ODDS # 1-41 , 40, 42

Pre-Calculus

Name: _____

More Practice with Laws of Logs

Expand each of the following as much as possible using laws of logarithms. When applicable, write "not possible."

1) $\log\left(\frac{x^3y^6}{\sqrt{z}}\right)$

$3\log x + 6\log y - \frac{1}{2}\log z$

2) $\log\sqrt[4]{x^2+y^2}$

$\frac{1}{4}\log(x^2+y^2)$

3) $\ln\left(\frac{x(x^2+1)}{\sqrt{x^2-1}}\right)$

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

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

4) $\log\left(\frac{x}{\sqrt[3]{1-x}}\right)$

$\log x - \frac{1}{3}\log(1-x)$

5) $\log_3\sqrt{\frac{x+y}{x^6}}$

$\frac{1}{3}\log(x+y) - 2\log x$

6) $\ln(x-y)$

not possible

Condense each of the following into a single logarithm using properties of logs:

7) $6\log x - 2\log y + \frac{1}{3}\log t$

$\log\frac{x^6\sqrt[3]{t}}{y^2}$

8) $5\log x - \frac{1}{4}\log(x^2+1) + 2\log(x-1)$

$\log\frac{x^5(x-1)^2}{\sqrt[4]{x^2+1}}$

9) $\ln\left(\frac{a}{a^2-b^2}\right) + \ln\left(\frac{a-b}{a^2}\right)$

$\ln\left(\frac{1}{a^2+ab}\right)$

10) $2(\log_5 x - 3\log_5 z + 2\log_5 y)$

$\log_5\frac{x^2y^4}{z^6}$

11) $3\ln x - \left(2\ln y + \frac{1}{2}\ln z\right)$

$\ln\frac{x^3}{y^2\sqrt{z}}$

12) $4(2\ln x - 3\ln y) + 3(4\ln y - \ln x)$

$\ln(x^5)$

13) $\frac{1}{3}(\log_4 x + 6\log_4 y)$

$\log_4(\sqrt[3]{x}\cdot y^2)$

14) $\log(x+3) - (\log(x^2-9) - \log(x^3-27))$

$\log(x^2+3x+9)$

15) $4\ln x - \frac{1}{2}\left(6\ln y - \frac{1}{4}\ln z\right)$

$\ln\frac{x^4\sqrt[8]{z}}{y^3}$

Solve each of the following:

16) $30 = 32(1-2^{-t})$

$\frac{15}{16} = 1-2^{-t}$

$-\frac{1}{16} = -2^{-t}$

$\frac{1}{16} = 2^{-t}$

$2^{-4} = 2^{-t}$

$\boxed{t=4}$

17) $\log_3(x+2) = 4$

$3^4 = x+2$

$81 = x+2$

$\boxed{x=79}$

18) $\frac{10}{1+e^{-x}} = 2$

$10 = 2+2e^{-x}$

$8 = 2e^{-x}$

$4 = e^{-x}$

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

$\ln 4 = -x$

$\boxed{x = -\ln 4 = \ln 4^{-1} = \ln\frac{1}{4}}$

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

$-2=\log_5(x-1)-\log_5(x+1)$

$-2=\log_5\left(\frac{x-1}{x+1}\right)$

$5^{-2}=\frac{x-1}{x+1}$

$\frac{1}{25}=\frac{x-1}{x+1}$

$x+1=25x-25$

$26=24x$

$x=\frac{26}{24}$

$\boxed{x=\frac{13}{12}}$

20) $2=\log_2(x^2-x-2)$

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

$0=x^2-x-6$

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

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

21) $\ln(x+4)=3$

$e^3=x+4$

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

22) $\log_2(3x+2)=3+\log_2 x$

$\log_2(3x+2)-\log_2 x=3$

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

$2^3=\frac{3x+2}{x}$

$8x=3x+2$

$5x=2$

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

23) $2\log_5 x-\log_5 9=2$

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

$\log_5\frac{x^2}{9}=2$

$5^2=\frac{x^2}{9}$

$x^2=225$

$\boxed{x=15}$ ~~-15~~

24) $\log(x^2)=\log 4+\log 5$

$\log(x^2)=\log 20$

$x^2=20$

$x=\pm\sqrt{20}=\boxed{\pm 2\sqrt{}}$

25) $\log_{\sqrt{216}} x=\frac{4}{3}$

$\sqrt{216}^{4/3}=x$

$\boxed{36=x}$

26) $\log_9 8=\log_9\frac{1}{2}+2\log_9 x$

$\log_9 8=\log_9\frac{1}{2}+\log_9 x^2$

$\log_9 8=\log_9\left(\frac{1}{2}x^2\right)$

$8=\frac{1}{2}x^2$

$16=x^2$

$\boxed{x=4}$ ~~-4~~

27) $6e^{2x}+45=3e^{4x}$

$0=3e^{4x}-6e^{2x}+45$

$3(e^{2x})^2$

$0=(3e^{2x}+9)(e^{2x}-5)$

$3e^{2x}+9=0$ $\quad e^{2x}-5=0$

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

$2x=\ln(-3)$ $\quad \boxed{x=\frac{\ln 5}{2}}$

28) $\left(\frac{1}{16}\right)^x=64$

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

$-2x=3$

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

29) $9^{2x}\cdot\left(\frac{1}{27}\right)^{x-1}=81$

$(3^2)^{2x}\cdot(3^{-3})^{x-1}=3^4$

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

$x+3=4$

$\boxed{x=1}$

30) $\log_3(x-1)-\log_3(x+6)=\log_3(x-2)-\log_3(x+3)$

$\log_3\frac{x-1}{x+6}=\log_3\frac{x-2}{x+3}$

$\frac{x-1}{x+6}=\frac{x-2}{x+3}$ LCD: $(x+6)(x+$

$\frac{(x+6)(x+3)(x-1)}{x+6}=\frac{(x-2)(x+6)(x+3)}{x+3}$

$x^2+2x-3=x^2+4x-12$

$9=2x$

$\boxed{x=9/2}$

Evaluate:

31) $\log_{25}\left(\frac{125}{\sqrt[3]{5}}\right)$ $\frac{4}{3}$

32) $\log_{49}\left(\frac{1}{7}\right)$ $-\frac{1}{2}$

33) $\log_8\left(\frac{2}{\sqrt[4]{4}}\right)$ $\frac{1}{6}$

34) $\frac{\log_4 16}{\log_3\left(\frac{1}{27}\right)}$ $-\frac{2}{3}$

35) $\log_3 2 \div \log_3 8$ $\frac{\log_3 2}{\log_3 8} = \log_8 2$ $\frac{1}{3}$

36) $\log_2 3 - \log_2 12 = \log_2 \frac{1}{4}$ -2

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37) Which of the following $\frac{\log 27}{\log 3}$? $= \log_3 27 = 3$ (Circle all that apply)

a) $\log 9$ **b)** 3 **c)** $-\log 3^{-1}$ **d)** $\log 24$

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38) Which of the following are equivalent?

i. $\frac{\log_6 216}{\log_6 36} = \frac{3}{2}$ *ii.* $\log_6 \frac{216}{36} = 1$ *iii.* $\log_6 216 - \log_6 36 = 1$

a) *i & ii* **b)** *ii & iii* **c)** *iii* **d)** none of these **e)** all of these

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39) Which of the following are equivalent?

i. $\frac{1}{3}\log 270 = \frac{1}{3}(\log(27\cdot 10)) = \frac{1}{3}\log 27 + \frac{1}{3}\log 10 = \log 3 + \frac{1}{3}$ *ii.* $\log 90 = \log 9 + \log 10 = (\log 9) + 1$ *iii.* $\frac{1}{3} + \log 3$

a) *i & ii* **b)** *i & iii* **c)** *ii & iii* **d)** none of these **e)** all of these

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40) Given $\log 7 = x$, $\log 5 = y$, $\log 3 = z$ determine each of the following:

a) $\log 9$ $\log 3^2 = 2\log 3 = 2z$

b) $\log 150$ $\log(5\cdot 5\cdot 3\cdot 2)$ $\log 5 + \log 5 + \log 3 + \log 2$ $2y + z + \log 2$

c) $\log_5 7$ $\frac{\log 7}{\log 5} = \frac{x}{y}$

d) $\log_7 15$ $\frac{\log 15}{\log 7} = \frac{\log 5 + \log 3}{\log 7} = \frac{y+z}{x}$

e) $\log(3/5)$ $\log 3 - \log 5$ $z - y$

f) $\log 30$ $= \log(2\cdot 3\cdot 5)$ $= \log 2 + \log 3 + \log 5$ $= (\log 2) + z + y$

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41) State the domain of each of the following:

a) $f(x) = \ln(9 - x)$ $9 - x > 0$ $-x > -9$ $x < 9$ $(-\infty, 9)$

b) $f(x) = \ln(3x + 2)$ $3x + 2 > 0$ $3x > -2$ $x > -\frac{2}{3}$ $\left(-\frac{2}{3}, \infty\right)$