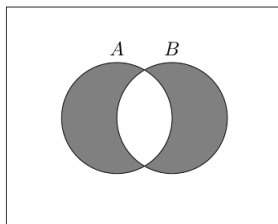


## 1 What is a Venn Diagram?

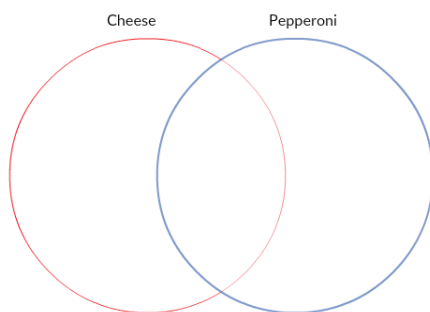
When we are solving a problem with addition and subtraction, it is sometimes helpful to use a picture, or a diagram, to solve that problem:



The picture above is called a **Venn diagram**. In the diagram, we draw Circle A for one group and Circle B for another group. In the circle overlap, we have a group that is in both A and B.

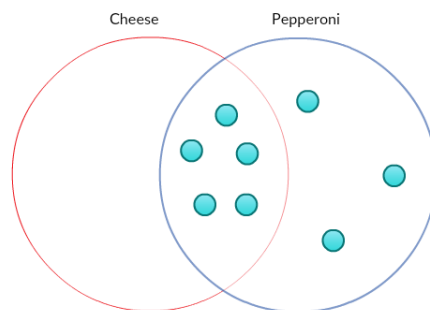
## 2 Draw a diagram and solve

At Mathnerd Elementary School, there are 12 kids in one class. All of the kids are eating at least one slice of pizza. They are offered cheese or pepperoni pizza. 8 of the kids ate pepperoni pizza and 5 of the kids ate both cheese and pepperoni pizza. How many kids ate cheese pizza?

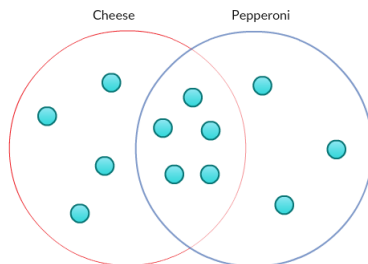


Alright! So let's try using the **Venn diagram**. We'll place points in the circles to represent the kids - one point per kid. Let's go!

We first place five points in the intersection space inside of both circles, because there are five kids that ate both pizzas. Now, since there are 8 kids eating pepperoni pizza, and 5 points are already inside the intersection, there must be three more points inside the pepperoni circle which aren't in the cheese circle!



Since there are 12 kids, there must be 4 left which are inside the cheese circle but not the pepperoni circle. We've placed all of our kids into the diagram. Now we can just read off the answer to our original problems.



There are 9 points inside the cheese circle on the left. So **9** kids ate cheese pizza!

**Quick Question:** Why did we start on the 5 kids with both pizzas rather than with the "12 total kids" or the "8 people eating pepperoni"?

### 3 Do it yourself

1. In the imaginary Pleasanton zoo, there are 30 leopards. These leopards have orange spots or purple spots (or maybe both!). 20 leopards have the color orange, while 13 leopards are both orange and purple. How many leopards only have purple spots?
2. There's a candy store that sells chocolate bars and lollipops. A customer can only buy one per candy. On one lovely afternoon, there were 66 chocolate bars and 59 lollipops sold. 19 customers bought both a chocolate bar and a lollipop. How many customers came in that afternoon?
3. A carnival has 40 clowns. 25 clowns tell jokes and 31 clowns tell riddles. 5 clowns don't tell anything. How many clowns can tell jokes and tell riddles? (*WARNING:* This question may require some algebra!)

### 4 Challenge Problems!!!

1. In another part of the Pleasanton Zoo, the sea lions can learn up to three tricks: roll over, clap, and dance. Of the sea lions:

50 sea lions can roll over, 50 sea lions can clap, 50 sea lions can dance, 9 sea lions can do all three. 17 sea lions can roll over and clap, 12 sea lions can dance and roll over, 18 sea lions can clap and dance, 9 sea lions can do none.

How many sea lions are in the zoo in total? How many sea lions know two or more tricks?

2. How many numbers between 1 and 50 are divisible by 4? Divisible by 5?

How many numbers between 1 and 50 are divisible by 4, but not by 5? How many are divisible by 5, but not by 4? Try showing this with a Venn Diagram.

How many numbers between 1 and 50 are neither divisible by 4 nor by 5?

3. Every student in Mathnerd Elementary takes biology or chemistry, or both. Let  $x$  be the number of students in biology,  $y$  be the number of students in chemistry, and  $z$  be the number of students in both classes. How many students are in the school in terms of  $x, y, z$ ?
4. There are 158 seniors at AVHS. 92 are taking Calc BC, 71 are taking Multi, and 40 are taking Problem Solving. The math students include 14 who are taking only both Calc BC and Multi, 18 are taking only Calc BC and Problem Solving, 11 are taking only Multi and Problem Solving. Lastly, there are 8 brave souls taking all three math classes. How many seniors (the non-cool seniors) at AVHS are not taking any math class?