

So let's start by reviewing the idea of average, or mean. So to find the average, you simply add up the values that you want to find the average of, and then divide by however many values you have. So for example, let's say I was training for a race, and I've done three different trial runs, and I want to know what my average time is.

So let's say the first time that I did my run, it took me 6.3 minutes. We'll say this is just a mile race, and I'm very quick. The second time I did my run, it took me 8.1 minutes. And the last time that I did my run, it took me 7.8 minutes. So I'm going to divide by, again, the number of values that I have. So I'm going to divide by 3. So simplifying my numerator first, 6.3 plus 8.1 plus 7.8 is going to give me a total of 22.2 minutes, divided by 3 is going to give me an average time of 7.4 minutes.

So let's do an example using weighted average. When you're finding the weighted average, that means that you have values that carry different weights than others. So we want to account for that by counting those values multiple times in our calculation. So here's a pretty common example of where you use weighted average, the final grade for a class is determined as follows. 50% of the grade is your test scores, 30% is your homework scores, and 20% is a final project. And so let's say I have these different average scores-- 85% for my test, 95% percent for my homework, and 70% for my project. And I want to see what my overall score for the class is going to be using these weights.

So values that carry more weight are going to be multiplied by a factor, and those factors are going to come from these percentages. And since we're going to be accounting for these weights in the numerator when we're calculating the average, and we're also going to be accounting for these weights in the denominator of our fraction. So let's see what that looks like.

Setting up my weighted average calculation, I'm going to have 50% of my test scores. And my test scores were 85%, so 0.85 plus 30% are my homework scores, so 30, times my average homework score, which is 95%, or 0.95, plus 20% of my project score, which was 70% or 0.70. Now I'm going to divide that by the total of my weights, so 50 plus 30 plus 20 is going to give me 100.

So simplifying this equation, or this expression, 50 times 0.85 gives me 42.5. 30 times 0.95 gives me 28.5, and 20 times 0.70 gives me 14, still out of 100. Adding these three numbers together in my numerator, I get 85. And that will, again, be out of 100, which would give me a final grade in my class of 85%.

So for this example, I've got two solutions. One with 45% acid and one with 85% acid. And we want to mix them together to get 48 milliliters of a solution that is overall 50% acid. So we want to know how much of the 45% acid solution do we need. So if we were to solve this problem, assuming that we need half and half of each one, then

we would have 24 milliliters, or half of 48, for each of these solutions.

So to find the overall percentage of acid, we could use our weighted average formula. So my 45% solution, I'd have 24 milliliters of that. And my 85% percent solution, I'd have 24 milliliters of that. And I'm going to divide that by a total of my 48 milliliters. Simplifying in my numerator, 0.45 times 24 is going to give me 10.8. 0.85 times 24 gives me 20.4. And that's still over 48.

And now continuing with my numerator, 10.8 plus 20.4 gives me 31.2 over 48. Dividing those, I get 0.65, or 65%. So because I only want acid, a solution with only 50% acid, I can see that by using 24 milliliters, or half, of each of the solutions, my acid percentage is too high. So I need to weight one of the acids, or use more of one of them, so that my overall acid solution is only 50% instead of 65%.

So before we can solve this problem, we need to define the two variables for what we don't know. I don't know how much of my 45% acid solution I need, so I'm going to define that with the x . And I don't know how much of my 85% acid solution I need, so I'm going to define that with the variable y . I know that between the two solutions, I need a total of 48 milliliters. So I can write an equation x plus y is equal to 48.

And since I want to use my variables in an equation, I only want one variable in my equation. So I'm going to rewrite this equation in terms of one of the variables. So I'm going to write it as y is equal to 48 minus x . And I got that just by subtracting x from both sides of the equation to isolate my y variable. So now substituting these variables into my weighted average formula, I will have my 45% solution. I have x milliliters of that. My 85% solution, I have 48 minus x milliliters of that. I have a total of 48 milliliters, and I know that I want the concentration of acid to be 50%.

So simplifying, I'm going to start by distributing. Bring down my first part. 0.85 times 48 is going to give me 40.8. And multiplying these two terms, I'll have minus 0.85 x over 48 is equal to 0.50. Now I have two like terms that I can combine, that will give me negative 0.4 x . Bring down the rest of my terms. Now to continue simplifying, I want to cancel out this denominator. I can do that by multiplying both sides by 48. And so that is going to give me negative 0.4 x plus 40.8 is equal to 24. I'm going to subtract 40.8 on both sides.

So it's going to give me negative 0.4 x is equal to negative 16.8. And finally, dividing by negative 0.4 on both sides will give me a value for x of 42 milliliters. So I've found that I actually need 42 milliliters of my 45% acid solution, which would leave me with 48 minus 42, or 6 milliliters of my 85% acid solution.

So let's go over our key points from today. Make sure you have them in your notes if you don't already, so you can refer to them later. A weighted average gives you the average of a set of values that may carry different weights. The more weight that a value has, the more it is accounted for in the calculation.

So I hope that these key points and examples helped you understand a little bit more about weighted average. Keep using your notes and keep on practicing, and soon you'll be a pro. Thanks for watching.