

Venn Diagrams

Notes & Steps



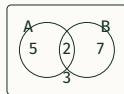
Key idea

A Venn diagram sorts items into regions. Each region tells you whether an item belongs to one set, both sets, or neither set.

Two-set reading steps

1. Read each separate region, not just each whole circle.
2. To find a whole set total, add every region inside that circle.
3. To find “at least one”, add all regions inside the circles.
4. The outside region means “neither”.

Example diagram



- ▶ A has $5 + 2 = 7$
- ▶ B has $2 + 7 = 9$
- ▶ $A \cup B$ has $5 + 2 + 7 = 14$
- ▶ Neither set has 3

Common mistake

Adding whole set totals without thinking about the overlap. The overlap belongs to both sets, so it gets double-counted if you are careless.

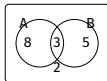
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Example 1: two sets

In a survey, 8 like pizza only, 3 like both pizza and pasta, 5 like pasta only, and 2 like neither.



So:

$$\text{pizza} = 8 + 3 = 11, \quad \text{pasta} = 3 + 5 = 8$$

$$\text{at least one} = 8 + 3 + 5 = 16$$

Example 2: finding a missing region

Suppose set A has 10, set B has 11, A only is 6, and B only is 7. Let the overlap be x .

$$6 + x = 10 \Rightarrow x = 4$$

Check with set B :

$$4 + 7 = 11$$

So the overlap is 4.

Try these

1. If A has 12, B has 9, and both has 4, how many are in $A \cup B$?
2. If 5 are outside both circles, what does that mean?
3. How do you find the number in exactly one set?

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Example 3: three sets

In a three-set Venn diagram, the middle region belongs to all three sets.



Exactly two sets means:

$$2 + 3 + 2 = 7$$

Exactly one set means:

$$4 + 5 + 6 = 15$$

At least one set means add every inside region.

Example 4: probability from a diagram

If the total number of items is 20 and 5 are in the overlap, then:

$$P(\text{both}) = \frac{5}{20} = \frac{1}{4}$$

If 6 are outside every set, then:

$$P(\text{neither}) = \frac{6}{20} = \frac{3}{10}$$

Probability is always:

$$\frac{\text{favourable}}{\text{total}}$$

Common mistake

In a three-set diagram, the centre is not just part of one pair. It belongs to all three sets, so it needs careful counting when you add totals.