College Algebra — Joysheet #11
MAT 140, Fall 2019 — D. Ivanšić

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Covers: 5.4–5.5 *Show all your work!*

1. (5pts) If $\log_a 4 = u$ and $\log_a 5 = v$, express in terms of u and v:

$\log_a 20 =$ $\log_a(4\cdot 5)$
$= \log_a 4 + \log_a 5$
$= u + v$

$\log_a \frac{25}{4} =$ $\log_a 25 - \log_a 4$
$= \log_a 5^2 - u$
$= 2\log_a 5 - u$
$= 2v - u$

2. (11pts) Write as a sum and/or difference of logarithms. Express powers as factors. Simplify if possible.

$\log_5(25x^{-7}y^3) =$ $\log_5 25 + \log_5 x^{-7} + \log_5 y^3$
$= 2 - 7\log_5 x + 3\log_5 y$

$\log_2 \frac{x^{\frac{5}{2}}y^3}{32\sqrt{x}y^5} =$ $\log_2 x^{\frac{5}{2}} + \log_2 y^3 - \log_2 32 - \log_2 x^{\frac{1}{2}} - \log_2 y^5$
$\uparrow$ $x^{\frac{1}{2}}$
$= \frac{5}{2}\log_2 x + 3\log_2 y - 5 - \frac{1}{2}\log_2 x - 5\log_2 y$
$= 2\log_2 x - 2\log_2 y - 5$

3. (12pts) Write as a single logarithm. Simplify if possible.

$2\log(3x^4) - \frac{1}{3}\log(27y^6) + 5\log x =$ $\log(3x^4)^2 - \log(27y^6)^{\frac{1}{3}} + \log x^5$
$= \log \frac{3^2 x^8 \cdot x^5}{3\cdot y^2} = \log \frac{3x^{13}}{y^2}$
$27^{\frac{1}{3}} = \sqrt[3]{27}$

$2\ln(x^2 - 4x - 5) - 3\ln(x-5) - 2\ln(x+1) =$ $\ln((x-5)(x+1))^2 - \ln(x-5)^3 - \ln(x+1)^2$
$(x-5)(x+1)$
$= \ln \frac{(x-5)^2(x+1)^2}{(x-5)^3(x+1)^2} = \ln \frac{1}{x-5} = -\ln(x-5)$

Solve the equations.

4. (5pts) $6^{2x-3} = \left(\frac{1}{36}\right)^{x+1}$

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

$6^{2x-3} = 6^{-2x-2}$

$2x-3 = -2x-2$

$4x = 1$

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

5. (7pts) $7^{x-4} = 4^{2x+1}$ | ln

$\ln 7^{x-4} = \ln 4^{2x+1}$

$(x-4)\ln 7 = (2x+1)\ln 4$

$x\ln 7 - 4\ln 7 = 2\ln 4 \cdot x + \ln 4$

$-4\ln 7 - \ln 4 = 2\ln 4 \cdot x - \ln 7 \cdot x$

$-4\ln 7 - \ln 4 = (2\ln 4 - \ln 7)x$

$x = -\frac{4\ln 7 + \ln 4}{2\ln 4 - \ln 7} = \frac{4\ln 7 + \ln 4}{\ln 7 - 2\ln 4}$

$= -11,092503$

6. (8pts) $e^{2x} + 11 \cdot e^x - 26 = 0$

$(e^x)^2 + 11e^x - 26 = 0$

let $u = e^x$

$u^2 + 11u - 26 = 0$

$(u+13)(u-2) = 0$

$u = -13, 2$

$e^x = -13$ not possible since $e^x > 0$

$e^x = 2$

$x = \ln 2$

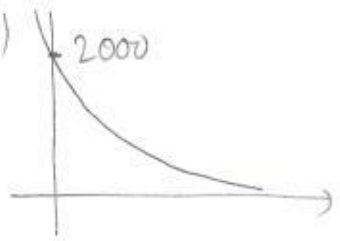
7. (12pts) A car repair shop bought a car-lift for \$2000. Its value after t years is given by the function $V(t) = 2000 \cdot 0.92^t$.

a) Graph the value function.

b) What is the value after 3, 5 and 7 years?

c) When will the value of the car-lift be \$400?

a)



b)

t	$2000 \cdot 0.92^t$
3	1557.38
5	1318.16
7	1115.69

c) $400 = 2000 \cdot 0.92^t$ | $\div 2000$

$0.2 = 0.92^t$ | ln

$\ln 0.2 = \ln 0.92^t$

$\ln 0.2 = t \cdot \ln 0.92$

$t = \frac{\ln 0.2}{\ln 0.92} = 19.302673$

In about 19 years, value is \$400