EXAM 1 - MATH 111

YOUR NAME:⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯

Thursday, September 21

George Voutsadakis

Read each problem **very carefully** before starting to solve it. Each problem is worth 10 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. (a) Find the domain of $f(x) = \dfrac{1}{x^2 + 4x - 45}$.

(b) Let $f(x) = \dfrac{2x + 3}{x^2 - 25}$. Compute $f(a + 5)$ and simplify.

2. (a) Find the rate of change of the function $f(x) = x^2 + 2x$ on $[1, a]$ and simplify.

(b) The tax system of a certain state stipulates that incomes up to $10,000 are exempt from tax. If an individual earns above $10,000 but below $30,000 then his/her total earnings are taxed at the rate of 15%. Finally, for higher incomes, the previous rate applies, except that the amount in excess of $30,000 is taxed at 20%. Please, write a piece-wise defined function $T(x)$ giving the tax amount T that an individual owes as a function of his income x.

3. (a) Suppose $f(x) = x^2 - 3x$ and $g(x) = 7x - 5$.

   (i) Compute $(f \circ g)(x)$ and simplify.

   (ii) Compute $(g \circ f)(x)$ and simplify.

   (iii) Compute $(g \circ g)(x)$ and simplify.

   (b) Suppose the functions f and g are given by the following table.

x	-5	-3	-2	0	1	3	4	7
$f(x)$	4	1	0	1	3	7	-2	-5
$g(x)$	-3	1	-5	4	-2	7	1	-3

   (i) Compute $f(g(4))$ showing all steps.

   (ii) Compute $g(f(-3))$ showing all steps.

4. Consider the functions $f(x) = \dfrac{3}{x-7}$ and $g(x) = \sqrt{5x-1}$.

(a) Showing all steps, find the domain of f.

(b) Showing all steps, find the domain of g.

(c) Write the two conditions that one needs to enforce to obtain the domain of $f \circ g$. Please do not do additional work here; only write down the conditions.

(d) Now work with the conditions you wrote in Part (c) to find the domain of $f \circ g$.

5. (a) We start with the graph of the function $y = |x|$ and would like to obtain the graph of $y = |5x - 7| - 3$. Fill in the blanks in the following table giving the formulas and a description of the individual transformations that are required to produce the desired transformation (as shown in class).

$y = |x| \quad \longrightarrow$ (   )

$\longrightarrow$ (   )

$\longrightarrow \quad y = |5x - 7| - 3$ (   )

(b) Solve the absolute value equation

$$9|5 - 12x| - 7 = 29.$$