MATH 111–05 (Kunkle), Quiz 9
10 pts, 10 minutes

Name: ____________________________

April 10, 2018

1 (5 pts). Write as a single logarithm: \[ 4 \ln(x - 1) - \frac{1}{3} \ln(3x + 6) + 2 \ln(3x + 2) \]

2 (5 pts). Write entirely in terms of logs of linear functions: \[ \log_2 \left( \frac{x^2 - x - 2}{4x^2 + 3x - 1} \right) \]

**Solution:**

1. (Source: 5.2.more.3f) Using the properties of logarithms (Theorem 5.2.1, p. 340),

\[
4 \ln(x - 1) - \frac{1}{3} \ln(3x + 6) + 2 \ln(3x + 2) = \ln(x - 1)^4 + \ln(3x + 6)^{-1/3} + \ln(3x + 2)^2
\]

\[
= \ln \left( (x - 1)^4 (3x + 6)^{-1/3} (3x + 2)^2 \right),
\]

which, according to the directions, is all that’s required. If you like, this could be written as

\[
\ln \left( \frac{(x - 1)^4 (3x + 2)^2}{(3x + 6)^{1/3}} \right),
\]

or even

\[
\ln \left( \frac{(x - 1)^4 (3x + 2)^2}{\sqrt[3]{3x + 6}} \right)
\]

2. (Source: 5.2.more.2i) Factor the quadratics:

\[
\log_2 \left( \frac{x^2 - x - 2}{4x^2 + 3x - 1} \right) = \log_2 \left( \frac{(x - 2)(x + 1)}{(4x - 1)(x + 1)} \right)
\]

Cancel the common factor, and then break up using the properties of logs:

\[
\log_2 \left( \frac{x - 2}{4x - 1} \right) = \log_2 (x - 2) - \log_2 (4x - 1)
\]

(done)