

**Math 112 - Test 1**  
February 14, 2019

Name \_\_\_\_\_

Score \_\_\_\_\_

Show all work. Supply explanations when necessary. Partial credit will be awarded for correct work.

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1. (6 points) Write each set in roster notation.

(a)  $A$  is the set of counting numbers less than 6.

(b)  $Q$  is the set of letters of the word *sleeplessness*.

(c)  $D = \{s \mid s \in \mathbb{N} \text{ and } 6 < s < 10\}$

2. (2 points) The set of heart failure patients who deserve heart transplants is not well defined. Give one reason for why not.

3. (3 points) The following set is described in set-builder notation. Translate this description word for word into a complete sentence.

$$B = \{x \mid x \in \mathbb{N} \text{ and } x < 10\}$$

4. (4 points) Give a verbal description of each set.

(a)  $\{10, 12, 14, 16, \dots, 48\}$

(b)  $\{a, u, g, s, t\}$

5. (2 points) Write the set  $M = \{1, 2, 3, 4, \dots, 100\}$  in set-builder notation.

6. (5 points) Decide whether each statement is true or false.

(a) \_\_\_\_\_  $79 \in \{1, 3, 5, 7, 9, 11, \dots\}$

(b) \_\_\_\_\_  $-5 \in \mathbb{N}$

(c) \_\_\_\_\_  $\{r \mid r \in \mathbb{N} \text{ and } r + 1 = 0\}$  is the empty set.

(d) \_\_\_\_\_  $\{k \mid k \in \mathbb{N} \text{ and } k - 1 = 0\}$  is the empty set.

(e) \_\_\_\_\_  $\text{Homewood} \in \{x \mid x \text{ is one of the United States}\}$

7. (5 points) Determine the cardinal number for each set.

(a) \_\_\_\_\_  $A = \{2, 4, 6, 8, 10\}$

(b) \_\_\_\_\_  $B = \text{the set of letters of the word } didgeridoo$

(c) \_\_\_\_\_  $C = \{\emptyset\}$

(d) \_\_\_\_\_  $B = \{\text{four}\}$

(e) \_\_\_\_\_  $E = \mathbb{N}$

8. (2 points) Give an example of a set that is equivalent to, but not equal to,  $\{1, 2, 3, 4\}$ .

9. (4 points) List all subsets of the set  $\{1, 2, 3\}$ .

10. (4 points) Decide whether each statement is true or false.

(a) \_\_\_\_\_  $\{3\} \cong \{\emptyset\}$

(b) \_\_\_\_\_ All equal sets are equivalent.

(c) \_\_\_\_\_ All equivalent sets are equal.

(d) \_\_\_\_\_  $\{1, 2, 3, 4, 5\} \cong \{10, 20, 30, 40, 50\}$

11. (1 point) Let  $A = \{d, o, g\}$ . Which one of these sets is NOT a proper subset of  $A$ ?
- (a)  $\{d\}$
  - (b)  $\{d, o, g\}$
  - (c)  $\{d, g\}$
  - (d)  $\emptyset$
12. (1 point) Let  $C = \{1, 2, 3, 4, 5, 6, 7\}$ . How many subsets does  $C$  have?
- (a) 7
  - (b) 100
  - (c) 128
  - (d) 150
13. (1 point) Which one of these sets is equivalent to  $\{a, b, c\}$ ?
- (a)  $\{abc\}$
  - (b)  $\{123\}$
  - (c)  $\{1, 2, 3\}$
  - (d)  $\emptyset$
14. (1 point) Suppose  $A$  and  $B$  are NOT empty sets. Which one of the following sets IS empty?
- (a)  $\{\emptyset\}$
  - (b)  $A \cup B$
  - (c)  $B \cap B'$
  - (d)  $A \cup B \cup \emptyset$
15. (1 point) Let  $A = \{1, 2\}$  and  $B = \{a, b, c\}$ . Which one of these is an element of  $A \times B$ ?
- (a)  $\{1, 2, a, b, c\}$
  - (b)  $\{1, b\}$
  - (c)  $(1, 1)$
  - (d)  $(2, c)$

16. (16 points) Let  $U$  be the set of letters of the English alphabet and think about the subsets  $A = \{a, b, c, d, e\}$  and  $B = \{a, e, i, o, u\}$ . Determine each of the following.

(a)  $n(B)$

(b)  $A'$

(c)  $A \cup B$

(d)  $A \cap B$

(e)  $A \cap B'$

(f)  $A - B$

(g)  $\emptyset \cup B$

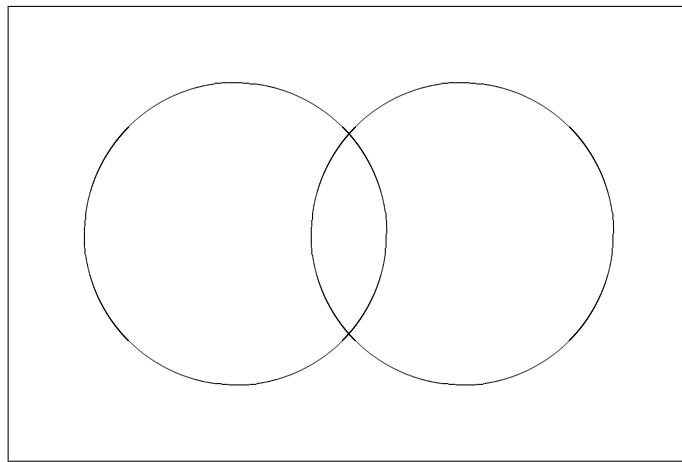
(h)  $A \cap \emptyset$

17. (6 points) Suppose  $U$  is the set of dogs at the local animal shelter. Let  $G$  be the subset of gray dogs and let  $H$  be the subset of dogs weighing more than 50 lbs.

(a) How would you describe the elements of  $G \cap H$ ?

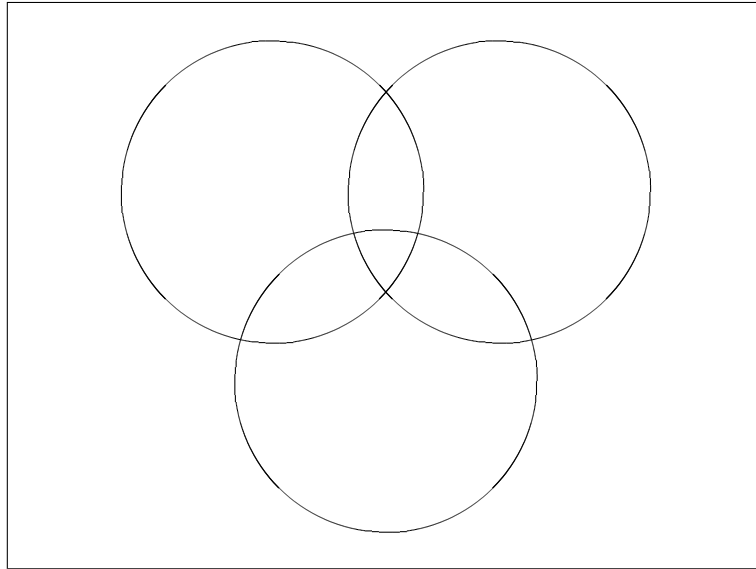
(b) How would you describe the elements of  $G'$ ?

18. (6 points) In the two-set Venn diagram shown below, label the sets  $A$  and  $B$ . Then label the four distinct (disjoint) regions with Roman numerals. Identify and shade the regions that make up  $B - A$ .



19. (8 points) Suppose  $n(A) = 53$ ,  $n(B) = 31$ ,  $n(A \cap B) = 17$ , and  $n(U) = 80$ . Use a Venn diagram to sort the data. Then determine  $n(A \cup B)$ .

20. (8 points) In the three-set Venn diagram shown below, label the sets  $A$ ,  $B$ , and  $C$ . Then label the distinct (disjoint) regions of the diagram with Roman numerals. Identify and shade the regions that make up  $A' \cap (B \cup C)$ .



21. (6 points) Rewrite each of the following statements using mathematical symbols.

(a)  $A$  is a subset of  $B$ .

(b) The cardinal number of  $D$  is 10.

(c)  $a$  is an element of the complement of the set  $Q$ .

22. (8 points) Out of 30 students taking an exam, 17 answered the first bonus question (Q1), 19 answered the second bonus question (Q2), and 6 did not attempt either of the two bonus questions. Use a Venn diagram to sort the data. Then determine how many students answered both bonus questions?