

## Sets Quiz (Katherine E. Stange, Math 2001, Spring 2023, CU Boulder)

Name:

Correct answers without justification will receive full credit (unless justification is required by the question). Incorrect answers with explanation can receive partial credit. If the questions are unclear, please ask during the test and I will clarify.

1. Give an example of a set  $A$  such that  $|A| = 3$  and  $1 \in A$ .

2. Compute the power set of  $\{1, 2, 3\}$ .

3. If  $|X| = n$ , then compute  $|\mathcal{P}(X)|$ .

4. Consider the sets  $A = \{1, 2, 3\}$  and  $B = \{-1, 0, 1\}$ .

(a) Compute  $A \cup B$ .

(b) Compute  $A \cap B$ .

(c) Compute  $A - B$ .

(d) Compute the complement of  $A$  in the universe  $\{1, 2, 3, 4, 5\}$ .

5. Let  $A$ ,  $B$  and  $C$  be arbitrary sets. Draw a Venn diagram illustrating  $(A \cap B) - C$ .
6. Give set builder notation for the integers between 1 and 10 (inclusive). Use symbols exclusively (not english words).
7. Give an example of a set  $A$  such that  $\{1\} \in A$  but  $\{1\} \not\subseteq A$ .
8. Give set builder notation for the set of points in the Cartesian plane that lie on the line  $y = 3x + 1$ . Use symbols exclusively (not english words).
9. Mark each of the following as TRUE, FALSE or NOT WELL-DEFINED (for example, if the set builder notation isn't valid – watch out for these!):
- |  |                               |
|--|-------------------------------|
| (a) $1 \in \{x \in \mathbb{R} : x\}$   | TRUE, FALSE, NOT WELL-DEFINED |
| (b) $\{1\} \subseteq \{xy : x \in \mathbb{Z}, y \in \mathbb{Z}\}$                            | TRUE, FALSE, NOT WELL-DEFINED |
| (c) $(-6, 4] \subseteq (-10, \infty)$  | TRUE, FALSE, NOT WELL-DEFINED |
| (d) $\{(x, y) : x \in \mathbb{R}, y \in \mathbb{Z}\} \subseteq \mathbb{R} \times \mathbb{R}$ | TRUE, FALSE, NOT WELL-DEFINED |
| (e) $\{x^2 : x \in \mathbb{R}\} = [0, \infty)$   | TRUE, FALSE, NOT WELL-DEFINED |
| (f) $\{1, 2, 3\} \in \{A \subseteq \mathbb{Z} :  A  = 2\}$                                   | TRUE, FALSE, NOT WELL-DEFINED |
| (g) $ \{0 < x < 3\}  = 2$  | TRUE, FALSE, NOT WELL-DEFINED |

10. Let  $|A| = n$  and  $|B| = m$ . What is the cardinality of  $\mathcal{P}(A \times B)$ ?

11. Is the following region of the plane a Cartesian product? If yes, give sets  $A$  and  $B$  so that it is  $A \times B$ .

*YES, NO*

If yes,  $A =$   
 $B =$

12. Compute the power set  $\mathcal{P}(\emptyset)$ .

13. True or False: The empty set is an element of every set. If True, explain why. If False, give an example of a set for which the empty set is not an element.

14. Suppose  $|A| = 5$ . Can  $A$  be a Cartesian product? If not, explain why not. If so, give an example.