Math 112 - Test 1

Name _____

September 14, 2017

Score _____

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

1. (5 points) Let A be the set of letters of the word *ZENZIZENZIZENZIC*. Write A in roster notation. Then determine $n(A)$.

2. (3 points) Explain why the set of all pretty flowers is not well defined.

3. (4 points) List all subsets of $\{x, y, z\}$.

4. (5 points) Determine whether each statement below is true or false.

   (a) _____ $\emptyset \subseteq \mathbb{N}$

   (b) _____ $\emptyset \in \{0, 1, 2, 3, 4, 5\}$

   (c) _____ $n(\emptyset) = 0$

   (d) _____ $n(\{\emptyset\}) = 0$

   (e) _____ $\{b\} \in \{a, b, c\}$

5. (4 points) Rewrite the set C in roster notation: $C = \{x \mid x \in \mathbb{N} \text{ and } -3 < x < 5\}$

6. (4 points) A botanist studying a certain plant has identified all the kinds of insects that feed on the plant. Let I be the set of all insects that feed on the plant, and let F be the set of all flying insects. Describe, in words, an element of the set $F - I$.

7. (16 points) Let $A = \{1, 3, 5, 7, 9\}$ and $B = \{0, 3, 6, 9\}$, and consider A and B as subsets of the universal set $U = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$. Determine each of the following.

   (a) $n(A)$

   (b) B'

   (c) $B \cup \emptyset$

   (d) $A \cap B$

   (e) $(A \cup B)'$

   (f) $A' \cap B'$

   (g) $\emptyset \cap A$

   (h) $B - A$

8. (1 point) Which one of these sets has a cardinality of 1?

   (a) $A = \{1, 11, 111, 1111, \dots\}$
   (b) $A = \{0, 1\}$
   (c) $A = \emptyset$
   (d) $A = \{\emptyset\}$

9. (1 point) Let $M = \{a, b, c, d, e\}$. Which one of these sets is NOT a proper subset of M?

   (a) $\{a\}$
   (b) $\{a, b, c\}$
   (c) $\{a, b, c, d, e\}$
   (d) $\emptyset$

10. (1 point) Which one of the statements below would be read "B is a subset of A?"

    (a) $A \subset B$
    (b) $B \subseteq A$
    (c) $B \in A$
    (d) $B = \{x \mid x \in A\}$

11. (1 point) Let $X = \{0, 1, 2\}$. How many subsets does X have?

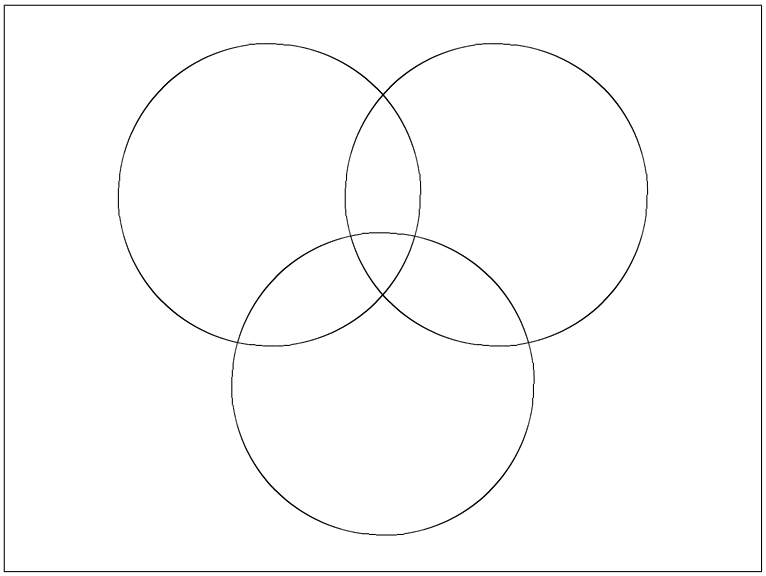
    (a) 3
    (b) 6
    (c) 7
    (d) 8

12. (1 point) Which one of the following sets is NOT empty?

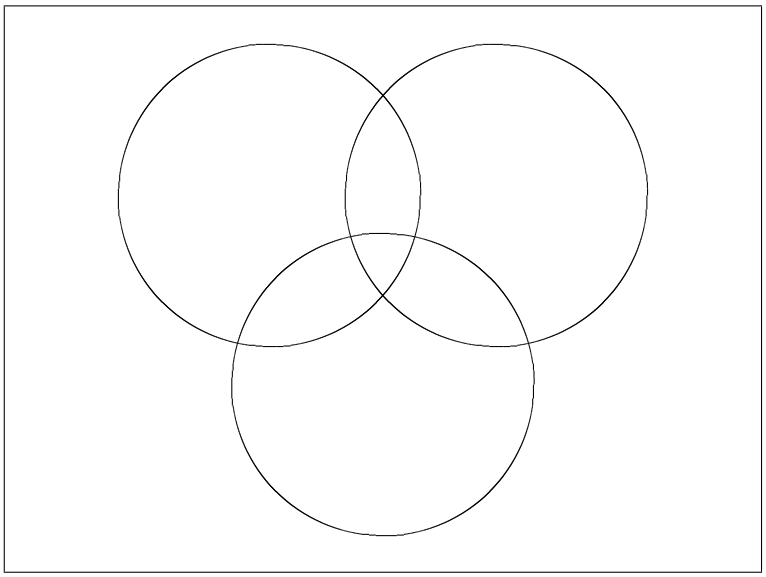
    (a) $\{\quad\}$
    (b) $\emptyset$
    (c) $\{\emptyset\}$
    (d) The set of all natural numbers strictly between 1 and 2

13. (10 points) Shade the region corresponding to each set. Show work or explain your reasoning. Label which circle represents each set. (It may help to label the individual, disjoint regions of the diagram.)

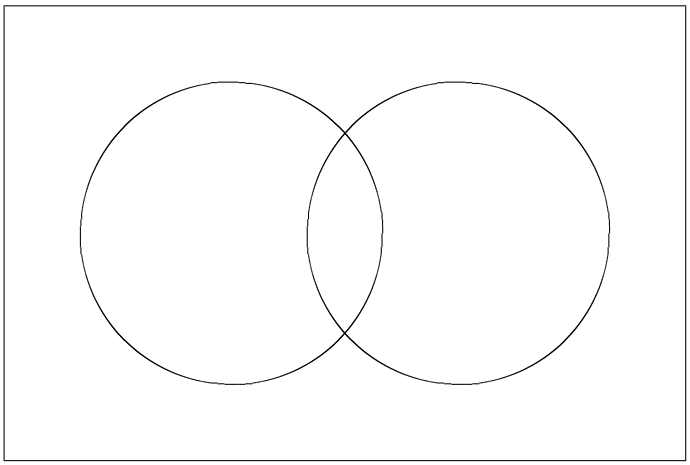
(a) $(B \cap C) \cup A$



(b) $C \cap (A' \cap B')$



14. (5 points) Shade the region corresponding to $A \cap B'$. Show work or explain your reasoning.



15. (4 points) The set A is defined below using set-builder notation.

$$A = \{x |\ x \in \mathbb{N} \text{ and } 67 \leq x \leq 73\}$$

(a) What is the cardinality of A?

(b) Give an example of a set that is equivalent to A, but not equal to A.

16. (4 points) Suppose U is the set of all U.S. presidents, and L is the subset of living presidents. Using words, describe the elements of L'.

17. (4 points) If $U =$ the set of all even natural numbers and $X = \{10, 12, 14, 16, 18, 20, 22, \dots\}$, find X'.

18. (4 points) Rewrite each of the following statements using mathematical symbols.

(a) The number 9 is an element of the set K.

(b) The empty set is a subset of the set A.

(c) The set X is equivalent to the set Y.

(d) The intersection of the two sets P and Q is empty.

19. (1 point) For which one of the sets defined below is it true that $n(A) = 4$?

(a) A is the set of of all solutions of the equation $2x = 8$.
(b) $A = \{0, 1, 2, 3, 4\}$
(c) A is the set of letters of the word *Mississippi*.
(d) A is the set of letters of the word *noon*.

20. (1 point) Which one of these sets is **NOT** well defined?

(a) The set of letters in the word *encyclopedia*
(b) $\{x \mid 2x + 1 = 5\}$
(c) The set of all wealthy people
(d) $\{1, 3, 5, 6, 8, 10\}$

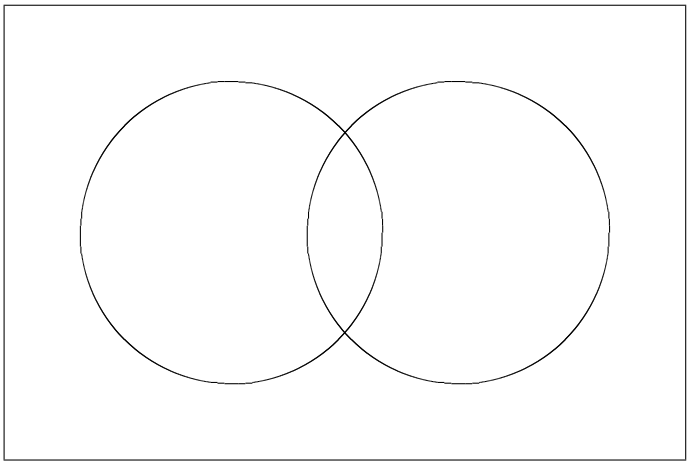
21. (1 point) Which one of the sets given below is **NOT** equivalent to $\{123\}$?

(a) $\{1\}$
(b) $\{\emptyset\}$
(c) $\{0\}$
(d) $\{1, 2, 3\}$

22. (10 points) The following information was obtained from a survey of 111 college students.

- 52 studied on weekends **only**
- 30 studied on weekdays **only**
- 16 never studied

(a) Sort these results and completely fill in an appropriate Venn diagram. Label the sets in your diagram.



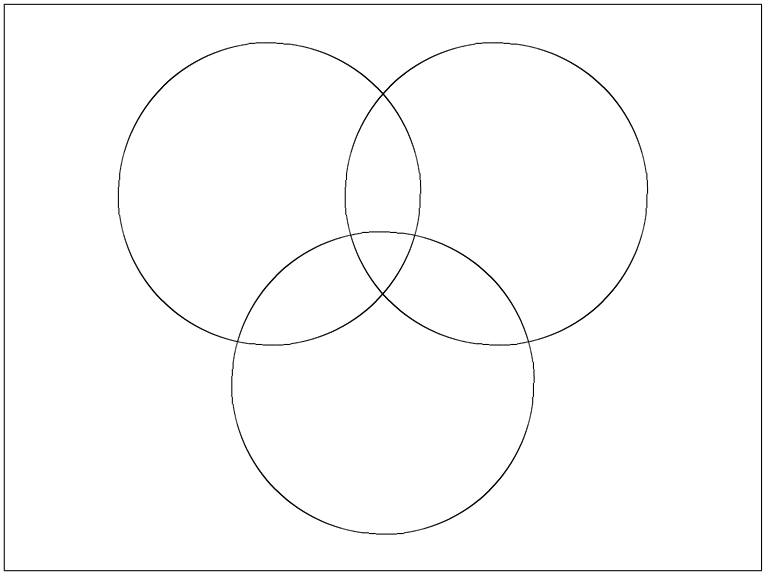
(b) How many students studied on weekends or weekdays?

(c) How many students studied on both weekends and weekdays?

23. (10 points) 140 high school teachers were asked whether they use a chalkboard, a whiteboard, or an overhead projector on a daily basis. Here are the results:

- 28 use a chalkboard
- 106 use a whiteboard
- 87 use an overhead projector
- 17 use both a chalkboard and a whiteboard
- 66 use both a whiteboard and an overhead projector
- 13 use both a chalkboard and an overhead projector
- 10 use all three

(a) Sort these results and completely fill in an appropriate a three-set Venn diagram.



(b) How many teachers do NOT use any of these three types of displays?

(c) How many teachers use exactly one type of display?