

# MATH 3 Midterm 2 version 1

Name: \_\_\_\_\_

Section : \_\_\_\_\_

Calculators are not allowed.

Read all the questions before you start working on any of them. Start with the ones you are most comfortable with, and continue with the other ones later. Always double-check your answers.

Relax, and do your best!

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PROBLEM 1: SHORT QUESTIONS. [60 POINTS]

Given the function  $f(x) = \frac{2x^2-2}{x+1}$

1. What is its domain of definition? ANSWER: \_\_\_\_\_

2. Simplify  $f(x)$ , for  $x$  inside the domain of definition. ANSWER:  $f(x) =$ \_\_\_\_\_

3. Sketch the function, making sure to annotate your graph.

4. What is the domain of  $\ln(f(x))$ ? ANSWER: \_\_\_\_\_

5. Solve the inequality  $\frac{7}{x+1} < 3$ . ANSWER:  $x \in$ -----

Given the functions  $f(x) = e^x$  and  $g(x) = 3 \ln(x)$

6. What is  $f \circ g(x)$ ? ----- (Simplify if possible)

7. What is  $g \circ f(x)$ ? ----- (Simplify if possible)

9. Given the function  $f(x) = 3x + 4$ , what is  $f^{-1}(x)$ ? ANSWER:  $f^{-1}(x) =$ -----

10. Given the function  $f(x) = \sqrt{x^3 - 1}$ , what is  $f[f^{-1}(x^2)]$ ? ANSWER: -----

11. 12. Sketch the functions  $f(x) = |x + 1| - 2$  and  $g(x) = \sqrt{x - 4} + 3$ , and annotate your graphs

13. Simplify  $f(x) = \frac{3^x 9^{-2x}}{27^x 3^{-x}}$ . ANSWER:  $f(x) =$ -----

14. Simplify  $\log_2(2x)$ . ANSWER: -----

15. 16. Sketch the functions  $\log_2(2x)$  and  $3^{-x}$ , and annotate your graphs.

17. Simplify  $\log_{10}(e^x)$ . ANSWER: -----

18. Express the function  $f(x) = \ln\left(\frac{2x^3(x+1)}{(x-1)^2(x+2)^2}\right)$  as sums and differences of logarithms .

ANSWER: -----

19. Solve the equation  $e^x = 2^{x+1}$ . ANSWER: -----

20. Write  $\left(\frac{1}{2}\right)^t$  as a natural exponential. ANSWER: -----

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PROBLEM 2: RATIONAL FUNCTIONS. [20 POINTS] Consider the function  $f(x) = \frac{x-2}{x-3}$

(a) What is the  $x$ -intercept? -----

(b) What is the  $y$ -intercept? -----

(c) What is the vertical asymptote? -----

(d) What is the horizontal asymptote? -----

(e) Draw a signs table for  $f(x)$

(f) Using this information, sketch  $f(x)$ .

(g) Calculate the inverse of  $f(x)$ .

(h) Verify that  $f[f^{-1}(x)] = x$ .

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PROBLEM 3: APPLIED PROBLEM [20 POINTS]

A bank offers an interest rate of 3% annually. Supposing your initial investment is \$10,000.

1. How much money will be in your bank account after 1 year? \_\_\_\_\_
2. How much money will be in your bank account after 2 years? \_\_\_\_\_  
(no need to simplify or evaluate the answer)
3. The amount of money in your bank account  $A$  as a function of the number of years passed  $n$  is (circle the correct answer)
  - $A(n) = 10,000(1.03)^{n+1}$
  - $A(n) = 10,000(0.03)^{n+1}$
  - $A(n) = 10,000(1.03)^n$
  - $A(n) = 10,000(0.03)^n$
4. Graph  $A(n)$ , making sure to annotate the important points (i.e. the  $y$ -intercept, and the answer to question 1).

5. Express the function  $A(n)$  as a natural exponential. \_\_\_\_\_

6. How long would it take until you have \$20,000 in the bank? Hint: you may need to use the fact that  $\ln(2) \simeq 0.7$ ,  $\ln(0.03) \simeq -3.5$ ,  $\ln(1.03) \simeq 0.035$ .