**Math 107 Section 1**
**Spring 2023**
**Exam I**
**March 1, 2023**
**Time Limit: 50 Minutes**

**Name (Print):** _____

**Student ID:** _____

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This exam contains 6 pages (including this cover page) and 5 problems. Check to see if any pages are missing. Enter all requested information on the top of this page, and put your initials on the top of every page, in case the pages become separated.

You may *not* use your books or notes on this exam. However, you may use a *basic* calculator.

You are required to show your work on each problem on this exam. The following rules apply:

- **Organize your work**, in a reasonably neat and coherent way, in the space provided. Work scattered all over the page without a clear ordering will receive very little credit.
- **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 might still receive partial credit. This especially applies to limit calculations.
- If you need more space, use the back of the pages; clearly indicate when you have done this.

| Problem | Points | Score |
|---|---|---|
| 1 | 10 | |
| 2 | 10 | |
| 3 | 10 | |
| 4 | 10 | |
| 5 | 10 | |
| Total: | 50 | |

Do not write in the table to the right.

1. (10 points)

   For this problem, consider the matrix

$$Q = \begin{pmatrix} 8 & 6 & 7 \\ 5 & 3 & 0 \\ 9 & x & \heartsuit \\ f & 1 & 43 \\ \Delta & z & \clubsuit \end{pmatrix}$$

   a) Write down the values of $Q(5,3)$, $Q(4,1)$, and $Q(2,3)$. Be sure to specify which is which.

   b) Write down an MATLAB expression which will create the $4 \times 2$ submatrix of $Q$ obtained by deleting the middle row and the middle column

   c) Write down the value of the matrix $Q(1:2:\text{end},[2,3])$

2. (10 points)

   (a) Determine the final values of the variables $x$, $y$, and $z$ after the list of commands are executed in the command window. You must show your work by hand.

```
x = 3;
y = 1;
z = 9;
x = y-z;
z = x + 2*y;
y = 2*y-z + x;
```

   (b) Consider the function defined below.

```
function [a,b,c] = examFun(x,y)
a = 2*x - y
b = x^2-y
c = a + b
end
```

   Determine the final values of the variables $x$, $y$, $z$, $a$, and $b$ after running the following lines in the command window. You must show your work by hand.

```
a = 1;
b = 4;
x = 2;
y = 3;
z = -1;
[b,y,z] = examFun(x,a)
```

3. (10 points)

(a) Find scalar values $a$ and $b$ satisfying

$$a\begin{pmatrix} 7 \\ -2 \end{pmatrix} + b\begin{pmatrix} -3 \\ 4 \end{pmatrix} = \begin{pmatrix} 5 \\ 8 \end{pmatrix}.$$

(b) Find a vector $\vec{v}$ satisfying

$$3\begin{pmatrix} 2 \\ 5 \end{pmatrix} - 3\vec{v} = 6\begin{pmatrix} 2 \\ 3 \end{pmatrix}$$

(c) Find a matrix $H$ such that

$$2H + 4\begin{pmatrix} 0 & 3 \\ -2 & 1 \end{pmatrix} = 2\begin{pmatrix} 1 & 0 \\ -4 & 2 \end{pmatrix}$$

4. (10 points) Consider the following code

```
x = 1;
y = 1;
while(y < 30)
  z = x+y;
  x = y;
  y = z;
end
```

Determine the values of $x$ and $y$ at the end of the code block.

Be sure to carefully show your work!

5. (10 points) Without using any built-in MATLAB functions, write down a function called *even_sum* which takes in a value $n$ and returns

$$2 + 4 + 6 + 8 + \cdots + 2n.$$

Make sure that your function is well-documented!