

MATH 121: EXTRA PRACTICE FOR TEST 3

**Disclaimer:** Any material covered in class and/or assigned for homework is fair game for the exam.

1. Given the functions  $f(x) = \sqrt{x-1}$ , and  $g(x) = \frac{x+2}{x-3}$ , find  $(f \circ g)(4)$  and  $(f \circ g)(2)$ .

2. Find  $f \circ g$ ,  $g \circ f$ , and  $f \circ f$  and the domain of each composition.

(a)  $f(x) = 1 - 2x$ ,  $g(x) = \sqrt{x-2}$

(c)  $f(x) = \frac{x-5}{x+1}$ ,  $g(x) = \frac{x+2}{x-3}$

(b)  $f(x) = \sqrt{x}$ ,  $g(x) = (x+4)^2$

(d)  $f(x) = \sqrt{x-1}$ ,  $g(x) = \frac{x+2}{x-3}$

3. The given functions are one-to-one. Find the inverse of each one.

(a)  $a(x) = -\frac{2}{3}x$

(e)  $\{(1, 2), (2, 3), (3, 4), (4, 5)\}$

(i)  $i(x) = 5 \ln(x+3) + 1$

(b)  $b(x) = x^2 - 5$ ,  $x \leq 0$

(f)  $f(x) = \frac{3x+4}{2x-3}$

(j)  $j(x) = \sqrt{x-7}$

(c)  $c(x) = (x-1)^2$ ,  $x \geq 1$

(g)  $g(x) = \log_3(x+1) - 4$

(k)  $k(x) = 7 + 3^{x-1}$

(d)  $d(x) = \frac{2x}{x-1}$

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

4. Consider the one-to-one function  $f(x) = \frac{5e^x}{e^x + 1}$ . Find a formula for  $f^{-1}(x)$ .

5. For the exponential function  $f(x) = e^x + 2$ , find:

(a) Domain

(b) Range

(c) Intercepts

(d) Intervals where it is increasing / decreasing

(e) Asymptotes

(f) Sketch and label the graph of the function

6. Find the domain of each of the given functions:

(a)  $a(x) = \ln(x^2 + 1)$

(d)  $e(x) = \sqrt{\ln(x+1)}$

(f)  $g(x) = \log_{1/2}(x^2)$

(b)  $b(x) = \log_4(1 - 3x)$

(e)  $f(x) = \frac{17}{\ln(x)}$

(g)  $h(x) = \ln(7-x) + \ln(x-4)$

(c)  $c(x) = 3 \log_2(x^2 - 1)$

7. For each of the given functions below, find the domain, the range, the intercepts, the asymptotes and sketch the graph.

(a)  $f(x) = \left(\frac{1}{4}\right)^x$

(d)  $g(x) = -3^x + 2$

(g)  $k(x) = \log(x+1) - 3$

(b)  $g(x) = 2 \cdot 3^{-x}$

(e)  $f(x) = 2 + e^x$

(h)  $f(x) = -\ln(-x)$

(c)  $h(x) = 3^{-x} + 1$

(f)  $h(x) = e^{x+3}$

(i)  $g(x) = \log_5(x-2)$

8. Evaluate, without using your calculator:

(a)  $\ln\left(\frac{1}{e}\right)$

(d)  $\log(10^3)$

(g)  $e^{\ln(10)}$

(j)  $\log_6(1)$

(b)  $\ln(e^{x-k})$

(e)  $\log_3(3^{100})$

(h)  $\log\left(\frac{1}{100}\right)$

(k)  $\ln(0)$

(c)  $\log_2(\sqrt{2})$

(f)  $2^{\log_2(\sqrt{2})}$

(i)  $\log_{1/7}(49)$

(l)  $\log_3\left(\frac{1}{27}\right)$

9. Write the given expressions as a sum or difference of logarithms. Assume when necessary that all quantities represent positive real numbers.

(a)  $\log_{1/4}(x^3y)$

(c)  $\log\left(\frac{x^3y^2}{100}\right)$

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

(b)  $\log_4\left(\sqrt{\frac{x}{y^2}}\right)$

(d)  $\log_4\left(\frac{\sqrt{x^2+2}}{4(x+1)^3}\right)$

(f)  $\ln\left(\frac{\sqrt[4]{y^3}}{e^5}\right)$

10. Write each expression as the logarithm of a single quantity:

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

(c)  $\ln(x) - 3\ln(x+1) + \frac{1}{3}\ln(2x)$

(b)  $\frac{1}{3}\log(64) + \frac{1}{2}\log(x)$

(d)  $3\log 5 - 1$