Name : ______________ **Lesson 2 Warm Up Quiz** **Class Number:** _____

Math 2B: Applied Linear Algebra

True/False

For the problems below, circle T if the answer is true and circle F is the answer is false.

1.	T	F	Suppose V_1 and V_2 are sets. Then any function is a subset of a cross product of sets in the form $V_1 \times V_2$
2.	T	F	Any relation from V_1 to V_2 is also a function $f : V_1 \to V_2$.
3.	T	F	A function $f : D \to V_2$ is a subset of $D \times V_2$
4.	T	F	If $f(\mathbf{x}) = A\mathbf{x}$, then the $\text{Rng}(f) = \{\mathbf{b} \in \mathbb{R}^m : \mathbf{b} = A\mathbf{x} \text{ for some } \mathbf{x} \in \mathbb{R}^n\}$
5.	T	F	If $f(\mathbf{x}) = \mathbf{x}^T$, then $\text{Dom}(f) = \mathbb{R}^n$
6.	T	F	Any function is a subset of a cross product of sets
7.	T	F	All functions are relations.

Multiple Choice

For the problems below, circle the correct response for each question.

1. Which of the following represents the 8-bit binary representation of the number 207?

   A. 11110011 B. 11010001 C. 10001011 D. 10111111 E. 11001111

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2. Define each of the following sets:

$$C([0,1]) = \{f(x) \,|\, \text{function } f : [0,1] \to \mathbb{R} \text{ is a continuous function on interval } [0,1].\ \}$$
$$C^{(1)}([0,1]) = \{f(x) \,|\, \text{function } f : [0,1] \to \mathbb{R} \text{ has a continuous first derivative } f'(x) \text{ on interval } [0,1].\ \}$$

   In other words, $C([0,1])$ is the set of continuous functions $f : [0,1] \to \mathbb{R}$ while $C^{(1)}([0,1])$ is the set of functions $f : [0,1] \to \mathbb{R}$ with continuous first derivatives. From Math 1A (Single-Variable, Differential Calculus), we know that if $f(x)$ is differentiable on $[0,1]$, then f is continuous on $[0,1]$. Identify the set theoretic formulation of this theorem: A. $C([0,1]) \subseteq C^{(1)}([0,1])$ B. $C([0,1]) = C^{(1)}([0,1])$ C. $C([0,1]) \cap C^{(1)}([0,1]) = \emptyset$

   D. $C^{(1)}([0,1]) \subseteq C([0,1])$ E. $C([0,1]) \cup C^{(1)}([0,1]) = C^{(1)}([0,1])$

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3. Let 10110110 be an 8−bit binary integer. What is the decimal representation of this number?

   A. 109 B. 364 C. 218 D. 80880880 E. 182

4. Let $E \subseteq \mathbb{R} \times \mathbb{R}$ be given by

$$E = \left\{ (x, y) \,:\, \frac{x^2}{1024} + \frac{y^2}{729} < 1 \right\}$$

Which of the following cannot be true about the relation E?

A. $\text{Dom}(E) = [-32, 32]$ B. $\text{Dom}(E) = (-32, 32)$ C. $\text{Rng}(E) = (-27, 27)$

D. E is not a function   E. $\text{Codomain}(E) = \mathbb{R}$

5. Suppose that we define ellipse $E = \left\{ (x, y) \,:\, \frac{x^2}{25} + \frac{y^2}{9} = 1 \right\}$. Find the range, $\text{Rng}(E)$, of this relation.

A. $(-5, 5)$ B. $[-5, 5]$ C. $[-3, 3]$ D. $(-3, 3)$ E. $\mathbb{R}$

Free Response

1. Let A and B be sets. Write the formal set-theoretic definition of a relation from A to B. Give two examples of relations that exist in your daily life.

2. Let A and B be sets. Suppose R is a relation from A to B. Write the formal set-theoretic definition of each of the following:

   i. Domain space of R ii. Domain of R iii. Domain of R iv. Range of R

3. Give an example of a relation in which the domain space is not equal to the domain.

4. Give an example of a relation in which the codomain is not equal to the range.

5. State the formal, set-theoretic definition of a mathematical function.

6. Convert the following unsigned decimal numbers into the corresponding unsigned binary representation:

   i. 47   ii. 127   iii. 128

7. Convert each of the following unsigned binary numbers into unsigned decimal numbers:

   i. 1001101   ii. 10111   iii. 101011011

8. Describe the 2-bit gray-scale color map as a function. Define the domain space and codomain of this function. Describe how this relates to digital images.