SET THEORY

A DEFINITIONS

A.1 LISTING THE ELEMENTS

MCQ 1: List the elements of the set A, which includes all objects shown in this figure:

Choose one answer:

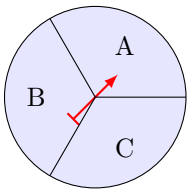
- ☐ $A =$ die, coin, duck
- ☐ $A = \{\text{duck, coin}\}$
- ☐ $A = \{\text{die, duck, coin}\}$

MCQ 2: List the elements of the set A, which includes all objects in this figure:

Choose one answer:

- ☐ $A =$ apple, cherry, lemon, orange
- ☐ $A = \{\text{apple, cherry}\}$
- ☐ $A = \{\text{apple, cherry, lemon, orange}\}$
- ☐ $A = \{\text{apple, cherry, lemon, orange, apple}\}$

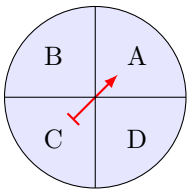
MCQ 3: List the elements of the set A, which includes all possible results the spinner can land on:



Choose one answer:

- ☐ $A = \{A, B, C\}$
- ☐ $A = \{A, B\}$
- ☐ $A = \{A, C\}$

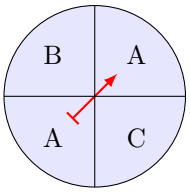
MCQ 4: List the elements of the set A, which includes all possible results the spinner can land on:



Choose two correct answers:

- ☐ $A = \{A, B, C, D\}$
- ☐ $A = \{A, B, C\}$
- ☐ $A = \{A, B\}$
- ☐ $A = \{D, B, C, A\}$

MCQ 5: List the elements of the set A, which includes all possible results the spinner can land on:



Choose one answer:

- ☐ $A = \{A, B, A, C\}$
- ☐ $A = \{A, B\}$
- ☐ $A = \{A, C\}$
- ☐ $A = \{A, B, C\}$

MCQ 6: Let A be the set of all possible combinations of two children in a family, where B means boy and G means girl (e.g., BG is a boy then a girl). List the elements of A.

Choose one answer:

- ☐ $A = \{BB, BG, GB, GG\}$
- ☐ $A = \{BB, GG\}$
- ☐ $A = \{B, G\}$

A.2 LISTING THE ELEMENTS IN ARITHMETIC

MCQ 7: What is the set A of all factors of 6?

Choose one answer:

- ☐ $A = \{1, 2, 3, 6\}$
- ☐ $A = \{0, 6, 12, 18, 24, \ldots\}$
- ☐ $A = \{0, 6, 12, 18, 24\}$
- ☐ $A = \{2, 3\}$

MCQ 8: What is the set A of all prime numbers between 1 and 10?

Choose one answer:

- ☐ $A = \{1, 2, 3, 5, 7\}$
- ☐ $A = \{2, 4, 6, 8, 10\}$
- ☐ $A = \{3, 5, 7, 9\}$
- ☐ $A = \{2, 3, 5, 7\}$

MCQ 9: What is the set A of all factors of 8?

Choose one answer:

- ☐ $A = \{1, 2, 4, 8\}$
- ☐ $A = \{0, 8, 16, 24, 32, \ldots\}$
- ☐ $A = \{2, 4, 6\}$

☐ $A = \{1, 3, 5, 7\}$

MCQ 10: What is the set A of all prime numbers between 10 and 20?

Choose one answer:

☐ $A = \{11, 13, 15, 17\}$

☐ $A = \{10, 12, 14, 16, 18\}$

☐ $A = \{13, 15, 17, 19\}$

☐ $A = \{11, 13, 17, 19\}$

A.3 CHECKING MEMBERSHIP

Ex 11: 2 ☐ $\in$ ☐ $\notin$ $\{1, 2, 3, 4, 5, 6\}$

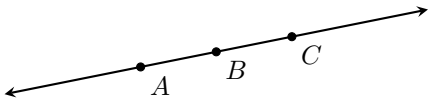
Ex 12: 7 ☐ $\in$ ☐ $\notin$ $\{1, 2, 3, 4, 5, 6\}$

Ex 13: d ☐ $\in$ ☐ $\notin$ $\{a, b, c, d\}$

Ex 14: z ☐ $\in$ ☐ $\notin$ $\{a, b, c, d\}$

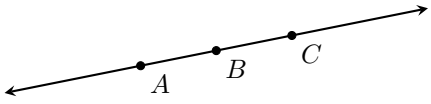
A.4 CHECKING MEMBERSHIP IN GEOMETRY

Ex 15:



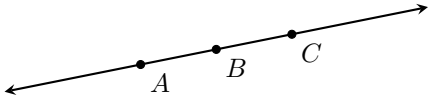
C ☐ $\in$ ☐ $\notin$ $\overleftrightarrow{AB}$

Ex 16:



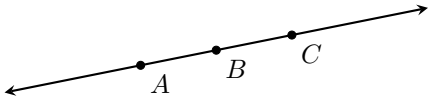
C ☐ $\in$ ☐ $\notin$ $\overline{BA}$

Ex 17:



B ☐ $\in$ ☐ $\notin$ $\overline{AC}$

Ex 18:



A ☐ $\in$ ☐ $\notin$ $\overleftrightarrow{BC}$

A.5 CHECKING SET EQUALITY

MCQ 19: Is this statement true or false?
$\{a, b, c\} = \{b, a, c\}$

Choose one answer:

☐ True

☐ False

MCQ 20: Is this statement true or false?
$\{a, b, c, d\} = \{a, b, c, d, e\}$

Choose one answer:

☐ True

☐ False

MCQ 21: Is this statement true or false?
$\{1, 2, 3\} = \{2, 1, 3\}$

Choose one answer:

☐ True

☐ False

MCQ 22: Is this statement true or false?
$\{1, 2, 3, 4\} = \{1, 2, 3, 4, 5\}$

Choose one answer:

☐ True

☐ False

B ORDERED PAIR

B.1 COMPARING PAIRS AND SETS

MCQ 23: A teacher picks one student to present on Monday and another to present on Tuesday from Louis and Hugo. The pair $(Louis, Hugo)$ means Louis presents on Monday and Hugo on Tuesday. Is this the same as $(Hugo, Louis)$?

Choose one answer:

☐ True

☐ False

MCQ 24: A teacher selects Louis and Hugo for a presentation. The set $\{Louis, Hugo\}$ shows both are chosen. Does $\{Louis, Hugo\}$ equal $\{Hugo, Louis\}$?

Choose one answer:

☐ True

☐ False

MCQ 25: A club picks two helpers, Zoe and Eli, for an event. The set $\{Zoe, Eli\}$ shows both are chosen. Does $\{Zoe, Eli\}$ equal $\{Eli, Zoe\}$?

Choose one answer:

☐ True

☐ False

MCQ 26: A coach assigns two players, Mia and Sam, to shoot baskets: one goes first, the other second. The pair (Mia, Sam) means Mia shoots first and Sam second. Is this the same as (Sam, Mia)?

Choose one answer:

☐ True

☐ False

B.2 CHOOSING BETWEEN ORDERED PAIRS AND SETS

MCQ 27: A teacher picks one student to present on Monday and another to present on Tuesday. This week, Louis presents on Monday and Hugo presents on Tuesday. The teacher wants to write this selection on the board.

Choose the correct way to write this:

☐ $(Louis, Hugo)$

☐ $\{Louis, Hugo\}$

MCQ 28: A teacher picks two students to do a presentation together. This week, Louis and Hugo are chosen. The teacher wants to write this selection on the board.

Choose the correct way to write this:

☐ $(Louis, Hugo)$

☐ $\{Louis, Hugo\}$

MCQ 29: A coach chooses one player to start the basketball game and another to substitute in the second half. Mia starts the game and Zoe comes in later. The coach wants to write this decision on the board.

Choose the correct way to write this:

☐ (Mia, Zoe)

☐ $\{Mia, Zoe\}$

MCQ 30: A school committee selects two parents to organize the end-of-year party. This year, Mr. Dupont and Ms. Lee are chosen. The committee writes their names on the announcement.

Choose the correct way to write this:

☐ $(Mr.\ Dupont, Ms.\ Lee)$

☐ $\{Mr.\ Dupont, Ms.\ Lee\}$

C SUBSETS

C.1 CHECKING SUBSETS

MCQ 31: Given $A = \{1, 3, 5\}$ and $B = \{1, 2, 3, 4, 5\}$, is $A \subseteq B$?

☐ Yes

☐ No

MCQ 32: Given $A = \{4, 9\}$ and $B = \{1, 2, 3, 4, 5, 6, 7\}$, is $A \subseteq B$?

☐ Yes

☐ No

MCQ 33: Given $A = \{7, 8\}$ and $B = \{6, 7, 8, 9, 10\}$, is $A \subseteq B$?

☐ Yes

☐ No

MCQ 34: Given $A = \{2, 7, 10\}$ and $B = \{1, 2, 3, 4, 5, 6\}$, is $A \subseteq B$?

☐ Yes

☐ No

D INTERSECTION AND UNION

D.1 FINDING THE INTERSECTION/UNION

Ex 35:

$$\{1,2,3\} \cap \{2,3,4\} =$$

☐ $\{1, 2, 3, 4\}$
☐ $\{2, 3\}$
☐ $\{2\}$
☐ $\{1, 2, 3\}$

Ex 36:

$$\{1,2\} \cup \{2,3,4\} =$$

☐ $\{2, 3, 4\}$
☐ $\{1, 2, 3, 4\}$
☐ $\{1, 4\}$
☐ $\{1, 2\}$

Ex 37:

$$\{5,6,7\} \cap \{6,8,9\} =$$

☐ $\{5, 6, 7, 8, 9\}$
☐ $\{5, 6\}$
☐ $\{7, 8\}$
☐ $\{6\}$

Ex 38:

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

☐ $\{a, b\}$
☐ $\{b, c\}$
☐ $\{a, c, d\}$
☐ $\{a, b, c, d\}$

Ex 39:

$$\{1,2,3\} \cap \{4,5,6\} =$$

☐ $\{1, 2, 3, 4, 5, 6\}$
☐ $\{\}$
☐ $\{3, 4\}$
☐ $\{1, 4\}$

Ex 40:

$$\{3,4,5\} \cap \{5,4,3\} =$$

☐ $\{3, 4, 5, 6, 7\}$
☐ $\{5\}$
☐ $\{4, 5\}$
☐ $\{3, 4, 5\}$

Ex 41:

$$\{5,6,7\} \cup \{\} = \begin{array}{l} \square\ \{5,6,7\} \\ \square\ \{\} \\ \square\ \{5,7\} \\ \square\ \{5,6\} \end{array}$$

Ex 42:

$$\{a,b,c\} \cap \{\} = \begin{array}{l} \square\ \{a\} \\ \square\ \{b,c\} \\ \square\ \{a,b,c\} \\ \square\ \{\} \end{array}$$

E CARDINALITY

E.1 COUNTING

Ex 43: $n(\{1,2,3\}) =$ ☐

Ex 44: $n(\{a,b,c,d,e\}) =$ ☐

Ex 45: $n(\{\text{apple, cherry, lemon, orange}\}) =$ ☐

Ex 46: Let $A = \{\text{die, duck, coin}\}$. Find the number of elements in A.

$$n(A) = \square$$

Ex 47: Let $A = \{1,2,3,4,5\}$. Find the number of elements in A.

$$n(A) = \square$$

E.2 COUNTING WAYS

Ex 48: Three friends run a sprint race. How many different podiums (1st, 2nd, 3rd) are possible?

☐ podiums

Ex 49: You pick 2 flavors from 3 ice cream options (chocolate, vanilla, and strawberry). Order doesn't matter. How many different ice creams can you make?

☐ ice creams

Ex 50: Three students enter an art contest. How many different ways can the judges award 1st, 2nd, and 3rd place prizes?

☐ ways

Ex 51: You choose 2 toppings from 3 pizza options (pepperoni, cheese, olives). Order doesn't matter. How many different pizzas can you make?

☐ pizzas

F COMPLEMENT

F.1 FINDING THE COMPLEMENT

MCQ 52: You are given the universe $U = \{1,2,3,4,5,6\}$ and the set $A = \{1,3,5\}$. What is the complement A'?

Choose one answer:

- ☐ $A' = \{2,4,6\}$
- ☐ $A' = \{1,2,4,6\}$
- ☐ $A' = \{1,2,3,4,5,6\}$
- ☐ $A' = \{3,5\}$

MCQ 53: You are given the universe $U = \{a,b,c,d,e,f\}$ and the set $B = \{a,c,e\}$. What is the complement B'?.

Choose one answer:

- ☐ $B' = \{a,b,d,f\}$
- ☐ $B' = \{a,b,c,d,e,f\}$
- ☐ $B' = \{c,e\}$
- ☐ $B' = \{b,d,f\}$

MCQ 54: You are given the universe $U = \{1,2,3,4,5,6,7,8\}$ and the set $C = \{2,4,6,8\}$. What is the complement C'?. Find the complement of C.

Choose one answer:

- ☐ $C' = \{1,2,3,5,7\}$
- ☐ $C' = \{1,3,5,7\}$
- ☐ $C' = \{2,4,6,8\}$
- ☐ $C' = \{1,2,3,4,5,6,7,8\}$

MCQ 55: The universe $U = \{BB, BG, GB, GG\}$ lists all two-child family combinations (B = boy, G = girl; e.g., BG = boy then girl). The set $A = \{BB\}$ includes only families with two boys. What is A'?

Choose one answer:

- ☐ $A' = \{BG, GB, GG\}$
- ☐ $A' = \{BB, BG\}$
- ☐ $A' = \{BG, GB\}$
- ☐ $A' = \{BB, GG\}$

MCQ 56: The universe $U = \{BB, BG, GB, GG\}$ lists all two-child family combinations (B = boy, G = girl; e.g., BG = boy then girl). The set $A = \{BG, GB\}$ includes families with one boy and one girl. What is A'?

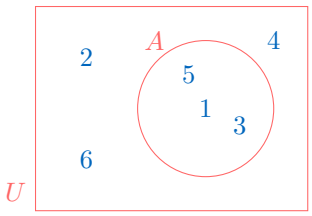
Choose one answer:

- ☐ $A' = \{BG, GB, GG\}$
- ☐ $A' = \{BB, BG\}$
- ☐ $A' = \{BG, GB\}$
- ☐ $A' = \{BB, GG\}$

G VENN DIAGRAMS

G.1 IDENTIFYING ELEMENTS USING VENN DIAGRAMS

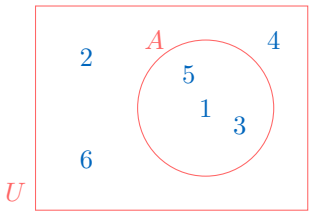
MCQ 57: For this Venn diagram:



Find A.

- ☐ $A = \{2, 4, 6\}$
- ☐ $A = \{1, 3, 5\}$
- ☐ $A = \{1, 2, 3, 4, 5, 6\}$

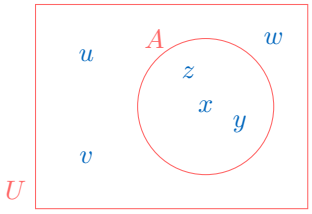
MCQ 58: For this Venn diagram:



Find A'.

- ☐ $A' = \{2, 4, 6\}$
- ☐ $A' = \{1, 3, 5\}$
- ☐ $A' = \{1, 2, 3, 4, 5, 6\}$

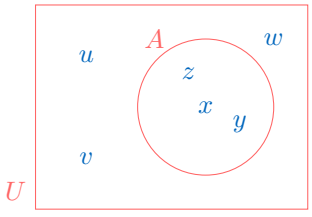
MCQ 59: For this Venn diagram:



Find A'.

- ☐ $A' = \{u, v, w\}$
- ☐ $A' = \{x, y, z\}$
- ☐ $A' = \{u, v, w, x, y, z\}$

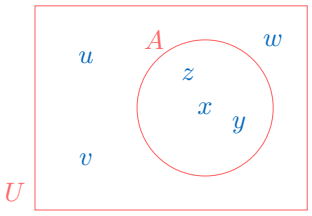
MCQ 60: For this Venn diagram:



Find the universe U.

- ☐ $U = \{u, v, w\}$
- ☐ $U = \{x, y, z\}$
- ☐ $U = \{u, v, w, x, y, z\}$

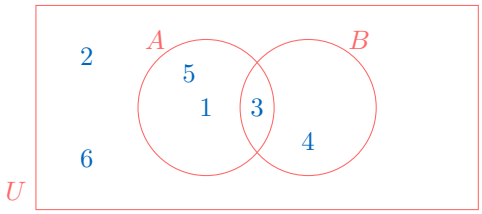
MCQ 61: For this Venn diagram:



Find A.

- ☐ $A = \{u, v, w\}$
- ☐ $A = \{x, y, z\}$
- ☐ $A = \{u, v, w, x, y, z\}$

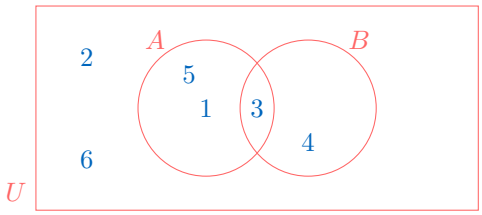
MCQ 62: For this Venn diagram:



Find A.

- ☐ $A = \{2, 4, 6\}$
- ☐ $A = \{1, 3, 5\}$
- ☐ $A = \{1, 2, 3, 4, 5, 6\}$

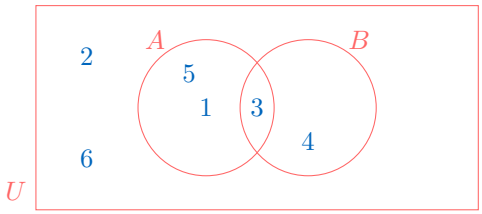
MCQ 63: For this Venn diagram:



Find A'.

- ☐ $A' = \{2, 4, 6\}$
- ☐ $A' = \{1, 3, 5\}$
- ☐ $A' = \{1, 2, 3, 4, 5, 6\}$

MCQ 64: For this Venn diagram:



Find B.

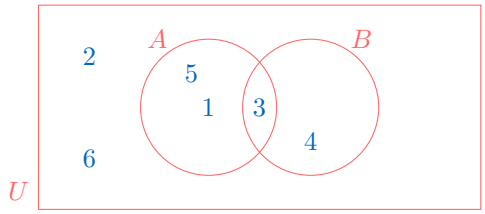
- ☐ $B = \{4\}$

☐ $B = \{3, 4\}$

☐ $B = \{1, 3, 4, 5\}$

☐ $B = \{2, 6\}$

MCQ 65: For this Venn diagram:



Find B'.

☐ $B' = \{4\}$

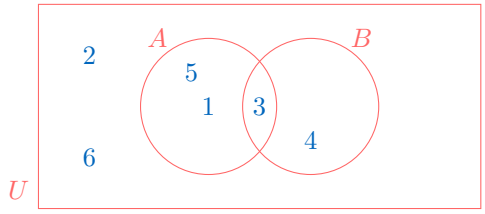
☐ $B' = \{3, 4\}$

☐ $B' = \{1, 2, 5, 6\}$

☐ $B' = \{2, 6\}$

G.2 IDENTIFYING ELEMENTS USING VENN DIAGRAMS

MCQ 66: For this Venn diagram:



Find $A \cup B$.

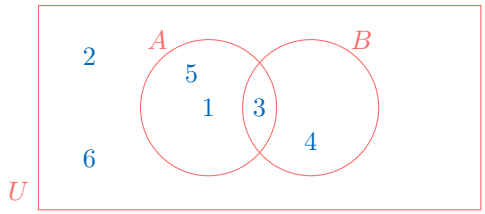
☐ $A \cup B = \{1, 3, 4, 5\}$

☐ $A \cup B = \{1, 2, 3, 4, 5, 6\}$

☐ $A \cup B = \{2, 4, 6\}$

☐ $A \cup B = \{1, 3, 4\}$

MCQ 67: For this Venn diagram:



Find $A \cap B$.

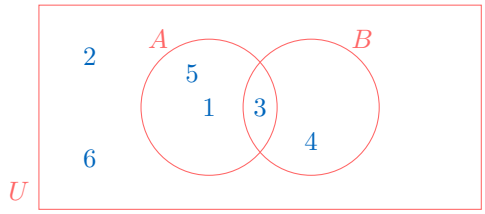
☐ $A \cap B = \{1, 3, 5\}$

☐ $A \cap B = \{3\}$

☐ $A \cap B = \{3, 4\}$

☐ $A \cap B = \{2, 6\}$

MCQ 68: For this Venn diagram:



Find $A' \cap B$.

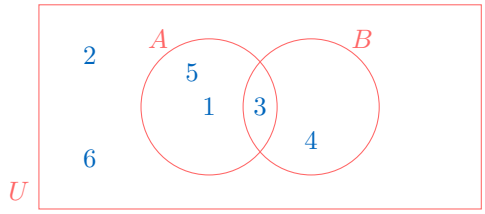
☐ $A' \cap B = \{2, 6\}$

☐ $A' \cap B = \{4\}$

☐ $A' \cap B = \{4, 3\}$

☐ $A' \cap B = \{1, 3, 4, 5\}$

MCQ 69: For this Venn diagram:



Find $A \cup B'$.

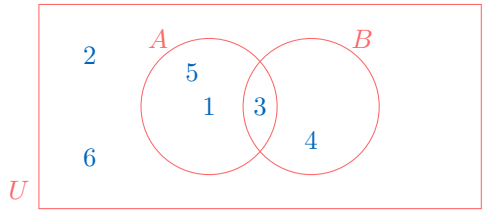
☐ $A \cup B' = \{1, 2, 5, 6\}$

☐ $A \cup B' = \{2, 4, 6\}$

☐ $A \cup B' = \{1, 2, 3, 5, 6\}$

☐ $A \cup B' = \{1, 3, 4, 5\}$

MCQ 70: For this Venn diagram:



Find $A \cap B'$.

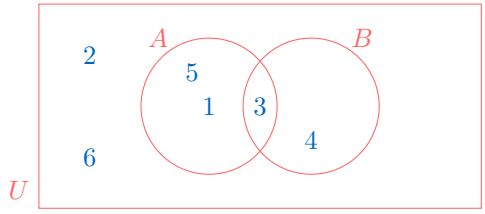
☐ $A \cap B' = \{1, 5\}$

☐ $A \cap B' = \{2, 6\}$

☐ $A \cap B' = \{3, 4\}$

☐ $A \cap B' = \{1, 3, 4, 5\}$

MCQ 71: For this Venn diagram:



Find $A' \cup B$.

☐ $A' \cup B = \{1, 2, 3, 4, 5, 6\}$

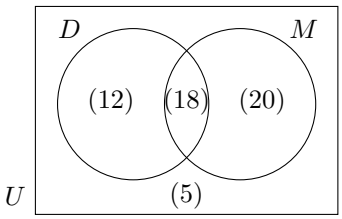
☐ $A' \cup B = \{1, 3, 4, 5\}$

☐ $A' \cup B = \{2, 4, 6\}$

☐ $A' \cup B = \{2, 3, 4, 6\}$

G.3 SOLVING WORD PROBLEMS WITH VENN DIAGRAMS

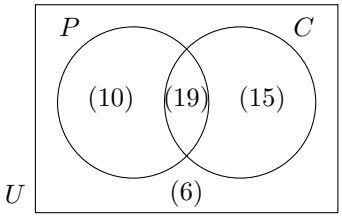
Ex 72: The Venn diagram shows the number of students in a school who participate in the drama club (D) and the music club (M).



How many students:

- are in the school? ☐ students
- participate in the music club? ☐ students
- participate in both clubs? ☐ students
- do not participate in either club? ☐ students
- participate in at least one club? ☐ students

Ex 73: The Venn diagram shows the number of participants in a community center attending painting (P) and cooking (C) classes.



How many participants:

- attend the community center? ☐ participants
- attend cooking classes? ☐ participants
- attend both classes? ☐ participants
- attend neither class? ☐ participants
- attend at least one class? ☐ participants

Ex 74: In a class of 40 students, 22 like mathematics (M), 18 like physics (P), and 10 like both. How many students:

- like at least one subject? ☐
- like mathematics but not physics? ☐
- like exactly one subject? ☐
- like neither subject? ☐

Ex 75: In a group of 40 employees, 25 work in sales (S), 20 in marketing (M), and 12 in both. How many employees:

- work in at least one department? ☐
- work in sales but not marketing? ☐
- work in exactly one department? ☐
- work in neither department? ☐