Tuesday, May 28, 2019
7:28 PM

KEY

Precalculus – Natural Logs **Class work (Day 3)**

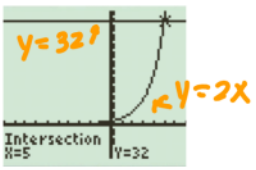
DO NOW: Solve each equation. Round to 3 decimal places, if necessary:

1. $2^x = 32$

HINT: Rewrite with the same base

$2^x = 2^5$

$x = 5$



2. $\left(\frac{1}{3}\right)^x = 9$

HINT: Rewrite with the same base

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

$-x = 2$

$x = -2$

3. $\log_4(3x+2) = \log_4(6-x)$

match

$3x+2 = 6-x$

$4x = 4$ $x = 1$

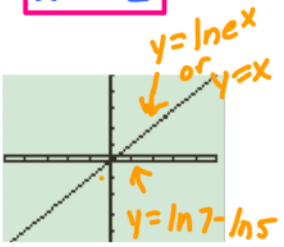
4. $\ln e^x = \ln 7 - \ln 5$

HINT: Condense the right side.

match e

$x = \ln \frac{7}{5}$

$x \approx .336$



How can you check your solution(s)?

1. Substitute your answer into the equation
2. Graph both sides. Look for point of intersection. (x-value).

CLASSWORK:
Find the point of intersection of:

1. $f(x) = e^{4x}$ and $g(x) = \ln e^{20}$

① set functions =

$e^{4x} = \ln e^{20}$

② solve

$e^{4x} = 20$

* switch forms

$\log_e 20 = 4x$

$\frac{\ln 20}{4} = \frac{4x}{4}$

$x \approx .7489$

Point! (.7489, 20)

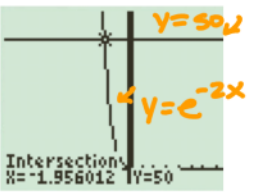
2. $f(x) = e^{\ln 50}$ and $g(x) = e^{-2x}$

$e^{\ln 50} = e^{-2x}$

$50 = e^{-2x}$

$\log_e 50 = -2x$

$\frac{\ln 50}{-2} = \frac{-2x}{-2}$



$x \approx -1.956$

Point! (-1.956, 50)

3. $f(x) = \ln(x^2+12)$ and $g(x) = \ln(8x)$

$\ln(x^2+12) = \ln(8x)$

match

$x^2+12 = 8x$

$x^2-8x+12 = 0$

$(x-6)(x-2) = 0$

$x = 6$ $x = 2$

points: (6,0) (2,0)

4. **Solve:** $\ln(2x) = \ln(x^2-8)$

a. Algebraically

b. Graphically using your calculator

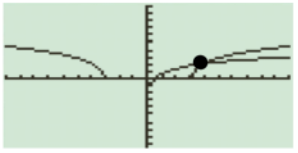
c. Any observations? How do you explain this?

$2x = x^2-8$

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

$0 = (x-4)(x+2)$

$x = 4$ $x = -2$



$x = -2$ is an extraneous solution

* check! can't take ln of a neg #

* the graph verifies this. (it does not show as a solution)

Find the Domain of each of the following. Write you answer in interval notation:

5. $\ln(5x-15)$

* must be positive (>0)

$5x-15>0$

$5x>15$

$x>3$

Domain $(3,\infty)$

6. $\ln(5x^2-9x-2)$

$5x^2-9x-2>0$

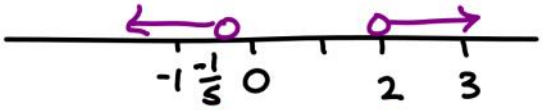
$(5x+1)(x-2)>0$

CRITICAL POINTS:

$5x+1=0$ $\quad x=2$

$5x=-1$

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



TEST: $x=-1$ TRUE | $x=0$ -270 FALSE | $x=3$ TRUE

Domain: $(-\infty,-\frac{1}{5})\cup(2,\infty)$

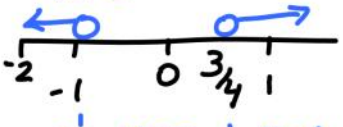
7. $\log_e\left(\frac{x+1}{4x-3}\right)$

$\frac{x+1}{4x-3}>0$

CRITICAL PTS:

$x=-1$

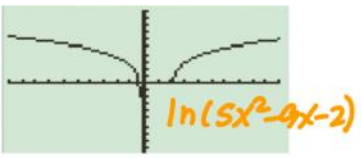
$x=\frac{3}{4}$



$x=-2$ T | $x=0$ F | $x=1$ T

Domain:

$(-\infty,-1)\cup(\frac{3}{4},\infty)$



How can you check your answer? * GRAPH!

Rewrite the following expressions as an expansion of base e with no negative exponents in the final answer.

8. e^{6x^3-7}

$e^{6x^3}\cdot e^{-7}=\frac{e^{6x^3}}{e^7}$

9. e^{-4x+3}

$=e^{-4x}e^3$

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

10. $e^{-\frac{1}{2}x-9}$

$e^{-\frac{1}{2}x}e^{-9}=\frac{1}{e^{\frac{1}{2}x}e^9}$

Use the change of base formula to evaluate each. Round to 3 decimal places.

11. $\log_7 4$

$\frac{\log 4}{\log 7}\approx .712$

12. $\log_{27} 81$

$\frac{\log 81}{\log 27}\approx 1.333$

13. $\log_9 27$

$\frac{\log 27}{\log 9}\approx 3$

KEY

Precalculus – Natural Logs **Homework (Day 3)**

Use the properties of logs to *expand* the expression as a sum, difference, and/or constant multiple of logs

1. $\log_5 \frac{x^2}{y^2 z^3}$

$2\log_5 x - 2\log_5 y - 3\log_5 z$

2. $\ln \frac{2w^5 x^{\frac{2}{3}} \sqrt{y}}{z^7}$

$\ln 2 + 5\ln w + \frac{2}{3}\ln x + \frac{1}{2}\ln y - 7\ln z$

3. $\ln e\sqrt{x^3(w-3)}$

$\log_e e + \frac{1}{2}\ln x^3 + \frac{1}{2}\ln(w-3)$

$= 1 + \frac{3}{2}\ln x + \frac{1}{2}\ln(w-3)$

Condense the expression to the log of a single quantity:

4. $\ln x + 3\ln(x+1)$

$= \ln x(x+1)^3$

5. $\frac{1}{3}\left[\log_8 y + 2\log_8(y+4)\right] - \log_8(y-1)$

$\log_8 \frac{\sqrt[3]{y(y+4)^2}}{(y-1)}$

Use the change of base formula to evaluate each. Round to 3 decimal places.

6. $\log_6 5$ $\frac{\log 5}{\log 6} \approx .898$

* must be positive (>0)

7. $\log_{18} 36$ $\frac{\log 36}{\log 18} \approx 1.24$

8. $\log_2 8$ $\frac{\log 8}{\log 2} = 3$

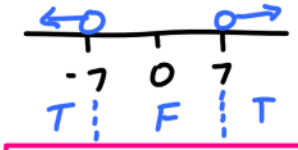
Find the Domain. Write your answer in interval notation:

9. $f(x) = \ln(x^2 - 49)$

$x^2 - 49 > 0$

$(x+7)(x-7) > 0$

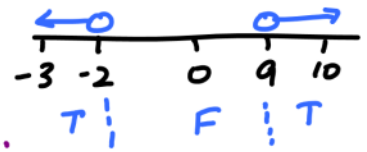
CRITICAL values: $x = -7$ $x = 7$



$(-\infty, -7) \cup (7, \infty)$

10. $f(x) = \log_e\left(\frac{x-9}{x+2}\right)$

$\frac{x-9}{x+2} > 0$



CRITICAL values: $x = 9$ $x = -2$

Domain: $(-\infty, -2) \cup (9, \infty)$

Rewrite the following expressions as an expansion of base e with no negative exponents in the final answer.

11. $e^{2x^5 - 4}$

$\frac{e^{2x^5}}{e^4}$

12. e^{-5x+2}

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

13. $e^{-\frac{1}{3}x+4}$

$\frac{e^4}{e^{\frac{1}{3}x}}$

TURN PAGE

Find the point(s) of intersection of each set of graphs:

14. $f(x) = \ln 21$ and $g(x) = \ln(x^2 - 15)$

$\ln 21 = \ln(x^2 - 15)$

$21 = x^2 - 15$

$0 = x^2 - 36$

$0 = (x+6)(x-6)$

$x = -6 \quad x = 6$

$(-6, 3.044)$

$(6, 3.044)$

* $\ln 21 \approx 3.044$

15. $y = \log_{11}(3x^2 - 9x - 26)$ and $y_2 = \log_{11}(2 - 14x)$

$\log_{11}(3x^2 - 9x - 26) = \log_{11}(2 - 14x)$

$3x^2 - 9x - 26 = 2 - 14x$

$3x^2 + 5x - 28 = 0$

$(3x - 7)(x + 4) = 0$

$x = 7/3 \quad x = -4$

points: $(7/3, 0), (-4, 0)$

③ ① ② ④

$2\ln(-(x-4)) + 3$

16. Graph: $h(x) = 2\ln(4 - x) + 3$

Transformations: * See below

Domain:

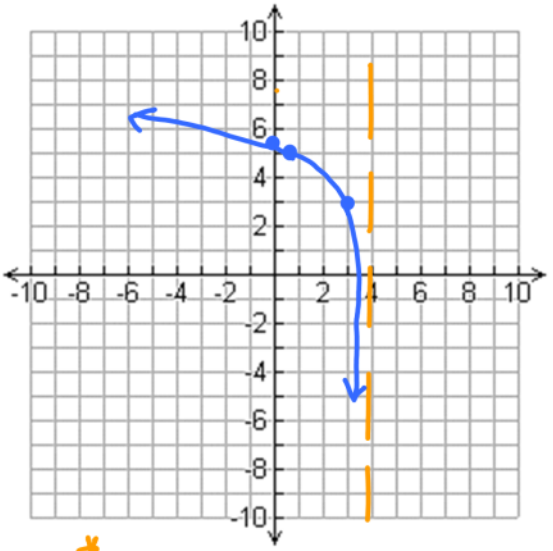
$4 - x > 0 \quad 4 > x \quad x < 4$ $(-\infty, 4)$

Range: $(-\infty, \infty)$

x-int:

y-int: $f(0) = 2\ln(4) + 3 = 5.7$ $(0, 5.7)$

Asymptote: $x = 4$



$p(x) = \ln x \Rightarrow e^y = x$

② $x+4$	① $-1(x)$	x	y	③ $y(2)$	④ $y+3$
3	-1	1	0	0	3
1.3	-2.7	2.7	1	2	5
x					y

* ① Reflect over y-Axis
② Shift 4 Right
③ Vertical Stretch - factor of 2
④ Shift up 3