Math 117 **Final Exam** **Joseph McGuire**

Student Name (print): ______________________________

This exam contains 6 pages (including this cover page) and 10 questions. The total number of possible points is 200. Enter your answers in the space provided. Draw a box around your final answer.

- **Mysterious or unsupported answers will not receive full credit**. A correct answer, unsupported by calculations, explanation, or algebraic work will receive no credit; an incorrect answer supported by substantially correct calculations and explanations may still receive partial credit.
- **Clearly identify your answer for each problem.**
- **No calculators or outside help allowed, unless it is with your instructor.**

Do not write in the table to the right.

Question	Points	Score
1	20	
2	20	
3	20	
4	20	
5	20	
6	20	
7	20	
8	20	
9	20	
10	20	
Total:	200	

1. (20 points) Let $0 < a < b < c < d$ be constants. Determine the quotient and remainder polynomials for
$$\frac{ax^3 + bx^2 + cx + d}{x+1}.$$
What formula involving a, b, c, d guarantees that this cubic polynomial has root at $x = -1$? Show your work.

2. (20 points) Let $b \neq 0$ be a constant. For what values of x is the following inequality true? Show your work.
$$x^2 - 2bx + b^2 \geq 1$$
Answer should be in terms of b.

Points earned: ______ out of 40 points

3. (20 points) Let $0 < a < b < c$ be constants. For what values of x is the following inequality true?

$$\frac{ax^2 + bx + c}{(a+1)x^2 + (b+1)x + (c+1)} \leq \frac{a}{a+1}$$

Answer should be terms of a, b, c. Show your work.

4. (20 points) Let $A, B, C, D, E, J > 0$ be constants. Your answer will be in terms of these constants. Show your work. Solve for x in the following equation:

$$A(B)^{(C^{E^x} D + E)} = J.$$

Clarification: Everything in the exponents place is an exponent of B.

Points earned: ______ **out of 40 points**

5. (20 points) Let $a, b, c \neq 0$ be constants. Recall $\ln(x) = \log_e(x)$ and $\log(x) = \log_{10}(x)$. Solve for x in the following logarithmic equation,

$$\ln(10) + \log(e) + \log_2(3) + \log_3(2) = \ln(10bx^2 + cx + c).$$

Show your work.

6. (20 points) With a, b, c, d, e, f, g, i are constants, find the determinant of the matrix

$$\begin{bmatrix} a & d & i \\ b & e & g \\ c & f & j \end{bmatrix}.$$

Show your work.

Points earned: ______ **out of 40 points**

7. (20 points) If $G = [\lambda]$ is a 1×1 matrix, and A is a $1 \times n$ matrix, is it true that $\lambda A = GA$ for any number λ. Is it true for $A\lambda = AG$? If it's true, then prove it with $A = [a_1\ a_2\ \ldots\ a_n]$. If it's false, give an example. Show your work.

8. (20 points) For constants a, b, c being constants, find the inverse of

$$A = \begin{bmatrix} a & 1 & 1 \\ 1 & 2 & 5 \\ 9 & 14 & 20 \end{bmatrix}.$$

When does A^{-1} not exist? Show your work.

Points earned: ______ out of 40 points

9. (20 points) Use your answer from 8 to solve the following system of linear equations:

$$\begin{cases} ax + y + z & = 1 \\ x + 2y + 5z & = 1 \\ 9x + 14y + 20z & = 1 \end{cases}.$$

Show your work.

10. (20 points) Solve the system of linear equations, or show that no solution exists. Use any method you would like. Show your work.

$$\begin{cases} 4w + 7x + 8y + z & = 1 \\ 8w + 2x + 9y + z & = 2 \\ 2w + 5x + 3y + 12z & = 3 \\ 3w + 13x + 7y + 6z & = 4 \end{cases}.$$

Points earned: ______ out of 40 points