



University of
Southampton

BAYESIAN CREATURES

L1: SETS

LESSON OUTCOMES

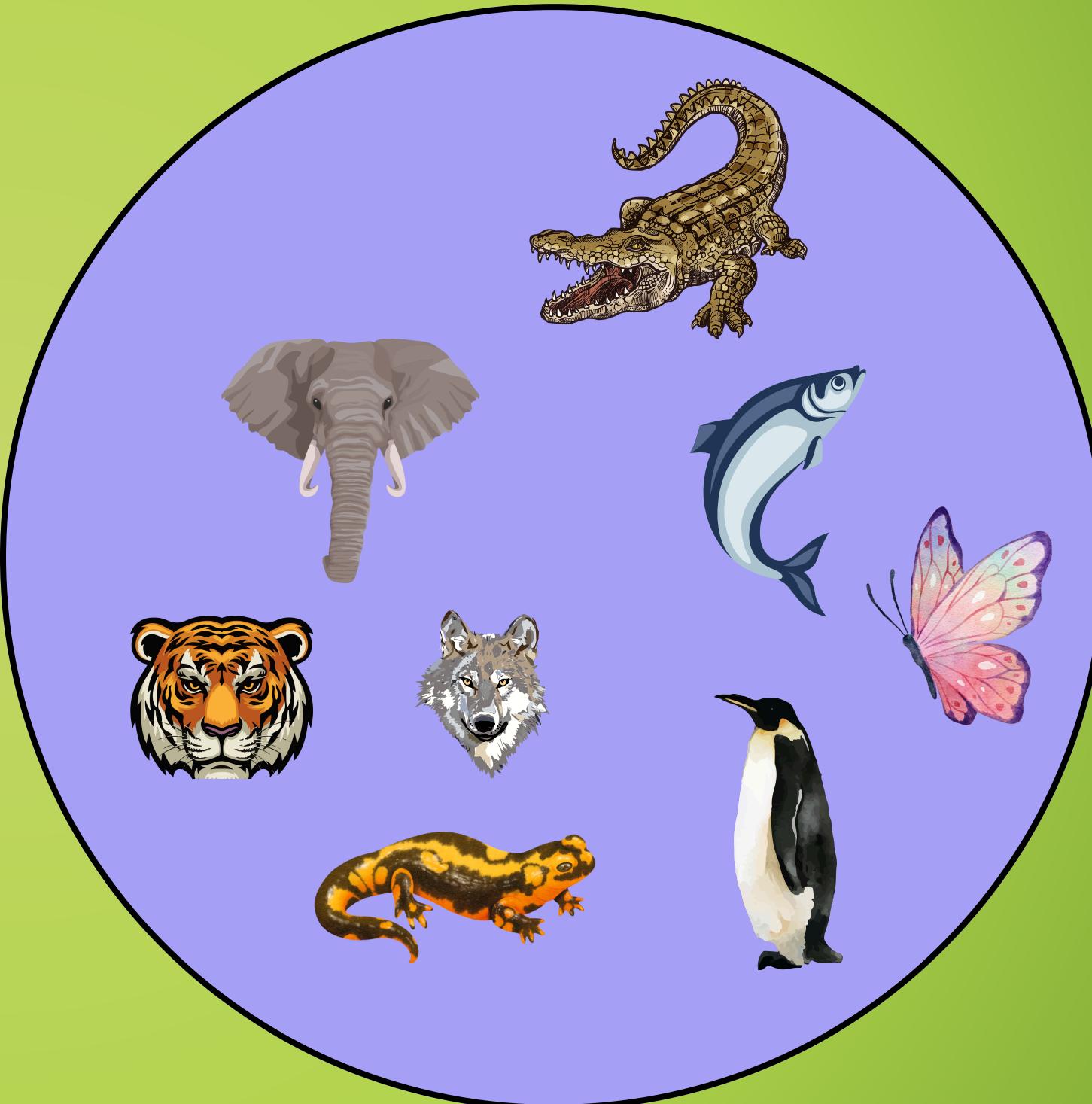
- LO 1: Give definitions for what is meant by a **set**, **subset**, and **cardinality**.
- LO 2: Explain four fundamental rules for sets.
- LO 3: Calculate set ratios.

DEFINITION

A **set** is a collection of things.

A set of animals

A =

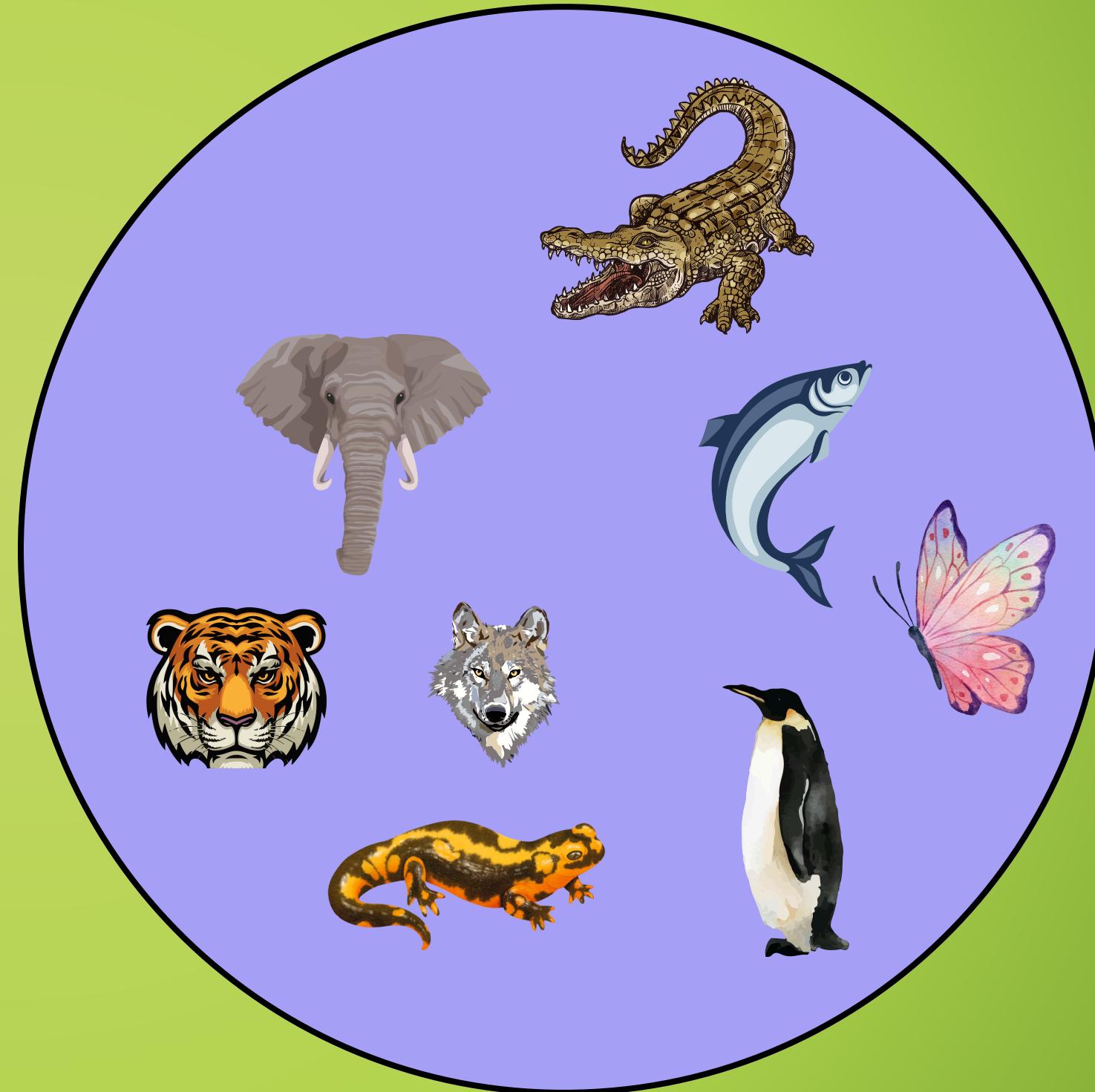


DEFINITION

A **subset** is a set made from elements of larger set called the **superset**.

A set of mammals

M =



NOTATION

$A = \{\text{elephant, tiger, wolf, alligator, salamander, fish, butterfly, penguin}\}$

$M = \{\text{elephant, tiger, wolf}\}$

$M \subset A$ (M is a **subset** of A)

$A \supset M$ (A is the **superset** of M)

RULES

1) Sets don't repeat elements.

$$S = \{1, 2\}, \text{not } S = \{1, 1, 2, 2, 2\}$$



2) Order doesn't matter

$$\{1, 2, 3\} = \{1, 3, 2\} = \{2, 1, 3\} = \text{etc.}$$

3) Sets can be members of sets

$$\{a, b, \{c, d\}, e, f\}$$

4) A set containing something is not the same as the thing.

$$\{a\} \neq a$$

QUESTION 1

S = {a, b, c, c, d, e}

What's wrong with this set?

ANSWER 1

$$S = \{a, b, c, e, d, e\}$$

The element 'c' is repeated.

QUESTION 2

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

Is this true?

ANSWER 2

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

Yes. Order doesn't matter.

Sets are defined by their members.

QUESTION 3

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

Is this true?

ANSWER 3

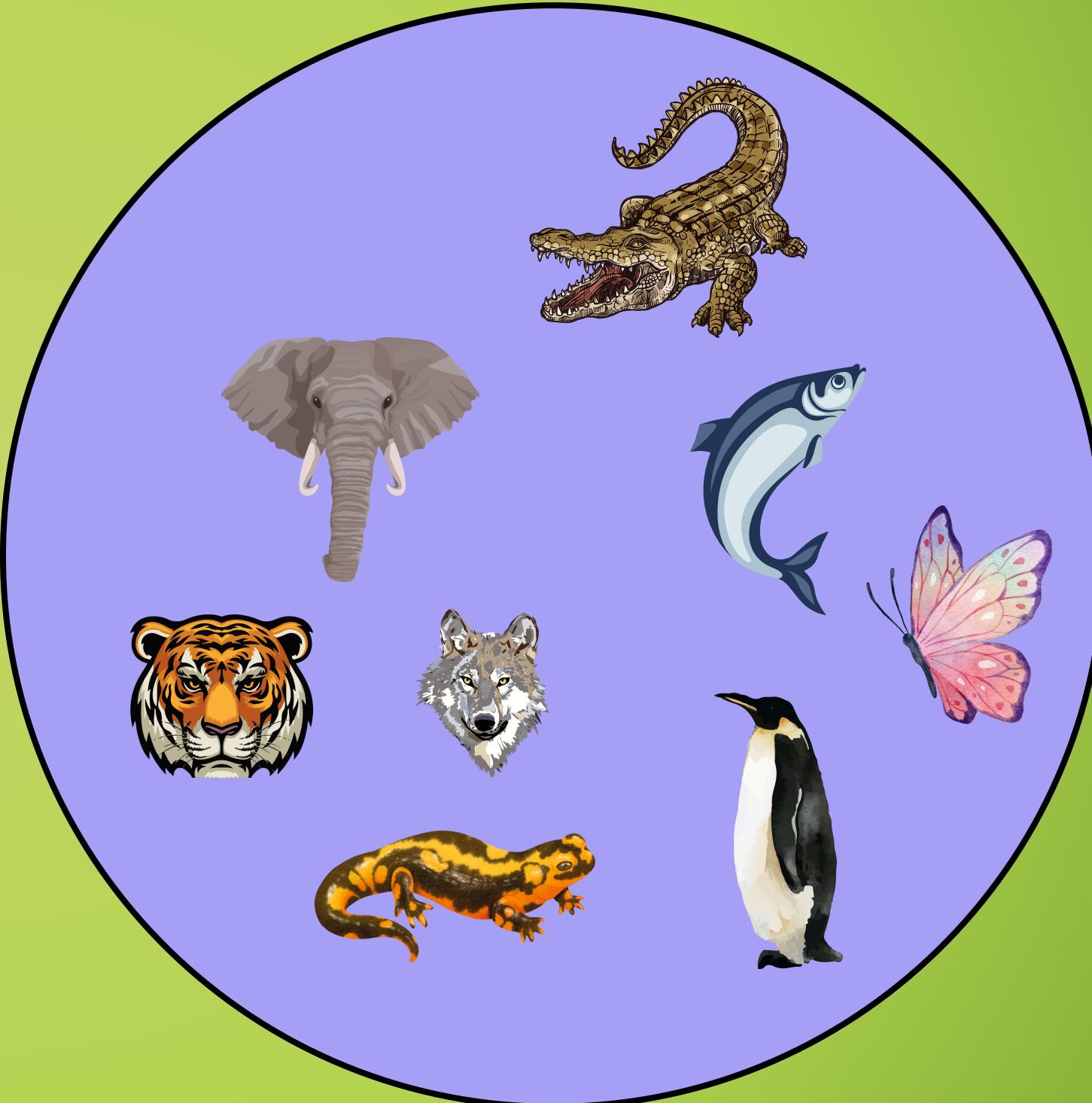
$$\{a, b, \{c\}, d\} = \{b, c, a, d\}$$

No. $\{c\}$ is not the same as c .

DEFINITION

The **cardinality** of a set is the number of members it has.

A =

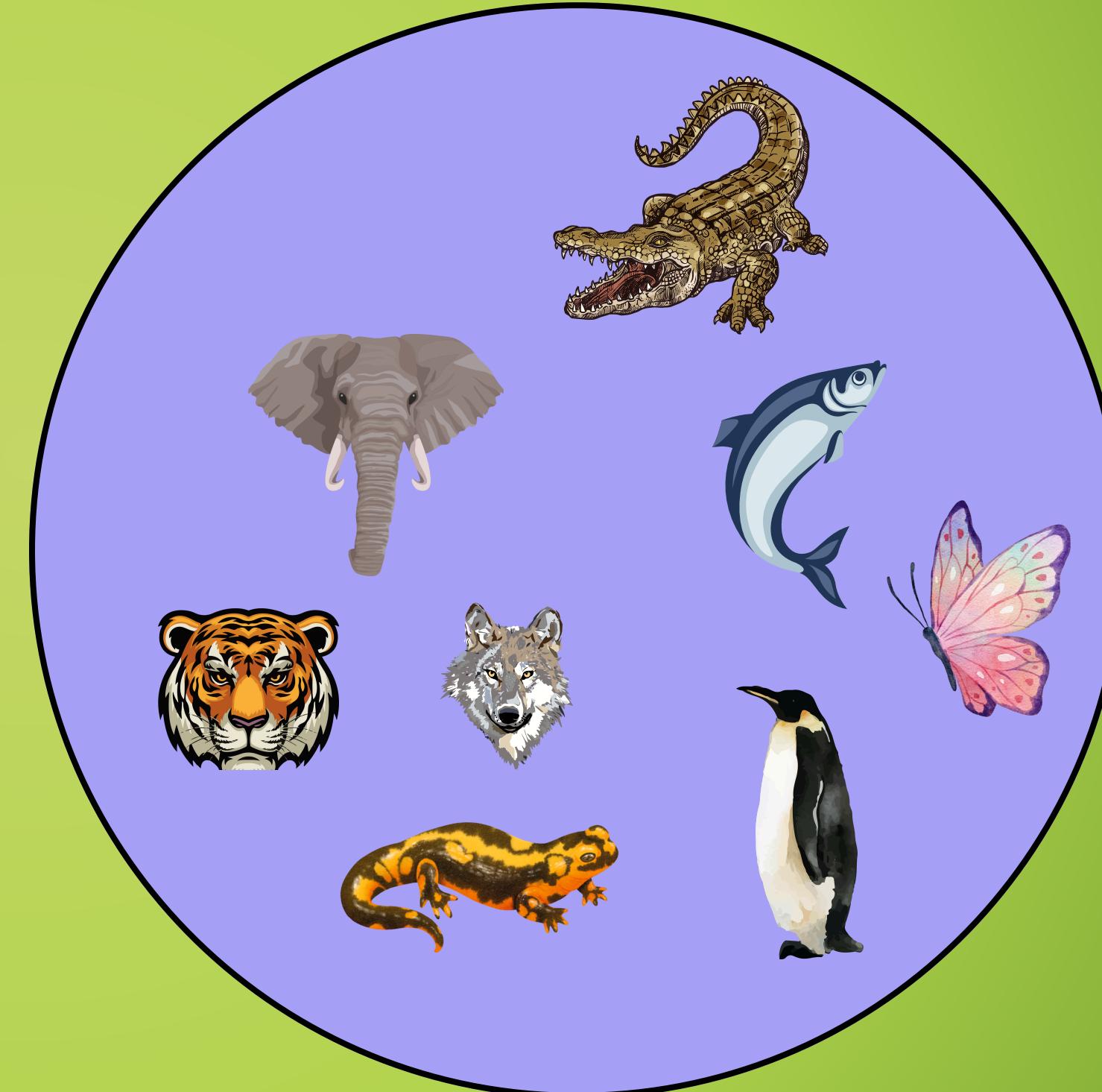


DEFINITION

The **cardinality** of a set is the number of members it has.

- 1) Elephant
- 2) Tiger
- 3) Wolf
- 4) Salamander
- 5) Alligator
- 6) Fish
- 7) Butterfly
- 8) Penguin

$$|A| = 8$$



NOTATION

$A = \{\text{elephant, tiger, wolf, alligator, salamander, fish, butterfly, penguin}\}$

$|A| = 8$ (the cardinality of set A is 8)

QUESTION 4

$S = \{a, b, c, d, e\}$

What is $|S|$?

ANSWER 4

$S = \{a, b, c, d, e\}$

$$|S| = 5$$

1.a, 2.b, 3.c, 4.d, 5.e

QUESTION 5

$S = \{a, b, \{c, d\}, e\}$

What is $|S|$?

ANSWER 5

$$S = \{a, b, \{c, d\}, e\}$$

$$|S| = 4$$

- 1.a, 2.b, 3.{c, d}, 4.e

The set {c, d} is one member of S.

IDEA

Using subsets and cardinality we can calculate percentages that tell us information about our sets.

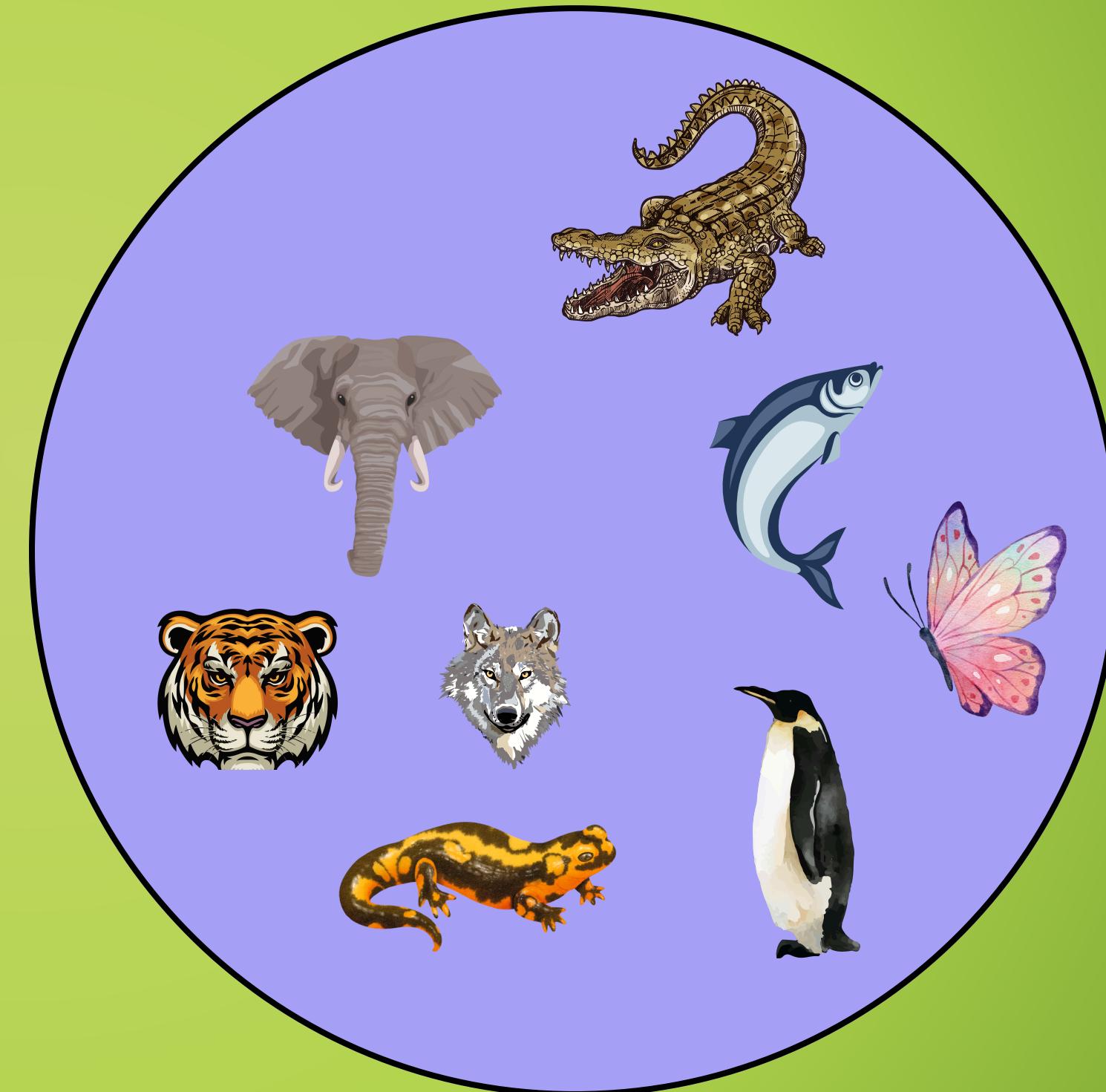
DEFINITION

Let **F** be a subset of **A** such that members of **F** have four legs

F



A



IDEA

A = {elephant, tiger, wolf, alligator, salamander, fish, butterfly, penguin}

F = {elephant, tiger, wolf, alligator, salamander}

Ratio of four legged animals in A = $\frac{|F|}{|A|} = \frac{5}{8}$

QUESTION 6

$A = \{\text{elephant, tiger, wolf, alligator, salamander, fish, butterfly, penguin}\}$

Write the set W such that W contains all members of A that have wings

ANSWER 6

A = {elephant, tiger, wolf, alligator, salamander, fish, butterfly, penguin}

W = {butterfly, penguin}

QUESTION 7

$A = \{\text{elephant, tiger, wolf, alligator, salamander, fish, butterfly, penguin}\}$

$W = \{\text{butterfly, penguin}\}$

What is the ratio of W to A ?

ANSWER 7

$A = \{\text{elephant, tiger, wolf, alligator, salamander, fish, butterfly, penguin}\}$

$W = \{\text{butterfly, penguin}\}$

$$\frac{|W|}{|A|} = 0.25$$

RECAP

- 1) What is a set?**
- 2) What is a subset?**
- 3) What is the cardinality of a set?**
- 4) What are the set rules covered today?**
- 5) How do we calculate the ratio of sets?**

RECAP

1) What is a set?

A set is a collection of things.

2) What is a subset?

A subset is a smaller set made of members of a larger superset.

3) What is the cardinality of a set?

The cardinality of a set is the number of members a set has.

4) What are the set rules covered today?

- i. No repetition.
- ii. Order doesn't matter.
- iii. Sets can be members of sets.
- iv. A set of something is not the same as that thing.

5) How do we calculate the ratio of sets?

The cardinality of the first set divided by the cardinality of the second.