

Sets – Exercises

Exercises for Chapter 1 of Steinhart, E. (2009) *More Precisely: The Math You Need to Do Philosophy*. Broadview Press. Copyright (C) 2009 Eric Steinhart. Non-commercial educational use encouraged! All others uses prohibited.

1. Collections

Write out the following:

The set of A:

The set of the set of A:

The set of A and B:

The set of both A and the set of A:

The set of A, B, and C:

If x is {A, B} and y is {C, D} then write out:

$\{x\} =$

$\{x, y\} =$

$\{\{x\}\} =$

$\{\{x\}, y\} =$

Answer the following (true or false):

$1 = \{1\}?$

$\{1\} = \{\{1\}\}?$

$\{1, 1\} = \{1, \{1\}\}?$

$\{1, B, 2\} = \{2, 1, B\}?$

2. Membership

True or false:

Is $A \in \{A\}?$

Is $\{A\} \in \{\{A\}\}?$

Is $A \in \{\{A\}\}?$

Is $\{B\} \in \{\{A\}, \{B\}\}?$

Is $\{A, B\} \in \{A, B\}?$

Is $\{\} \in \{A\}?$

3. Set Builders

Using the set $Y = \{1, A, 2, B, 3, C\}$, write out the following sets:

$\{x \in Y \mid x \text{ is a letter}\} =$

$\{x \in Y \mid x \text{ is a number}\} =$

If $X = \{A, B, C, 1, 2, 3\}$, $Y = \{A, B, C\}$, and $Z = \{1, 2, 3\}$, then write:

$\{x \in X \mid x \text{ is also in } Y\} =$

$\{x \in X \mid x \in Z\} =$

4. Unions

Write out:

$$\{a, b\} \cup \{1\} =$$

$$\{a, b\} \cup \{c, d\} =$$

$$\{a\} \cup \{b\} \cup \{c\} =$$

$$\{\{A\}\} \cup \{\{B\}\} =$$

5. Subsets

$\{A, B\}$ is a subset of $\{A, B, C\}$?

$\{A\}$ is a subset of $\{A, B\}$?

A is a subset of $\{A\}$?

$\{A\}$ is a subset of $\{\{A\}\}$?

$\{A\}$ is a subset of $\{A, \{A\}\}$?

$\{A, B\}$ is a subset of $\{A, B\}$?

Write the subsets of $\{1, 2\}$:

6. Power Sets

The power set of $\{1, A\}$ is:

The power set of $\{Q\}$ is:

The power set of $\{\{\}\}$ is:

7. Diagramming Sets

Use dots for sets and an arrow from x to y iff x is a member of y .

Draw the diagram for $\{A, B\}$.

Draw the diagram for $\{A, \{A\}\}$

Draw the diagram for $\{\{A\}, \{B\}\}$.

Draw the diagram for $\{\{\}, \{\{\}\}\}$.

8. Numbers as Sets

Using the idea that n is the set of all numbers less than n , write out:

0

1

2

3

4

9. Diagramming Numbers as Sets

Draw a diagram for each of the numbers in exercise 8 above:

0

1

2

3

4

10. Iteration versus Accumulation

An *iterative hierarchy* says that every next level is just the power set of the previous level.

Consider this iterative hierarchy:

$$H(0) = \{A\};$$

$$H(n+1) = \text{pow } H(n).$$

Write out levels $H(0)$, $H(1)$, and $H(2)$ of this iterative hierarchy:

$H(0) =$

$H(1) =$

$H(2) =$

A *cumulative hierarchy* says that every next level is the power set of the previous level unioned with the previous level.

Consider this cumulative hierarchy:

$$K(0) = \{A\}; \quad K(n+1) = \text{pow } K(n) \cup K(n).$$

Write out levels $K(0)$, $K(1)$, and $K(2)$ of this cumulative hierarchy:

$K(0) =$

$K(1) =$

$K(2) =$

Give an example of an object that appears on $K(1)$ that does not appear on $H(1)$:

Give an example of an object that appears on $K(2)$ that does not appear on $H(2)$:

Explain why $K(n)$ is richer than $H(n)$ for $n > 0$:

11. Ordered Pairs

Diagram (Sue, Bob)

Diagram (Bob, Bob)

Diagram (Sue, {Sue})

Diagram ({}, {{}})

12. Cartesian Products

Write the Cartesian Product $\{A, B\} \times \{1, 2\}$.

Write the Cartesian Product $\{Abe, Bob, Sue\} \times \{Happy, Sad\}$.