

ANSWER KEY TO EXERCISE 3: Set Relation

1. Let

$$A = \{d, a, y, s\}, \quad B = \{g, o, n, e\}, \quad C = \{b, o, y\}, \quad D = \{n, e, o, g\}$$

Compare the sets, using the terms: a) equal and equivalent; b) joint and disjoint

- a) Sets A and B **$A \sim B$; disjoint**
- b) Sets A and C **$A \neq C$; joint**
- c) Sets A and D **$A \sim D$; disjoint**
- d) Sets B and C **$B \neq C$; joint**
- e) Sets B and D **$B = D$; joint**
- f) Sets C and D **$C \neq D$; joint**

2. TRUE or FALSE. If FALSE, explain why.

- a) All equivalent sets are equal. **False**
- b) All equal sets are equivalent. **True**
- c) All empty sets are equal. **True**
- d) All empty sets are equivalent. **True**
- e) $\{ \}$ is an empty set. **True**
- f) $\{ 0 \}$ is an empty set. **False**
- g) A null set is a finite set. **True**
- h) If $B = \{ b \mid b \text{ is a whole number less than } 10 \}$, then $n(B) = 9$. **False. $N(B) = 10$ because 0 is a whole number.**
- i) $\{4\} \subseteq \{ 3, 4, 5 \}$ **True**
- j) $5 \in \{ \{3\}, \{4\}, \{5\} \}$ **False. It must be $\{\{5\}\}$.**
- k) $\{3\} \subseteq \{ 3, 4, 5 \}$ **True**
- l) $3 \subseteq \{ 3, 4, 5 \}$ **False. It must be $\{3\}$.**
- m) $\{ \} \subseteq \{ 3, 4, 5 \}$ **True**
- n) $\{ c, a, t, s \} = \{ a, c, t, s \}$ **True**
- o) $3 \in \{ 3, 4, 5 \}$ **True**

3. Which of the following statements are true?

Given: $M = \{ 0, 2, 4, 6, 8 \}$

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|--|---|
| a) $0 \in M$ True | f) $\{ 0, 2 \} \subset M$ True |
| b) $4 \subseteq M$ False. {4} is a subset of M. | g) $0 \subseteq M$ False. {0} is a subset of M. |
| c) $M \subseteq M$ True | h) $\emptyset \subseteq M$ True. \emptyset is a subset of any s |
| d) $\emptyset \in M$ False | i) $6, 8 \subseteq M$ False. $6, 8 \in M$ |
| e) $\{ 0 \} \subseteq M$ True | j) $M \subset M$ False. M is a subset of M. |

4. A set contains 50 elements.

- a) How many subsets does it contain? **2^{50}**
b) How many proper subsets does it contain? **$2^{50} - 1$**

5. List all the subsets of:

- a) $W = \{w \mid w \text{ is a whole number less than } 3\}$
 $\{0, 1, 2\}, \{0, 1\}, \{1, 2\}, \{1, 2\}, \{0\}, \{1\}, \{2\}, \{ \}$
- b) $C = \{c \mid c \text{ is a counting number less than } 3\}$
 $\{1, 2\}, \{1\}, \{2\}, \{ \}$
- c) $O = \{o \mid o \text{ is an odd factor of } 12\}$
 $\{1, 3\}, \{1\}, \{3\}, \{ \}$
- d) $E = \{e \mid e \text{ is an even factor of } 10\}$
 $\{2, 10\}, \{2\}, \{10\}, \{ \}$
- e) $F = \{f \mid f \text{ is a factor of } 8\}$
 **$\{1, 2, 4, 8\}$
 $\{1, 2, 4\}, \{1, 2, 8\}, \{1, 4, 8\}, \{2, 4, 8\}$
 $\{1, 2\}, \{1, 4\}, \{1, 8\}, \{2, 4\}, \{2, 8\}, \{4, 8\}$
 $\{1\}, \{2\}, \{4\}, \{8\}, \{ \}$**

6. Rewrite the following statements using mathematical symbols.
- a) A is not equal to the set whose elements are 1, 2, 3, and 4.
 $A \neq B = \{1, 2, 3, 4\}$
 - b) S is not an element of set R.
 $S \notin R$
 - c) The set consisting of the elements q, r, and s is a proper subset of the set consisting of elements p, q, r, s, and t.
 $\{q, r, s\} \subset \{p, q, r, s, t\}$
 - d) 0 is not an element of the empty set.
 $0 \notin \{ \}$
 - e) The set whose only element is 0 is not equal to the empty set.
 $\{0\} \neq \{ \}$