QUIZ 10 MATH 161 Thompson

1) Use the properties of logarithms to find the exact value of the expression. Do not use a calculator.

$\log_4 24 - \log_4 6$ $\qquad \frac{log_4 24)}{log_4 6} = log_4 4 = 1$

2) Solve the following logarithmic equation.

$4 \log_3 x = -\log_3 81$ $\qquad log_3 x^4 = -4$

$3^{-4} = x^4 \qquad x = \frac{1}{3}$

3) Write as the sum and/or difference of logarithms. Express powers as factors.

$\log_4 \left(\frac{x^3}{y^6}\right)$ $\qquad 3 \log_4 x - 6 \log_4 y$

4) Solve the following logarithmic equation.

$\log x + \log (x + 99) = 2$ $\qquad \log_{10} x(x+99) = 2$

$x^2 + 99x = 10^2$

$x^2 + 99x - 100 = 0$

$(x+99)(x-1) = 0$

$x = -99, 1$

5) Write the expression as a single logarithm.

$3 \log_6 u + 6 \log_6 v$ $\qquad \log_6 (u^3 v^6)$

6) Use properties of logarithms to find the exact value of the expression. Do not use a calculator.

$\log_8 4 + \log_8 2$ $\qquad log_8 4 \cdot 2 = x$

$log_8 8 = x \qquad x = 1$

7) Write the expression as a sum and/or difference of logarithms. Express powers as factors.

$$\log\left[\frac{x(x+6)}{(x+5)^{10}}\right],\ x>0$$

$\log x + \log(x+6) - 10\log(x+5)$

8) $\log_a M^r = r\log_a M$

9) Solve the following logarithmic equation. Express irrational solutions in exact form and as a decimal rounded to three decimal places.

$$\log_5(x+4) + \log_5(x+3) = 2$$

$\log_5 (x+4)(x+3) = 2$ *foil* $(x+4)(x+3)=5^2$

$x^2 + 7x + 12 = 25$

$x^2 + 7x - 13 = 0$

$\frac{-7+\sqrt{101}}{2}$ only positive answer

plug into calculator $\frac{-7+\sqrt{101}}{2} = 1.525$

10) $\ln e^9 = 9$ (Type an integer or a simplified fraction.)

11) $\log_a a^r = r$

12) Write as the sum and/or difference of logarithms. Express powers as factors.

$$\log_w\left(\frac{7x}{4}\right)$$

$\log_w 7 + \log_w x - \log_w 4$

13) Write the expression as a single logarithm.

$$\log_4\left(x^2-64\right) - 4\log_4(x+8)$$

$\log_4\left[\frac{(x-8)}{(x+8)^3}\right]$

14) Solve the following logarithmic equation.

$\frac{1}{2}\log_9 x = 2\log_9 4$

$\log_9 \sqrt{x} = \log_9 4^2$

$\sqrt{x} = 16$ *square both sides*

$x = 256$

15) Use the properties of logarithms to find the exact value of the expression. Do not use a calculator.

$\log_{153} 9 + \log_{153} 17$

$\log_{153}(9 \cdot 17)$

$\log_{153} 153 = 1$

16) $\ln e^{-21} =$ -21 (Type an integer or a simplified fraction.)

17) Solve the following logarithmic equation. Express irrational solutions in exact form and as a rounded decimal. Verify your results using a graphing utility.

$\ln x + \ln(x+8) = 4$

$\ln x(x+8) = 4$ $x^2 + 8x = e^4$

$x^2 + 8x = e^4$

$x^2 + 8x - e^4 = 0$

$$\frac{-8 \pm \sqrt{64 - 4(e^4)}}{2}$$

factor out a 4 inside radical $\frac{-8+\sqrt{4(16+e^4)}}{2}$

take square root of 4 $\frac{-8+2\sqrt{16+e^4}}{2}$

reduce $\boxed{-4 + \sqrt{16 + e^4}}$

plug into calculator $\approx \boxed{4.402}$

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

$\ln x(x+4) = 3 \quad x^2 + 4x = e^3$

$x^2 + 4x = e^3$

$x^2 + 4x - e^3 = 0$

$$\frac{-4 \pm \sqrt{16 - 4(e^4)}}{2}$$

factor out a 4 inside radical $\frac{-4 + \sqrt{4(4+e^3)}}{2}$

take square root of 4 $\frac{-4 + 2\sqrt{4+e^3}}{2}$

reduce $\boxed{-2 + \sqrt{4 + e^3}}$

plug into calculator $\approx \boxed{2.908}$

19) $\ln x + \ln(x+10) = 3$

$\ln x(x+10) = 3 \quad x^2 + 10x = e^3$

$x^2 + 10x = e^3$

$x^2 + 10x - e^3 = 0$

$$\frac{-10 \pm \sqrt{100 - 4(e^4)}}{2}$$

factor out a 4 inside radical $\frac{-10 + \sqrt{4(25+e^3)}}{2}$

take square root of 4 $\frac{-10 + 2\sqrt{25+e^3}}{2}$

reduce $\boxed{-5 + \sqrt{25 + e^3}}$

plug into calculator $\approx \boxed{1.715}$

20) ln x + ln(x+2) = 3

ln x(x+2) = 3 $x^2 + 2x = e^3$

$x^2 + 2x = e^3$

$x^2 + 2x - e^3 = 0$

$\frac{-2 \pm \sqrt{4 - 4(e^4)}}{2}$

factor out a 4 inside radical $\frac{-2 + \sqrt{4(1 + e^3)}}{2}$

take square root of 4 $\frac{-2 + 2\sqrt{1 + e^3}}{2}$

reduce $\boxed{-1 + \sqrt{1 + e^3}}$

plug into calculator $= \boxed{3.592}$

21) ln x + ln(x+6) = 4

ln x(x+6) = 4 $x^2 + 6x = e^4$

$x^2 + 6x = e^4$

$x^2 + 6x - e^4 = 0$

$\frac{-6 \pm \sqrt{36 - 4(e^4)}}{2}$

factor out a 4 inside radical $\frac{-6 + \sqrt{4(9 + e^4)}}{2}$

take square root of 4 $\frac{-6 + 2\sqrt{9 + e^4}}{2}$

reduce $\boxed{-3 + \sqrt{9 + e^4}}$

plug into calculator $= \boxed{4.975}$