College Algebra w.B.A. — Joysheet 8
MAT 120, Spring 2014 — D. Ivanšić

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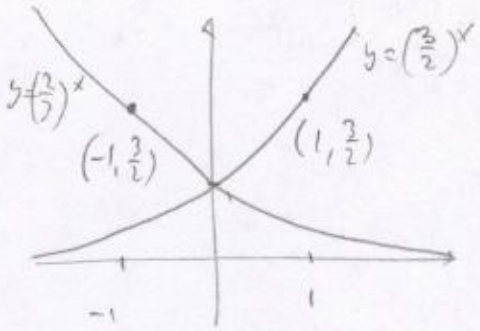
Show all your work!

1. (6pts) Let $f(x) = \left(\frac{3}{2}\right)^x$ and $g(x) = \left(\frac{2}{3}\right)^x$.
a) Sketch the graphs of the functions on the same coordinate system.
b) What do you notice about the two graphs?
c) Indicate two related points, one on each graph, that verify your observation in b).

b) they are symmetric about y-axis



2. (8pts) Evaluate without using the calculator:

$\log_2 16 = 4$ $\quad$ $\log_3 \frac{1}{243} = -5$ $\quad$ $\log_{49} 7 = \frac{1}{2}$ $\quad$ $\ln \sqrt[5]{e^9} = \frac{9}{5}$

$2^? = 16$ $\quad$ $3^? = \frac{1}{243}$ $\quad$ $49^? = 7$ $\quad$ $e^? = \sqrt[5]{e^9} = e^{\frac{9}{5}}$

3. (4pts) Use your calculator to find $\log_7 33$ with accuracy 6 decimal places. Show how you obtained your number.

$\log_7 33 = \frac{\ln 33}{\ln 7} = 1.796849$

4. (8pts) If $\log_a 5 = 0.859833$ and $\log_a 8 = 1.11093$, find (show how you obtained your numbers):

$\log_a \frac{5}{8} = \log_a 5 - \log_a 8$
$= 0.859833 - 1.11093$
$= -0.251097$

$\log_a 200 = \log_a (5 \cdot 5 \cdot 8)$
$= \log_a (5^2 \cdot 8)$
$= 2\log_a 5 + \log_a 8$
$= 2 \cdot 0.859833 + 1.11093 = 2.830596$

$a = 6.5$
$a^{0.859833} = 5$
$a = 5^{\frac{1}{0.859833}} = 6.5$

5. (11pts) Write as a sum and/or difference of logarithms. Express powers as factors. Simplify if possible.

$\log_7 (49x^3y^4) = \log_7 49 + \log_7 x^3 + \log_7 y^4 = 2 + 3\log_7 x + 4\log_7 y$

$\log_3 \frac{9\sqrt[4]{x^7}}{y^3} = \log_3 9 + \log_3 x^{\frac{7}{4}} - \log_3 y^3 = 2 + \frac{7}{4}\log_3 x - 3\log_3 y$

6. (11pts) Write as a single logarithm. Simplify if possible.

$2\log(7x^4) - \frac{1}{2}\log(25y^6) - 2\log x =$ $\log(7x^4)^2 - \log 25y^6)^{\frac{1}{2}} - \log x^2$

$= \log \frac{49x^{8\,6}}{5y^3x^4} = \log \frac{49x^6}{5y^3}$

$\log_a(x^2 - 3x - 10) - \log_a(x-5) - 2\log_a(x+2) =$ $\log_a \frac{x^2-3x-10}{(x-5)(x+2)^2}$

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

7. (12pts) In 2005, a restaurant purchased a pizza oven for \$4,000. In 2011, its value was estimated to be \$1900. Suppose the value of the oven is described by the function $V(t) = y_0 b^t$.

a) Find the function $V(t)$ describing the value of the oven t years after 2005.

b) Sketch the graph of $V(t)$.

c) What is the value of the oven in 2014?

d) What is the rate of depreciation on the oven? (That is the annual rate at which the oven loses value.)

a) $y_0 = 4000$

$1900 = V(6) = 4000\, b^6 \quad | \div 4000$

$\frac{1900}{4000} = b^6$

$b^6 = 0,475$

$b = 0,475^{\frac{1}{6}} = 0,883315$

c) $V(9) = 4000 \cdot 0,883315^9$

$= \$1309,48$

d) $0.883315 - 1 = -0,116685$

loses about 12% of its value per year.

b)