**Math 101 - Unit 6 Assessment**
**Linear & Non-linear Systems**

Name:_____ Score:_____/ 50
KUID:_____
Instructor:_____
**Instructions:**
**All work is to be shown on a separate sheet of paper. Answers given without any supporting work will receive minimum credit only. Do not write on this paper. Clearly label each problem on the sheet. Put your name on any attached pages and staple to this form.**

**Part I. Multiple Choice. Circle the answer**. [6 points]

1. Which of the following is *not* an allowed matrix row operation? [2 points]
   (a) multiply one row by another row
   (b) add a multiple of one row to another row
   (c) interchange two rows
   (d) multiply one row by a non-zero constant

2. Stan was solving a system of linear equations which resulted in the statement $0 = -1$. What does this mean? [2 points]
   (a) He made a mistake.
   (b) It is an inconsistent system.
   (c) The answer is $(0, -1)$
   (d) The lines are coincident.

3. Which of the following is an augmented matrix for the given system? [2 points]
   $\begin{cases} 9x - 3y + 7 = 0 \\ 8x - 6 = 5y \end{cases}$

   (a) $\left[\begin{array}{cc|c} 9 & -3 & 7 \\ 8 & -6 & 5 \end{array}\right]$
   (b) $\left[\begin{array}{cc|c} 9 & -3 & 7 \\ 8 & 5 & 6 \end{array}\right]$
   (c) $\left[\begin{array}{cc|c} -9 & 3 & 7 \\ 8 & -5 & 6 \end{array}\right]$
   (d) $\left[\begin{array}{cc|c} -9 & 3 & -7 \\ 8 & 5 & -6 \end{array}\right]$

**Part II. Show all work on the following problems.**
For the systems given in #4 - #8, use **substitution or elimination** to solve 4 of the 5 problems to find all *real* solutions. If the system is dependent, write the answer(s) in terms of $z$. [20 points]

4) $\begin{cases} x^2+y^2=1 \\ x^2+(y+3)^2=4 \end{cases}$ 5) $\begin{cases} x^2+y^2=5 \\ 2x+y+3=0 \end{cases}$ 6) $\begin{cases} \frac{3}{2}x-\frac{1}{3}y=\frac{1}{2} \\ 2x-\frac{1}{2}y=-\frac{1}{2} \end{cases}$

7) $\begin{cases} x-3y+2z=12 \\ 2x-5y+5z=14 \\ x-2y+3z=20 \end{cases}$ 8) $\begin{cases} x+y-10z=-4 \\ -x+7z=5 \\ -3x-5y+36z=10 \end{cases}$

9) [5 points] Describe what has happened at each step of the following transformation of the given matrix.

$$\left[\begin{array}{rrr|r} 1 & 1 & -5 & 3 \\ 1 & 0 & -2 & 1 \\ 2 & -1 & -2 & -2 \end{array}\right]$$

$$\left[\begin{array}{rrr|r} 1 & 1 & -5 & 3 \\ 0 & -1 & 3 & -2 \\ 2 & -1 & -2 & -2 \end{array}\right]$$

[a] [a] _____

$$\left[\begin{array}{rrr|r} 1 & 1 & -5 & 3 \\ 0 & -1 & 3 & -2 \\ 0 & -3 & 8 & -4 \end{array}\right]$$

[b] [b] _____

$$\left[\begin{array}{rrr|r} 1 & 1 & -5 & 3 \\ 0 & 1 & -3 & 2 \\ 0 & -3 & 8 & -4 \end{array}\right]$$

[c] [c] _____

$$\left[\begin{array}{rrr|r} 1 & 1 & -5 & 3 \\ 0 & 1 & -3 & 2 \\ 0 & 0 & -1 & 2 \end{array}\right]$$

[d] [d] _____

$$\left[\begin{array}{rrr|r} 1 & 1 & -5 & 3 \\ 0 & 1 & -3 & 2 \\ 0 & 0 & 1 & -2 \end{array}\right]$$

[e] [e] _____

10) [9 points] For the system of equations given, write the augmented matrix. Use matrix row operations to put the matrix into row echelon or triangular form. Then solve the system.

$$\begin{cases} 4x + 8y - 4z = 4 \\ 3x + 8y + 5z = -11 \\ -2x + y + 12z = -17 \end{cases}$$

11) [10 points] Choose *2* of the following applications to solve using a system of equations. Clearly identify the representation for each unknown and set up a system of equations. Solve the system using substitution, elimination, or matrix row operations.

a) At a college production of *A Streetcar Named Desire*, 400 tickets were sold. The ticket prices were \$8, \$10, and \$12, and the total income from the ticket sales was \$3700. How many tickets of each type were sold if the combined number of \$8 and \$10 tickets sold was 7 times the number of \$12 tickets sold.

b) Cholesterol intake should be limited to 300 mg or less each day. One serving of scrambled eggs from McDonalds and one Double Beef Whopper from Burger King exceed this intake by 241 mg. Two servings of scrambled eggs and three Double Beef Whoppers provide 1257 mg of cholesterol. Determine the cholesterol content in each item.

c) Melodee has \$45,000 to invest and wishes to receive an annual income of \$4290 from this money. She has chosen investments that pay 5%, 8%, and 12% simple interest. Melodee wants to have the amount invested as 12% to be double the amount invested at 5%. How much should she invest at each rate?

d) Old MacDonald has three farms which he rents to his neighbors. His holdings total 960 acres. The farms rent for \$80, \$60, and \$50 per acre, respectively. His combined income from the higher priced rentals exactly doubles his income from the \$50-per-acre farm. If his total income is \$60,000, how large is each farm?