# Example 1: Any one of the 3 variables can be changed individually to produce the desired output, but changing z is most parsimonious

Prompt:

Given that x=2, y=-1, z=3 is a solution to 2x + 3y - 4z = -11, find the most parsimonious integer-valued assignments for x, y, z such that the equation now evaluates to 1. Define a parsimonious solution as one that assigns new values to as few of the variables x, y, z as possible. If there are multiple solutions that change the same number of variables, select the solution that changes these variables by the smallest absolute amount. Use the Wolfram plugin to perform math calculations when necessary.

### Response 1: Incorrect; failed to come up with a solution; did not use a systematic approach

* Most parsimonious solution
* Valid solution
* Systematic approach
* Correct reasoning

The equation \(2x + 3y - 4z = 1\) has an infinite number of solutions. However, we are interested in finding the most parsimonious solution, which changes the fewest variables from the original solution \(x=2, y=-1, z=3\), and if there are multiple such solutions, we want the one that changes these variables by the smallest absolute amount.

Given the integer solution provided by Wolfram Alpha: \(y = 4n + 2x + 3, z = 3n + 2x + 2\), where \(n\) is an integer, we can try to find a solution that minimizes the changes to \(x, y, z\).

Let's start by keeping \(x\) and \(y\) the same as in the original solution, i.e., \(x=2\) and \(y=-1\), and see if we can find a suitable \(n\) that gives us a new \(z\) value. We can then check if this new \(z\) value makes the equation \(2x + 3y - 4z = 1\) true.

Let's calculate this.

[Used **Wolfram**]

The solution for \(n\) in terms of \(z\) is \(n = -2 + z/3\), where \(z\) is an integer.

Now, let's find the smallest integer \(z\) that is different from the original \(z = 3\) and makes the equation \(2x + 3y - 4z = 1\) true. We can do this by checking the equation for \(z = 2\) and \(z = 4\) (the integers closest to 3), and seeing which one, if any, satisfies the equation.

[Used **Wolfram**]

Neither \(z = 2\) nor \(z = 4\) satisfy the equation \(2x + 3y - 4z = 1\) when \(x = 2\) and \(y = -1\).

This means we need to change another variable. Let's try changing \(y\) while keeping \(x = 2\). We'll find the smallest integer \(y\) that is different from the original \(y = -1\) and makes the equation true. We can do this by checking the equation for \(y = 0\) and \(y = -2\) (the integers closest to -1), and seeing which one, if any, satisfies the equation.

[Used **Wolfram**]

Neither \(y = 0\) nor \(y = -2\) satisfy the equation \(2x + 3y - 4z = 1\) when \(x = 2\) and \(z = 3\).

This means we need to change another variable. Let's try changing \(x\) while keeping \(y = -1\) and \(z = 3\). We'll find the smallest integer \(x\) that is different from the original \(x = 2\) and makes the equation true. We can do this by checking the equation for \(x = 1\) and \(x = 3\) (the integers closest to 2), and seeing which one, if any, satisfies the equation.

[Used **Wolfram**]

Neither \(x = 1\) nor \(x = 3\) satisfy the equation \(2x + 3y - 4z = 1\) when \(y = -1\) and \(z = 3\).

This means we need to change more than one variable to find a new solution. Let's try changing \(x\) and \(y\) while keeping \(z = 3\). We'll find the smallest integer \(x\) and \(y\) that are different from the original \(x = 2, y = -1\) and make the equation true. We can do this by checking the equation for \(x = 1, y = 0\) and \(x = 3, y = -2\) (the integers closest to 2 and -1), and seeing which one, if any, satisfies the equation.

[Used **Wolfram**]

Neither \(x = 1, y = 0\) nor \(x = 3, y = -2\) satisfy the equation \(2x + 3y - 4z = 1\) when \(z = 3\).

This means we need to change all three variables to find a new solution. Let's try changing \(x\), \(y\), and \(z\) to the closest integers that are different from the original \(x = 2, y = -1, z = 3\) and make the equation true. We can do this by checking the equation for \(x = 1, y = 0, z = 2\) and \(x = 3, y = -2, z = 4\) (the integers closest to 2, -1, and 3), and seeing which one, if any, satisfies the equation.

[Used **Wolfram**]

Neither \(x = 1, y = 0, z = 2\) nor \(x = 3, y = -2, z = 4\) satisfy the equation \(2x + 3y - 4z = 1\).

It seems we may need to consider larger changes to the variables to find a solution. Let's try a different approach. We'll generate a range of integer values for \(x\), \(y\), and \(z\) around their original values, and then search this space for a solution that satisfies the equation. We'll limit the range to avoid an excessively large search space. Let's say we consider values from -5 to 5 for each variable.

[Used **Wolfram**]

It appears there was an error in the calculation. The Minimize function in Wolfram Language expects a variable, but it received a list of numbers. This is likely due to a misunderstanding in the structure of the function.

Let's try a different approach. We'll generate a list of all possible combinations of \(x\), \(y\), and \(z\) within the range -5 to 5, and then find the combination that satisfies the equation and is closest to the original solution \(x=2, y=-1, z=3\). We'll measure "closeness" as the sum of the absolute differences between the original and new values for each variable.

[Used **Wolfram**]

I apologize for the confusion, but it seems there was a misunderstanding in the interpretation of the Wolfram Language code. The output provided is the code itself, not the result of the computation. This might be due to a technical issue. Let me try again.

[Used **Wolfram**]

I apologize for the inconvenience, but it seems there was a technical issue with the computation. I attempted to find the most parsimonious integer-valued assignments for \(x\), \(y\), and \(z\) such that the equation \(2x + 3y - 4z = 1\) is satisfied, starting from the original solution \(x=2\), \(y=-1\), \(z=3\).

I tried changing each variable individually, then in pairs, and finally all three together, but none of the combinations within a small range around the original values satisfied the equation. I then attempted to search a larger space of possible values, but encountered a technical issue that prevented me from obtaining the result.

I'm sorry I couldn't provide the answer you were looking for. If you have any other questions or need further assistance, feel free to ask!

### Response 2: Correct; correct and most parsimonious solution; however, used a brute force rather than system approach when finding most parsimonious solution

* Most parsimonious solution
* Valid solution
* Systematic approach
* Correct reasoning

The equation \(2x + 3y - 4z = 1\) has an infinite number of solutions. However, we are looking for the most parsimonious solution, which means we want to change as few variables as possible from the original solution \(x=2, y=-1, z=3\), and if we have to change any, we want to change them by the smallest absolute amount.

Given the integer solution provided by Wolfram Alpha, \(y = 4n + 2x + 3, z = 3n + 2x + 2, n \in Z\), we can see that the solution depends on the value of \(n\).

Let's try to find the smallest \(n\) such that the new values of \(x, y, z\) are as close as possible to the original values \(x=2, y=-1, z=3\).

We can start by setting \(n=0\) and see if we can find a solution that changes the least number of variables.

[Used **Wolfram**]

Setting \(n=0\) gives us the solution \(x=2, y=7, z=6\). This solution changes the values of both \(y\) and \(z\), and the changes are quite large.

Let's try \(n=-1\) to see if we can find a solution that changes fewer variables or changes them by a smaller amount.

[Used **Wolfram**]

Setting \(n=-1\) gives us the solution \(x=2, y=3, z=3\). This solution changes the values of both \(y\) and \(z\), but the changes are smaller than in the previous solution.

Let's try \(n=-2\) to see if we can find a solution that changes fewer variables or changes them by a smaller amount.

[Used **Wolfram**]

Setting \(n=-2\) gives us the solution \(x=2, y=-1, z=0\). This solution changes only the value of \(z\), and the change is by 3 units, which is smaller than the changes in the previous solutions.

So, the most parsimonious integer-valued assignments for \(x, y, z\) such that the equation \(2x + 3y - 4z = 1\) evaluates to 1 are \(x=2, y=-1, z=0\). This solution changes the least number of variables (only \(z\)) and changes it by the smallest absolute amount (3 units) compared to the original solution \(x=2, y=-1, z=3\).

### Response 3: Correct; Systematic approach for finding most parsimonious solution

* Most parsimonious solution
* Valid solution
* Systematic approach
* Correct reasoning

The given equation \(2x + 3y - 4z = -11\) evaluates to -11 with the provided values of \(x=2\), \(y=-1\), and \(z=3\).

Now we want to find the most parsimonious integer-valued assignments for \(x\), \(y\), \(z\) such that the equation now evaluates to 1.

To do this, we can try changing the values of \(x\), \(y\), and \(z\) one at a time and see which change results in the equation evaluating to 1.

Let's start by changing the value of \(x\) while keeping \(y\) and \(z\) constant.

[Used **Wolfram**]

By changing the value of \(x\) from 2 to 8, the equation \(2x + 3y - 4z\) evaluates to 1. This requires an absolute change of 6 in the value of \(x\).

Next, let's try changing the value of \(y\) while keeping \(x\) and \(z\) constant.

[Used **Wolfram**]

By changing the value of \(y\) from -1 to 3, the equation \(2x + 3y - 4z\) evaluates to 1. This requires an absolute change of 4 in the value of \(y\).

Finally, let's try changing the value of \(z\) while keeping \(x\) and \(y\) constant.

[Used **Wolfram**]

By changing the value of \(z\) from 3 to 0, the equation \(2x + 3y - 4z\) evaluates to 1. This requires an absolute change of 3 in the value of \(z\).

Comparing the changes required for each variable, changing \(z\) requires the smallest absolute change. Therefore, the most parsimonious solution is \(x=2\), \(y=-1\), and \(z=0\).

# Example 2: Changing either y or z individually yields correct value, but z is most parsimonious

Prompt:

Given that x=-3, y=-7, z=1 is a solution to the equation 5x - 8y - 16z = 25, find the most parsimonious integer-valued assignments for x, y, z such that the equation now evaluates to 9. Define a parsimonious solution as one that assigns new values to as few of the variables x, y, z as possible. If there are multiple solutions that change the same number of variables, select the solution that changes these variables by the smallest absolute amount. Use the Wolfram plugin to perform math calculations when necessary.

### Response 1: Correct; systematic and correct reasoning

* Most parsimonious solution
* Valid solution
* Systematic approach
* Correct reasoning

The given solution \(x=-3\), \(y=-7\), \(z=1\) indeed satisfies the equation \(5x - 8y - 16z = 25\).

Now, we need to find the most parsimonious integer-valued assignments for \(x\), \(y\), \(z\) such that the equation evaluates to 9.

The most parsimonious solution would involve changing the value of only one variable, if possible. Let's try changing the values of \(x\), \(y\), and \(z\) one at a time to see if we can make the equation equal to 9.

First, let's see what happens if we change \(x\) while keeping \(y=-7\) and \(z=1\). We need to solve the equation \(5x - 8\*(-7) - 16\*1 = 9\) for \(x\).

[Used **Wolfram**]

The solution for \(x\) is \(-31/5\), which is not an integer. So, changing \(x\) alone will not give us an integer solution.

Next, let's try changing \(y\) while keeping \(x=-3\) and \(z=1\).

[Used **Wolfram**]

The solution for \(y\) is \(-5\), which is an integer. So, changing \(y\) alone to \(-5\) while keeping \(x=-3\) and \(z=1\) makes the equation equal to 9.

This is a parsimonious solution as it involves changing the value of only one variable. However, to ensure this is the most parsimonious solution, let's also check what happens if we change \(z\) while keeping \(x=-3\) and \(y=-7\). We need to solve the equation \(5\*(-3) - 8\*(-7) - 16z = 9\) for \(z\).

[Used **Wolfram**]

The solution for \(z\) is \(2\), which is an integer. So, changing \(z\) alone to \(2\) while keeping \(x=-3\) and \(y=-7\) also makes the equation equal to 9.

Now, we have two parsimonious solutions:

1. Change \(y\) to \(-5\) (change of \(2\) units from \(-7\))

2. Change \(z\) to \(2\) (change of \(1\) unit from \(1\))

Since the second solution changes \(z\) by a smaller absolute amount, it is the most parsimonious solution according to the given criteria. Therefore, the most parsimonious integer-valued assignments for \(x\), \(y\), \(z\) such that the equation \(5x - 8y - 16z = 9\) are \(x=-3\), \(y=-7\), \(z=2\).

### Response 2: Incorrect; systematic but does not find the most parsimonious solution, selecting y instead of z; incorrect reasoning that selecting the variable with the smallest coefficient produces the smallest absolute change to the variable

* Most parsimonious solution
* Valid solution
* Systematic approach
* Correct reasoning

The equation \(5x - 8y - 16z\) evaluates to 25 with the given values of \(x=-3\), \(y=-7\), and \(z=1\).

Now, we want to find the most parsimonious integer-valued assignments for \(x\), \(y\), \(z\) such that the equation evaluates to 9. This means we need to decrease the value of the equation by 16 (from 25 to 9).

We can achieve this by changing the value of one of the variables. Since we want to change the variables by the smallest absolute amount, we should choose the variable with the smallest coefficient in the equation, which is \(x\).

Let's find the new value of \(x\) that would make the equation equal to 9. We'll solve the equation \(5x - 8\*(-7) - 16\*1 = 9\) for \(x\).

[Used **Wolfram**]

The solution \(x = -31/5\) is not an integer. Therefore, we need to consider changing another variable.

Next, let's try changing \(y\), which has the next smallest coefficient. We'll solve the equation \(5\*(-3) - 8y - 16\*1 = 9\) for \(y\).

[Used **Wolfram**]

The solution \(y = -5\) is an integer. Therefore, the most parsimonious integer-valued assignments for \(x\), \(y\), \(z\) such that the equation \(5x - 8y - 16z = 9\) are \(x=-3\), \(y=-5\), and \(z=1\). This solution changes the value of \(y\) from -7 to -5, which is the smallest absolute change among the variables.

### Response 3: Correct; systematic and correct reasoning

* Most parsimonious solution
* Valid solution
* Systematic approach
* Correct reasoning

The equation \(5x - 8y - 16z\) evaluates to 25 for the given values of \(x=-3\), \(y=-7\), and \(z=1\). Now, we need to find new values for \(x\), \(y\), and \(z\) such that the equation evaluates to 9, changing as few variables as possible and by the smallest absolute amount.

Let's first see if we can achieve the target value by changing only one of the variables. We will try changing \(x\) first, then \(y\), and finally \(z\), and see which requires the smallest absolute change.

[Used **Wolfram**]

[Used **Wolfram**]

[Used **Wolfram**]

The solutions for each variable while keeping the other two constant are:

- \(x = -31/5\), which is not an integer.

- \(y = -5\), which is an integer and requires a change of \(|-5 - (-7)| = 2\) from the original value.

- \(z = 2\), which is an integer and requires a change of \(|2 - 1| = 1\) from the original value.

Since we are looking for integer solutions and the smallest absolute change, the most parsimonious solution would be to change \(z\) from 1 to 2, while keeping \(x = -3\) and \(y = -7\).

# Example 3: x and y variables must be changed (most parsimonious and only solution)

Prompt:

Given that x=4, y=1, z=-2 is a solution to the equation -3x + 2y - 6z = 2, find the most parsimonious integer-valued assignments for x, y, z such that the equation now evaluates to -3. Define a parsimonious solution as one that assigns new values to as few of the variables x, y, z as possible. If there are multiple solutions that change the same number of variables, select the solution that changes these variables by the smallest absolute amount. Use the Wolfram plugin to perform math calculations when necessary.

### Response 1: Incorrect; failed to generate solution; went variable by variable, but used brute force rather than systematic approach for determining how much to change each variable by

* Most parsimonious solution
* Valid solution
* Systematic approach
* Correct reasoning

The given solution \(x=4\), \(y=1\), \(z=-2\) does not satisfy the equation \(-3x + 2y - 6z = -3\). Therefore, we need to find a new solution that satisfies the equation and meets the parsimony criteria.

Let's first check if the given solution satisfies the original equation \(-3x + 2y - 6z = 2\).

The given solution \(x=4\), \(y=1\), \(z=-2\) does satisfy the original equation \(-3x + 2y - 6z = 2\).

Now, let's find the most parsimonious solution that makes the equation \(-3x + 2y - 6z = -3\). We'll start by changing one variable at a time and checking if the equation is satisfied. We'll start with \(x\), then \(y\), and finally \(z\). We'll also aim to change the variable by the smallest absolute amount possible.

Let's start with \(x\). We'll increment \(x\) by 1 and check if the equation is satisfied. If not, we'll increment \(x\) by 2, and so on. We'll do the same for \(y\) and \(z\).

[Used **Wolfram**]

[Used **Wolfram**]

[Used **Wolfram**]

[Used **Wolfram**]

[Used **Wolfram**]

[Used **Wolfram**]

[Used **Wolfram**]

[Used **Wolfram**]

Changing \(x\) alone does not seem to satisfy the equation \(-3x + 2y - 6z = -3\). Let's now try changing \(y\) while keeping \(x=4\) and \(z=-2\). We'll increment \(y\) by 1 and check if the equation is satisfied. If not, we'll increment \(y\) by 2, and so on.

[Used **Wolfram**]

[Used **Wolfram**]

[Used **Wolfram**]

[Used **Wolfram**]

[Used **Wolfram**]

[Used **Wolfram**]

I have attempted to find the most parsimonious solution to the equation \(-3x + 2y - 6z = -3\) given the original solution \(x=4\), \(y=1\), \(z=-2\) for the equation \(-3x + 2y - 6z = 2\). I started by trying to change one variable at a time, starting with \(x\) and then \(y\), but none of the integer changes to \(x\) or \(y\) resulted in the equation evaluating to \(-3\).

Due to time constraints, I was not able to check changes to the variable \(z\). However, you can continue this process by checking integer changes to \(z\) while keeping \(x=4\) and \(y=1\). If changing one variable at a time does not yield a solution, you may need to consider changing two or all three variables.

Please note that this process may not yield a unique solution, as there may be multiple combinations of \(x\), \(y\), and \(z\) that satisfy the equation. The goal is to find the solution that changes the fewest variables and changes them by the smallest absolute amount.

### Response 2: Incorrect; failed to generate solution; went variable by variable, but used brute force rather than systematic approach for determining how much to change each variable by

* Most parsimonious solution
* Valid solution
* Systematic approach
* Correct reasoning

The given solution \(x=4\), \(y=1\), \(z=-2\) does not satisfy the equation \(-3x + 2y - 6z = -3\). Therefore, we need to find a new solution that satisfies the equation and follows the given conditions.

Let's start by changing one variable at a time and see if we can find a solution that satisfies the equation. We'll start with \(x\), then \(y\), and finally \(z\). We'll also try to change the variables by the smallest absolute amount possible.

Let's first try changing \(x\) from 4 to 3.

[Used **Wolfram**]

Changing \(x\) from 4 to 3 does not satisfy the equation \(-3x + 2y - 6z = -3\). Let's try changing \(x\) from 4 to 5.

[Used **Wolfram**]

Changing \(x\) from 4 to 5 also does not satisfy the equation \(-3x + 2y - 6z = -3\). Let's now try changing \(y\) from 1 to 0 while keeping \(x\) and \(z\) at their original values.

[Used **Wolfram**]

Changing \(y\) from 1 to 0 does not satisfy the equation \(-3x + 2y - 6z = -3\). Let's try changing \(y\) from 1 to 2.

[Used **Wolfram**]

Changing \(y\) from 1 to 2 also does not satisfy the equation \(-3x + 2y - 6z = -3\). Let's now try changing \(z\) from -2 to -1 while keeping \(x\) and \(y\) at their original values.

[Used **Wolfram**]

Changing \(z\) from -2 to -1 does not satisfy the equation \(-3x + 2y - 6z = -3\). Let's try changing \(z\) from -2 to -3.

[Used **Wolfram**]

Changing \(z\) from -2 to -3 also does not satisfy the equation \(-3x + 2y - 6z = -3\).

It seems that changing just one variable at a time is not sufficient to find a solution that satisfies the equation. We may need to change more than one variable.

Let's try changing \(x\) from 4 to 3 and \(y\) from 1 to 0. This changes two variables but by the smallest absolute amount possible.

[Used **Wolfram**]

Changing \(x\) from 4 to 3 and \(y\) from 1 to 0 does not satisfy the equation \(-3x + 2y - 6z = -3\).

Let's try changing \(x\) from 4 to 3 and \(z\) from -2 to -1. This also changes two variables but by the smallest absolute amount possible.

[Used **Wolfram**]

Changing \(x\) from 4 to 3 and \(z\) from -2 to -1 also does not satisfy the equation \(-3x + 2y - 6z = -3\).

Let's try changing \(y\) from 1 to 0 and \(z\) from -2 to -1. This also changes two variables but by the smallest absolute amount possible.

[Used **Wolfram**]

I attempted to find the most parsimonious integer-valued assignments for \(x\), \(y\), and \(z\) such that the equation \(-3x + 2y - 6z = -3\) is satisfied, starting from the solution \(x=4\), \(y=1\), \(z=-2\) to the equation \(-3x + 2y - 6z = 2\).

I tried changing one variable at a time (first \(x\), then \(y\), and finally \(z\)), and then combinations of two variables, but none of these changes resulted in the equation evaluating to -3.

It seems that a solution may require changing all three variables, or changing one or two variables by more than a single unit. However, without more time to continue the search, I cannot provide a definitive answer.

If you would like, I can continue the search by exploring more combinations or larger changes to the variables. Alternatively, if you have a different approach in mind, I would be happy to try that as well.

### Response 3: Incorrect; hallucinates a solution is correct when it isn’t without verifying its correctness; attempts systematic approach but makes many mathematical errors that prevent its continuation

* Most parsimonious solution
* Valid solution
* Systematic approach
* Correct reasoning

The given solution \(x=4\), \(y=1\), \(z=-2\) does not satisfy the equation \(-3x + 2y - 6z = -3\). Therefore, we cannot use this solution as a starting point to find a parsimonious solution.

However, we can still find a parsimonious solution for the equation \(-3x + 2y - 6z = -3\) by starting from the original solution \(x=4\), \(y=1\), \(z=-2\) that satisfies the equation \(-3x + 2y - 6z = 2\), and then changing as few variables as possible.

To do this, we can first calculate the difference between the current value of the equation and the target value, which is -3. This difference will tell us how much we need to change the equation to reach the target value. Then, we can try changing each variable one by one to see which change brings us closest to the target value.

Let's start by calculating the difference between the current value of the equation and the target value.

[Used **Wolfram**]

The difference between the current value of the equation and the target value is 5. This means we need to decrease the value of the equation by 5 to reach the target value of -3.

Now, let's see how changing each variable affects the value of the equation. We'll start with \(x\). We'll decrease \(x\) by 1 and see how much the value of the equation changes.

[Used **Wolfram**]

Decreasing \(x\) by 1 results in the same value of the equation, which is 5. This means that decreasing \(x\) does not bring us closer to the target value of -3.

Next, let's try decreasing \(y\) by 1 and see how much the value of the equation changes.

[Used **Wolfram**]

Decreasing \(y\) by 1 results in a value of 0 for the equation. This is a decrease of 5, which is exactly what we need to reach the target value of -3 from the current value of 2.

Therefore, the most parsimonious solution is \(x=4\), \(y=0\), \(z=-2\). This solution changes only one variable, \(y\), and it changes it by the smallest absolute amount that achieves the target value.