7182

CC PRECALCULUS
CHAPTER 5 –
EXPONENTIAL AND LOGARITHMIC FUNCTIONS

- SECTION 5.4 - LOGARITHMIC FUNCTIONS

Objectives:

- Change exponential statements to logarithmic statements and vice versa
- Evaluate logarithmic expressions
- Determine the domain of logarithmic functions
- Graph logarithmic functions
- Solve logarithmic equations

Definition of Logarithmic

The **logarithmic function with base a**, where $a > 0$ and $a \neq 1$, is denoted by $y = \log_a x$ (read as " y is the logarithm with base a of x") and is defined by

$$y = \log_a x \quad \text{if and only if} \quad x = a^y$$

The domain of the logarithmic function $y = \log_a x$ is $x > 0$.

Definition of Natural Logarithmic

$$y = \ln x \quad \text{if and only if} \quad x = e^y$$

Definition of Common Logarithmic

$$y = \log x \quad \text{if and only if} \quad x = 10^y$$

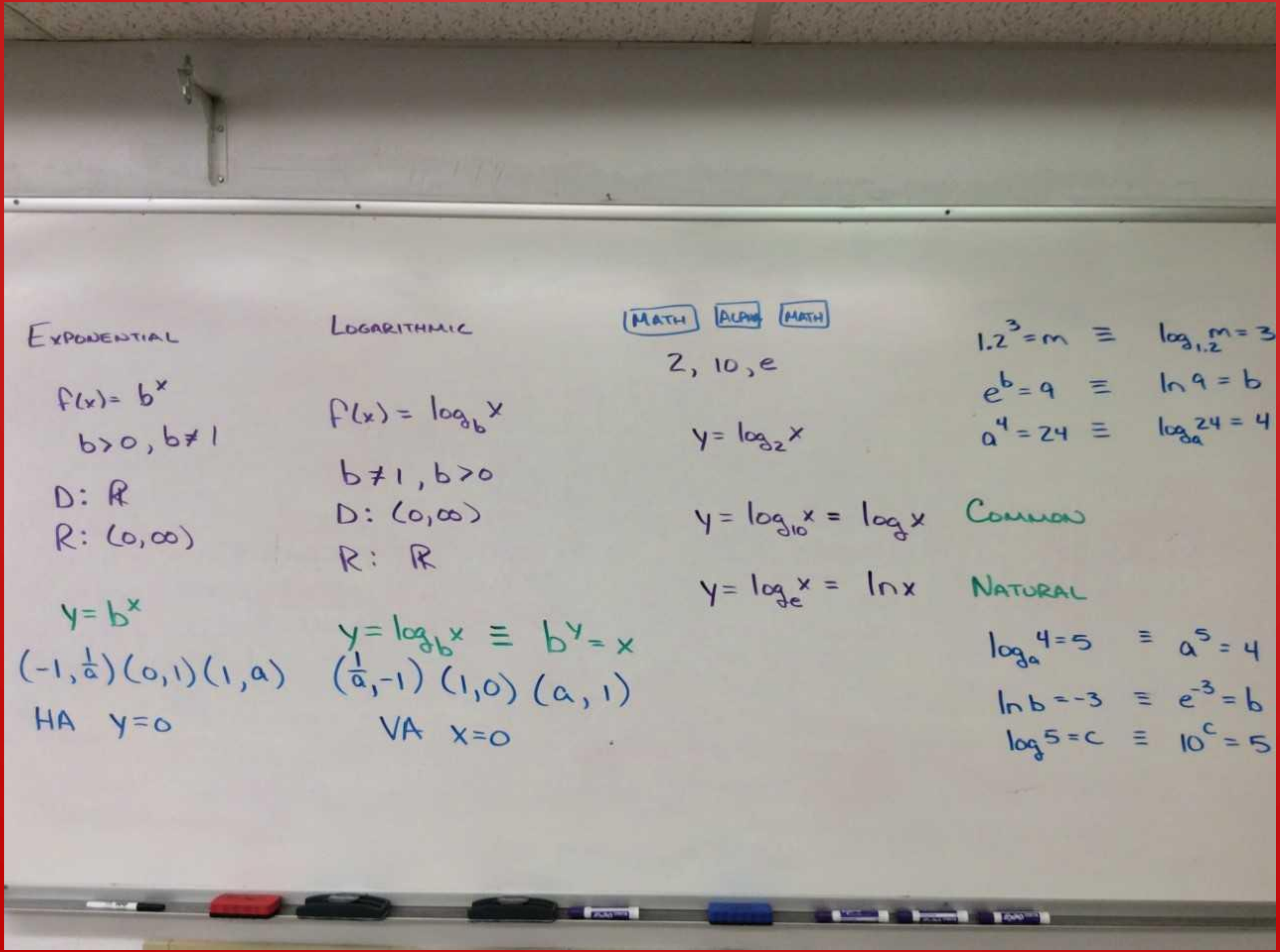
Similarities of Logarithmic and Exponential

Domain of the logarithmic function = Range of the exponential function = $(0, \infty)$

Range of the logarithmic function = Domain of the exponential function = $(-\infty, \infty)$

Properties of the Logarithmic Function $f(x) = \log_a x$; $a > 0$, $a \neq 1$

1. The domain is the set of positive real numbers, or $(0, \infty)$ using interval notation; the range is the set of all real numbers, or $(-\infty, \infty)$ using interval notation.
2. The x-intercept of the graph is 1. There is no y-intercept.
3. The y-axis $(x = 0)$ is a vertical asymptote of the graph.
4. A logarithmic function is decreasing if $0 < a < 1$ and is increasing if $a > 1$.
5. The graph of f contains the points $(1, 0)$, $(a, 1)$, and $\left(\frac{1}{a}, -1\right)$.
6. The graph is smooth and continuous, with no corners or gaps.



Frank Phillips College Plainsmen

Borger Independent School District 1926

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

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

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

$$e^{-x} = y-2$$

$$y = e^{-x}+2$$

$$f^{-1}(x) = e^{-x}+2$$

$$f(f^{-1}(x)) = -\ln(e^{-x}+2-2)$$

$$= -\ln e^{-x}$$

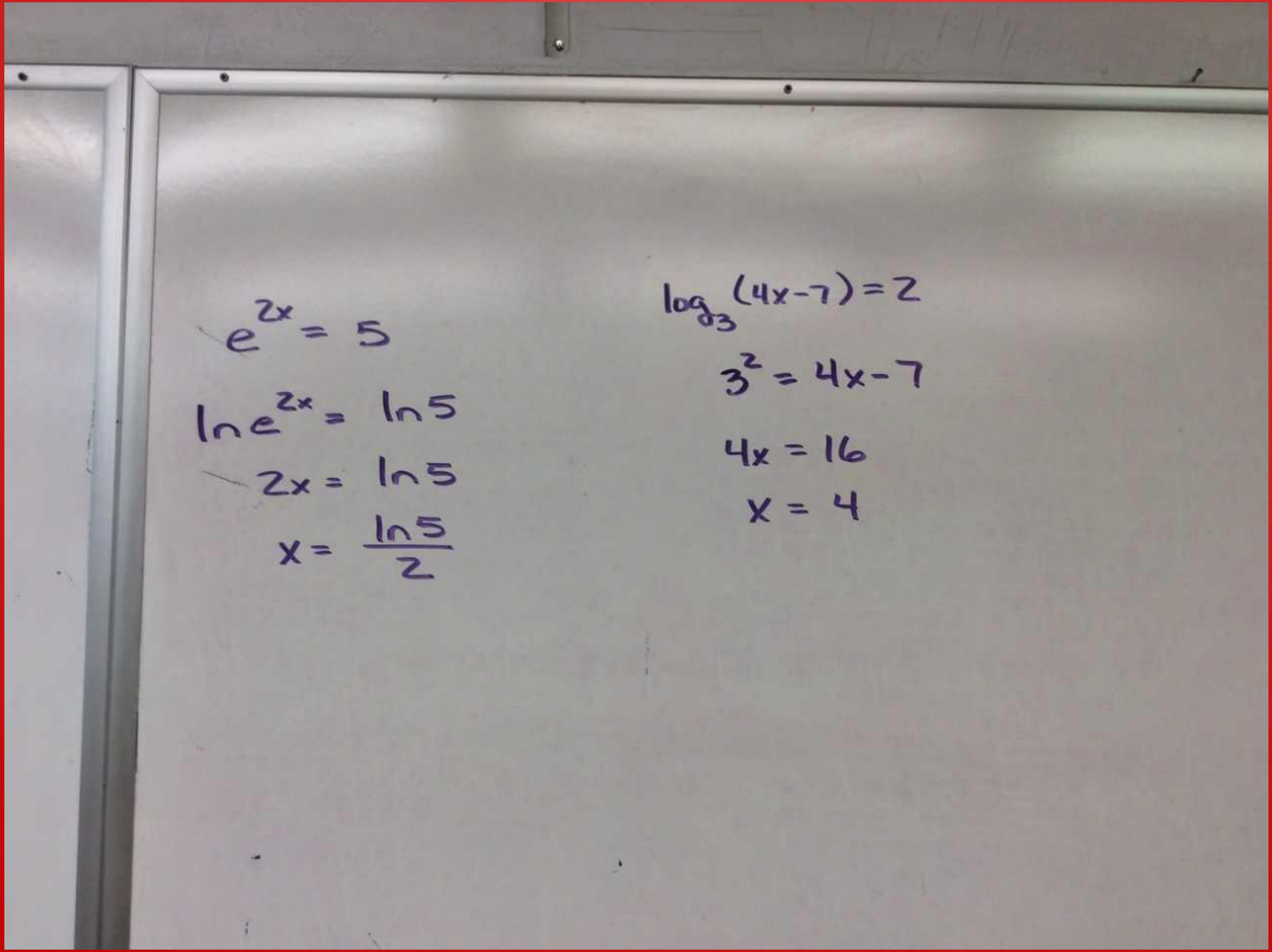
$$= x$$

$$f^{-1}(f(x)) = e^{-(-\ln(x-2))}+2$$

$$= e^{\ln(x-2)}+2$$

$$= x-2+2$$

$$= x$$


$e^{2x} = 5$
$\ln e^{2x} = \ln 5$
$2x = \ln 5$
$x = \frac{\ln 5}{2}$
$\log_3(4x-7) = 2$
$3^2 = 4x-7$
$4x = 16$
$x = 4$