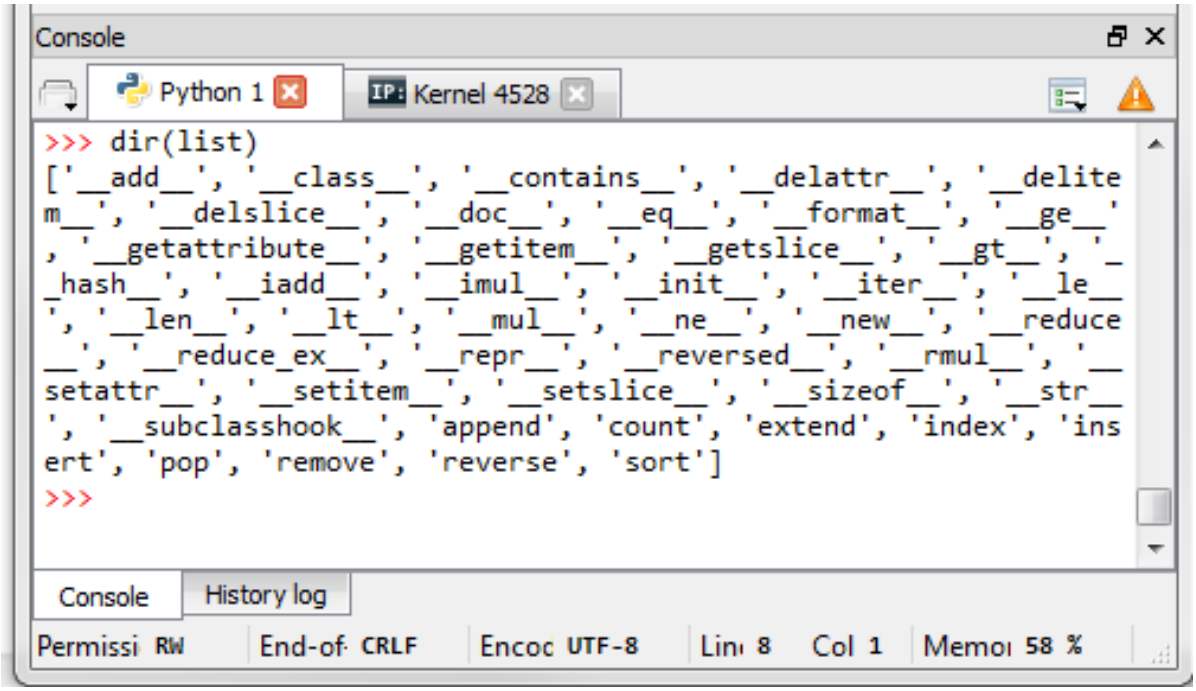
Lists: Methods

list Type Methods

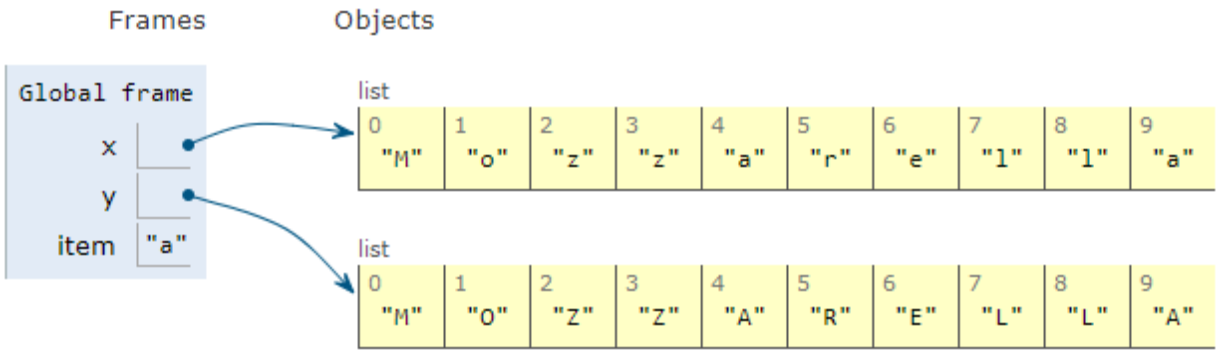
```
>>> dir(list)
```




```
>>> x = ['M','o','z','z','a','r','e','l','l','a']
>>> x.sort()
>>> print(x)
['M', 'a', 'a', 'e', 'l', 'l', 'o', 'r', 'z', 'z']
```

List Iteration

```
>>> # capitalize all letters in x
>>> x = list("Mozzarella")
>>> y = []   # y = list()
>>> for item in x:
>>>     y.append(item.upper())
```



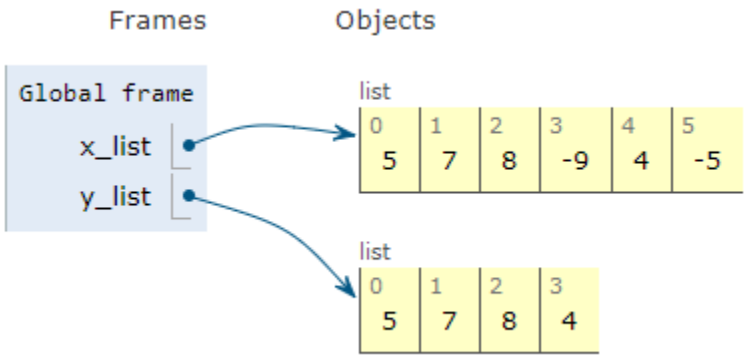
List Iteration Example: Remove Vowels

```
>>> x = list("Mozzarella")
>>> y = []
>>>  # same as y = list()
>>> VOWELS = list(“aeiou”)
>>> for item in x:
>>>     if item not in VOWELS:
>>>         y.append(item)
```

General Form of List Comprehension

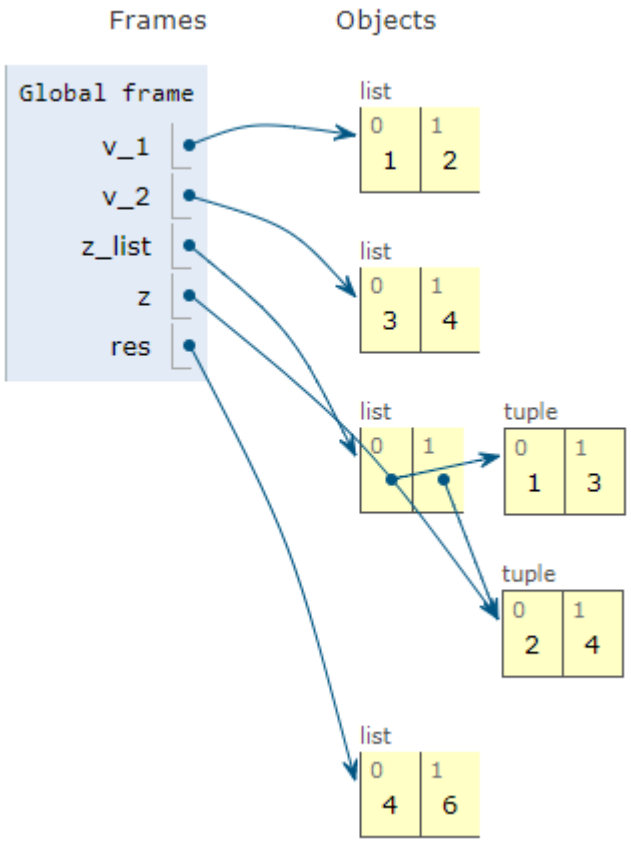
[expression for item in iterable
if condition]

```
>>> x_list = [5, 7, 8, −9, 4, −5]
>>> y_list = [x + 1 for x in x_list if x > 0]
>>> y_list
>>> [5, 7, 8, 4]
```



List Comprehension: Vector Addition

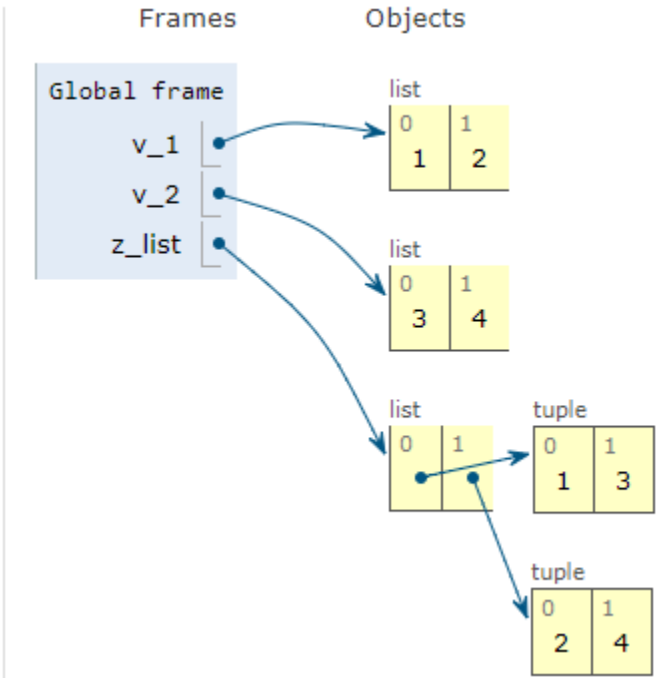
```
>>> v_1 = [1 ,2];  v_2 = [3, 4]
>>> z_list = zip(v_1, v_2)
```




```
>>> res = [z[0] + z[1] for z in z_list]
>>> res
[4, 6]
```

List Comprehension: Vector Dot Product

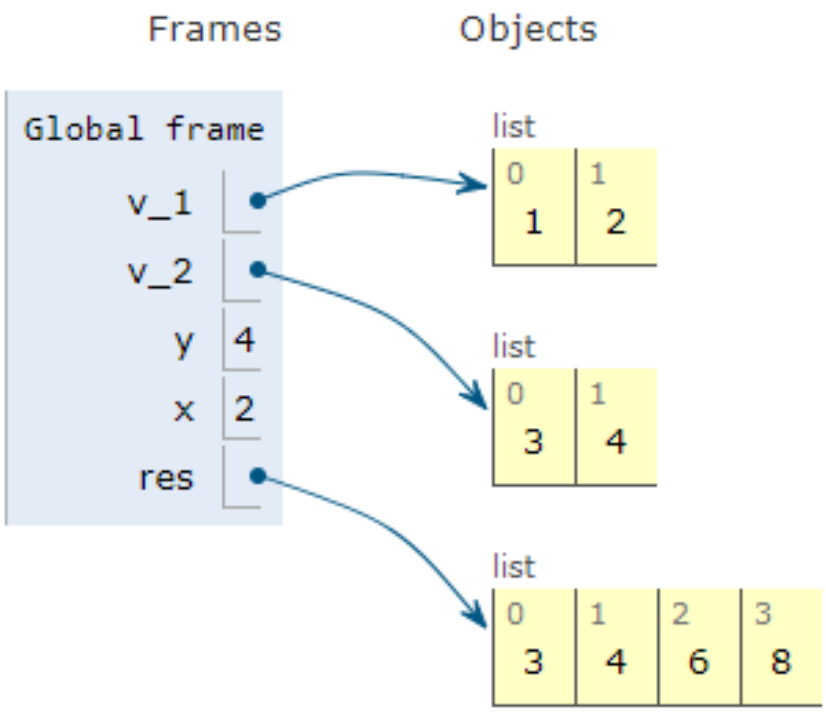
```
>>> v_1 = [1 ,2]
>>> v_2 = [3, 4]
>>> z_list = zip(v_1, v_2)
```




```
>>> res = sum(z[0] * z[1] for z in z_list)
>>> res
11
```

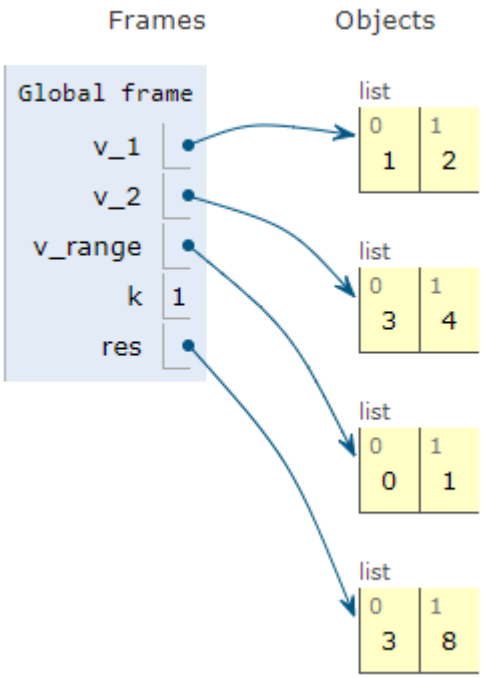
List Comprehension: Vector Cross Product

```
>>> v_1 = [1 ,2]
>>> v_2 = [3, 4]
>>> res = [x*y for x in v_1 for y in v_2]
>>> res
[3, 4, 6, 8]
```



List Comprehension: Hadamard Vector Product

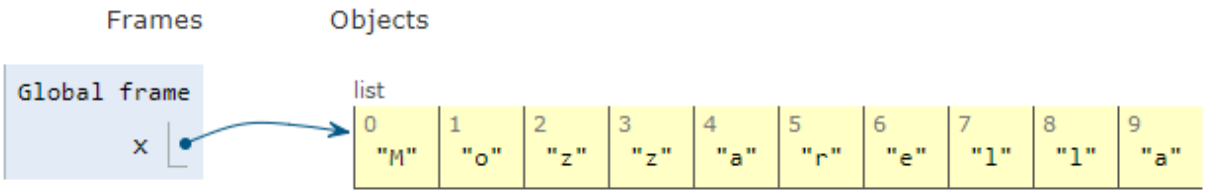
```
>>> # pointwise multiplication
>>> v_1 = [1 ,2];
>>> v_2 = [3, 4]
>>> v_range = range(len(v_1))
>>> res = [ v[k]+w[k]   for k in v_range ]
>>> res
[3, 8]
```



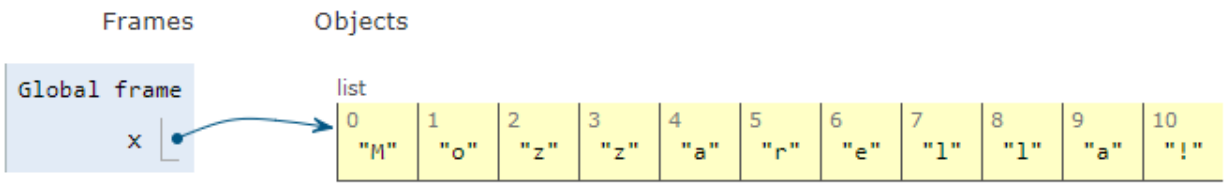
List Methods: *append*()

	0	1	2	3	4	5	6	7	8	9	
[	‘M’,	‘o’,	‘z’,	‘z’,	‘a’,	‘r’,	‘e’,	‘l’,	‘l’,	‘a’	]
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

```
>>> x = [‘M’,‘o’,‘z’,‘z’,‘a’,‘r’,‘e’,‘l’,‘l’,a’]
```



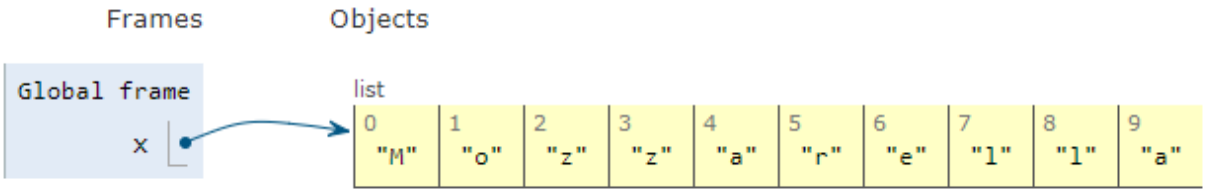

```
>>> # append ‘!’ to the end of list x
>>> x.append(‘!’)
>>> x
>>> [ ‘M’,‘o’,‘z’,‘z’,‘a’,‘r’,‘e’,‘l’,‘l’,‘a’,‘!’]
```



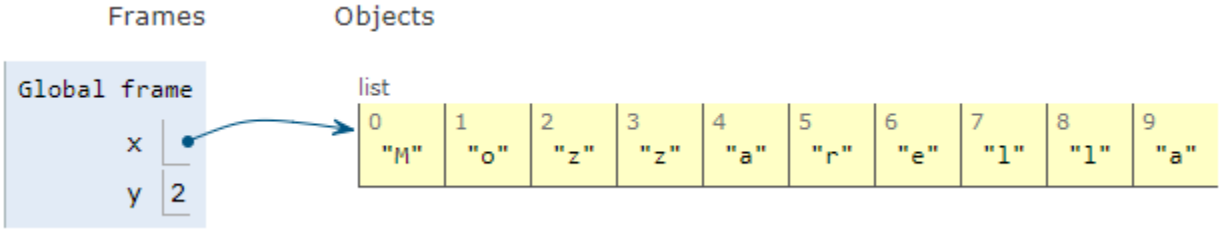
List Methods: *count*()

	0	1	2	3	4	5	6	7	8	9	
[	'M',	'o',	'z',	'z',	'a',	'r',	'e',	'l',	'l',	'a'	]
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

```
>>> x = ['M','o','z','z','a','r','e','l','l',a']
```



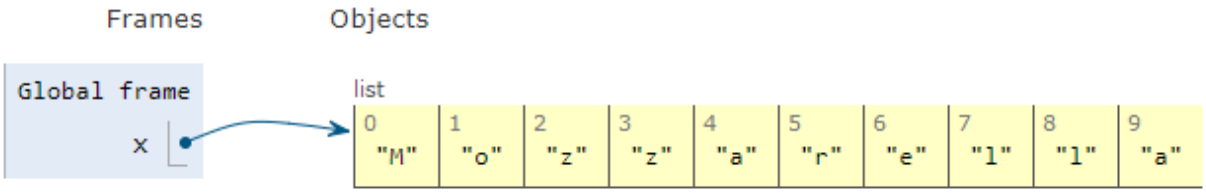

```
>>> # number of occurences of 'a' in x
>>> y = x.count('a')
>>> y
>>> 2
```



List Methods: *extend*()

	0	1	2	3	4	5	6	7	8	9	
[	'M',	'o',	'z',	'z',	'a',	'r',	'e',	'l',	'l',	'a'	]
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

>>> x = ['M','o','z','z','a','r','e','l','l',a']

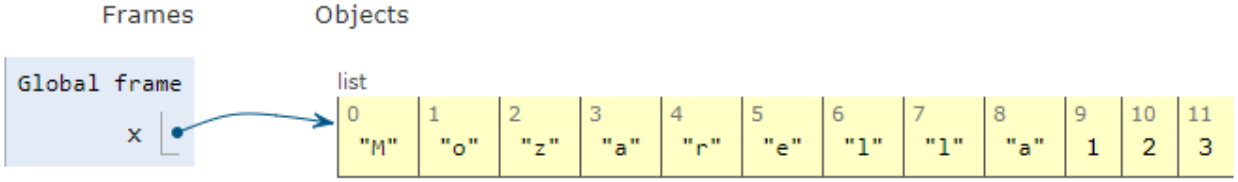


>>> append all items in list [1, 2, 3] to x

>>> x.*extend*([1, 2, 3])

>>> x

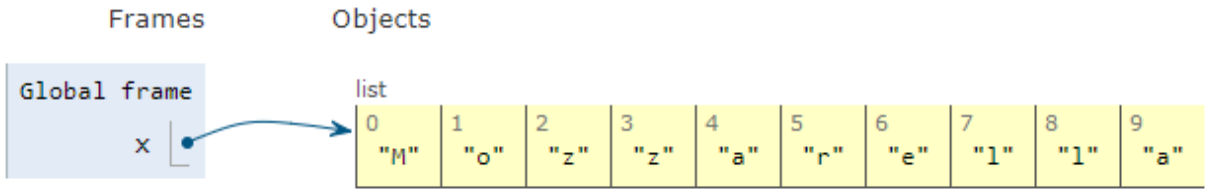
>>> ['M','o','z','z','a','r','e','l','l','a',1,2,3]



List Methods: *index*()

	0	1	2	3	4	5	6	7	8	9	
[	‘M’,	‘o’,	‘z’,	‘z’,	‘a’,	‘r’,	‘e’,	‘l’,	‘l’,	‘a’	]
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

>>> x = [‘M’,‘o’,‘z’,‘z’,‘a’,‘r’,‘e’,‘l’,‘l’,a’]

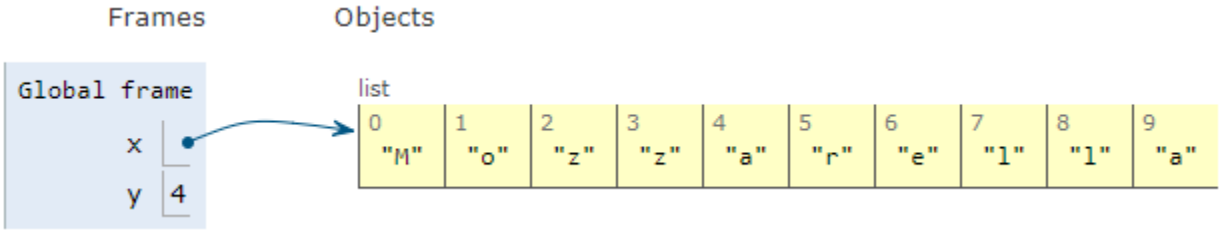


>>> # first occurrence of ‘a’ in list x

>>> y = x.*index*(‘a’)

>>> y

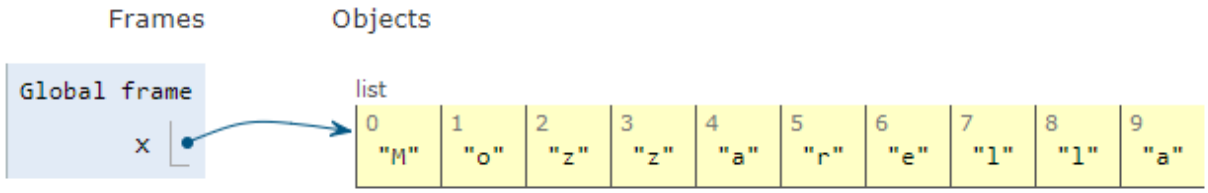
>>> 4



List Methods: *insert*()

	0	1	2	3	4	5	6	7	8	9	
[	‘M’,	‘o’,	‘z’,	‘z’,	‘a’,	‘r’,	‘e’,	‘l’,	‘l’,	‘a’	]
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

>>> x = [‘M’,‘o’,‘z’,‘z’,‘a’,‘r’,‘e’,‘l’,‘l’,a’]

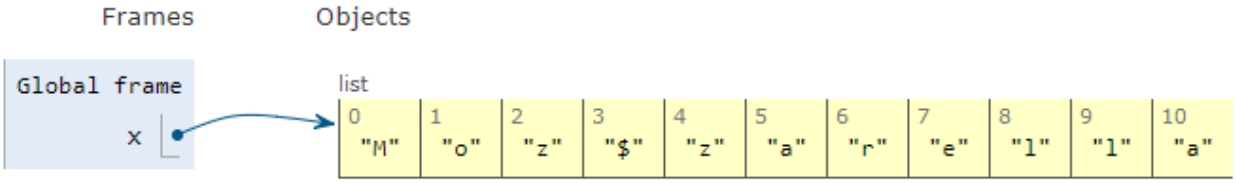


>>> # insert ‘$’ at index 3 in list x

>>> x.*insert*(3, ‘$’)

>>> x

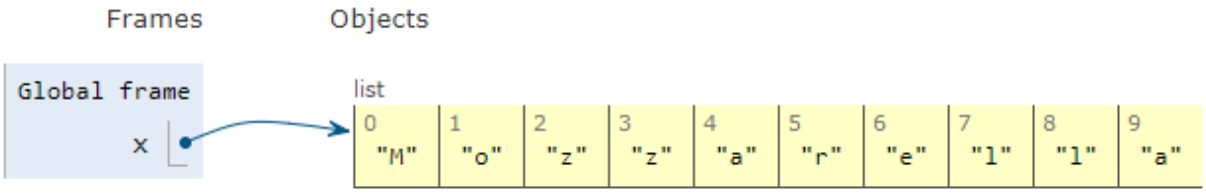
>>> [‘M’,‘o’,‘z’,’$’,’z’,‘a’,‘r’,‘e’,‘l’,‘l’,‘a’]



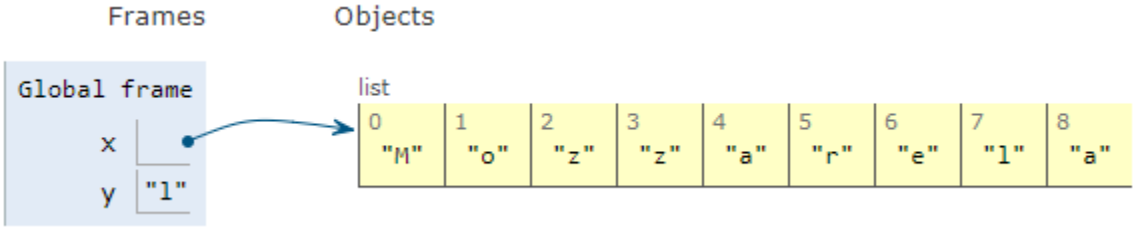
List Methods: *pop*(*i*=−1)

	0	1	2	3	4	5	6	7	8	9	
[	'M',	'o',	'z',	'z',	'a',	'r',	'e',	'l',	'l',	'a'	]
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

```
>>> x = ['M','o','z','z','a','r','e','l','l',a']
```



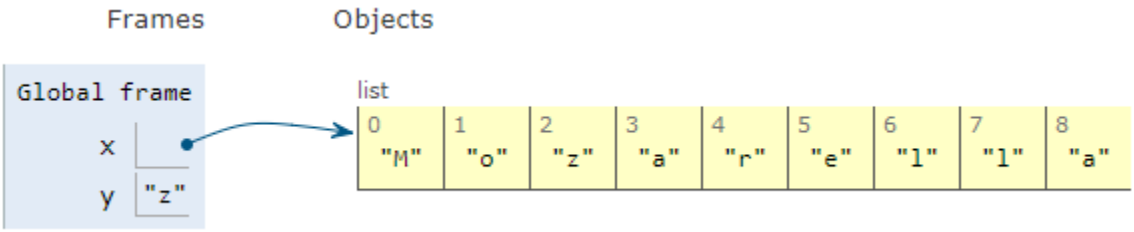

```
>>> # return the value at index i and
>>> # remove this value from the list
>>> y = x.pop(−3)
>>> x
>>> ['M','o','z','z','a','r','e','l','a' ]
```



List Element Removal

	0	1	2	3	4	5	6	7	8	9	
[	‘M’,	‘o’,	‘z’,	‘z’,	‘a’,	‘r’,	‘e’,	‘l’,	‘l’,	‘a’	]
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

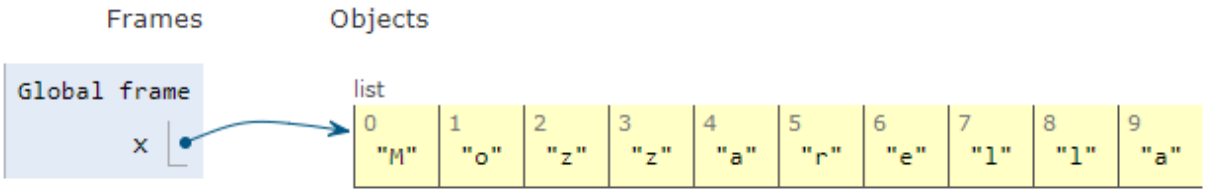
```
>>> x = [‘M’,‘o’,‘z’,‘z’,‘a’,‘r’,‘e’,‘l’,‘l’,a’]
>>> y = x.pop(2)
>>> y
>>> z
```



List Methods: *remove*()

	0	1	2	3	4	5	6	7	8	9	
[	‘M’,	‘o’,	‘z’,	‘z’,	‘a’,	‘r’,	‘e’,	‘l’,	‘l’,	‘a’	]
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

>>> x = [‘M’,‘o’,‘z’,‘z’,‘a’,‘r’,‘e’,‘l’,‘l’,a’]

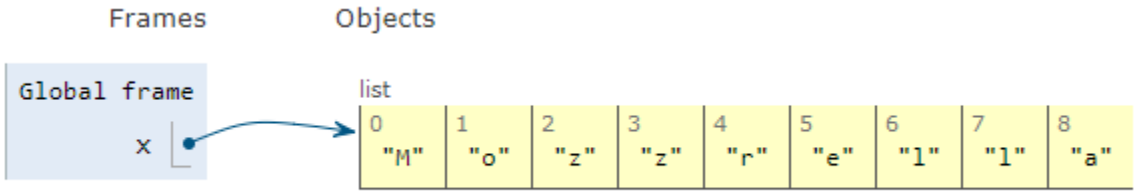


>>> # remove first ‘a’ from list x

>>> x.*remove*(‘a’)

>>> x

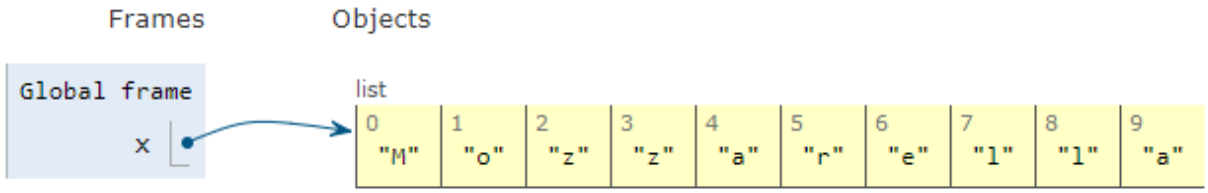
>>> [‘M’,‘o’,‘z’,’z’,‘r’,‘e’,‘l’,‘l’,‘a’]



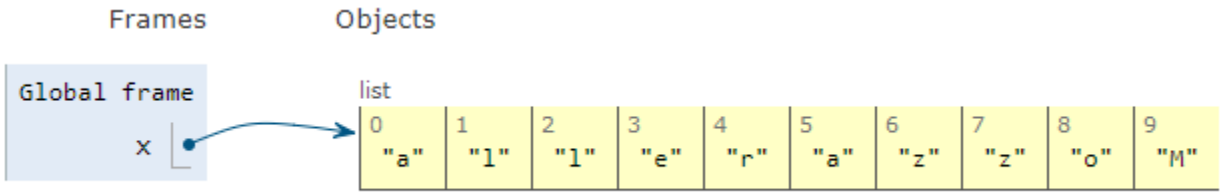
List Methods: *reverse*()

	0	1	2	3	4	5	6	7	8	9	
[	‘M’,	‘o’,	‘z’,	‘z’,	‘a’,	‘r’,	‘e’,	‘l’,	‘l’,	‘a’	]
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

```
>>> x = [‘M’,‘o’,‘z’,‘z’,‘a’,‘r’,‘e’,‘l’,‘l’,a’]
```



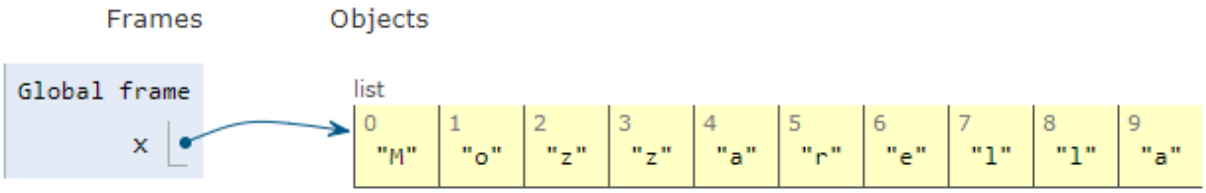

```
>>> # reverse list x in-place
>>> x.reverse()
>>> x
>>> [‘a,‘l’,‘l’,’e’,‘r’,‘a’,‘z’,‘z’,‘o’,‘M’]
```



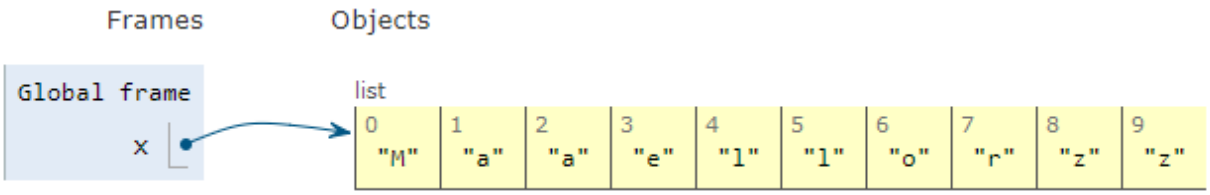
List Methods: *sort*()

	0	1	2	3	4	5	6	7	8	9	
[	'M',	'o',	'z',	'z',	'a',	'r',	'e',	'l',	'l',	'a'	]
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

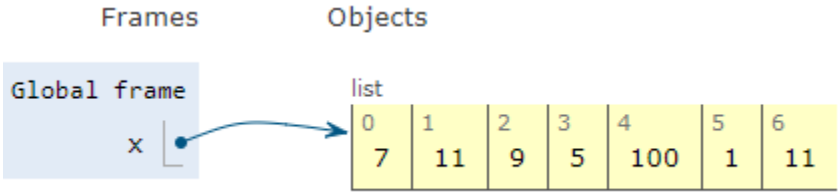
```
>>> x = ['M','o','z','z','a','r','e','l','l',a']
```



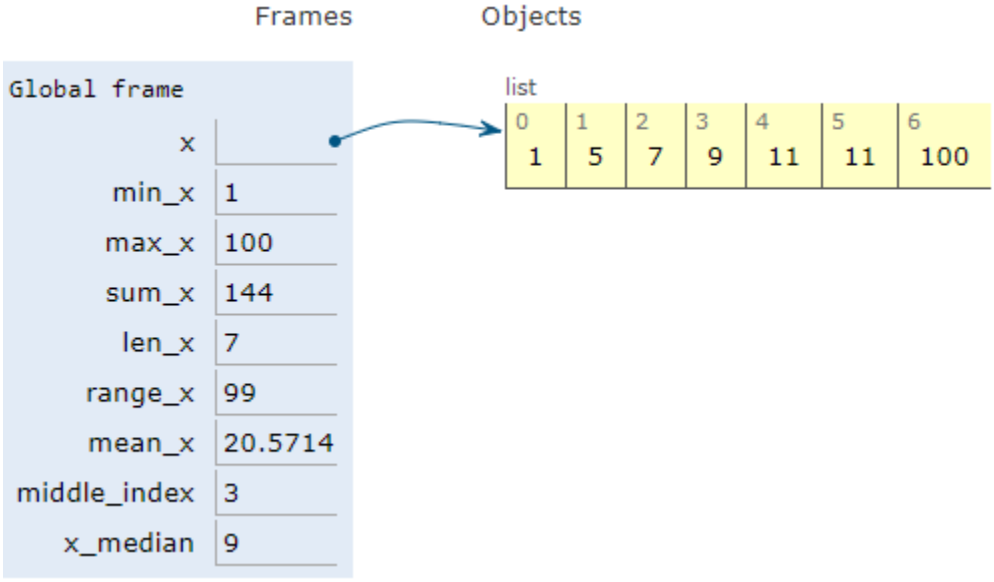

```
>>> # sort list x in-place
>>> x.sort()
>>> x
>>> ['M','a,'a','e','l','l','o','r','r','z']
```



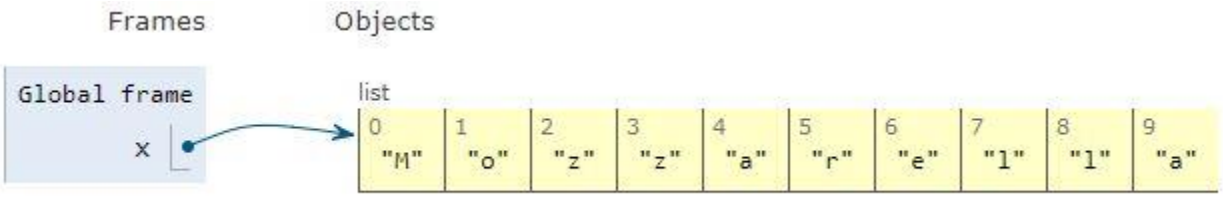
min(), *max*(), *sum*()



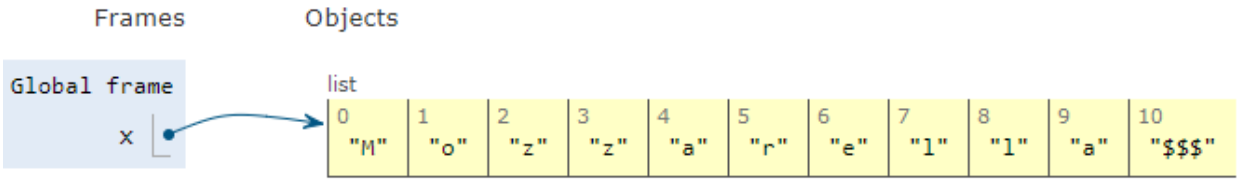

```
>>> x.sort()
>>> min_x = min(x); max_x = max(x)
>>> sum_x = sum(x); len_x = len(x)
>>> range_x = max_x – min_x
>>> mean_x = float(sum_x)/len_x
>>> middle_index = len_x // 2
>>> x_median = x[middle_index]
```



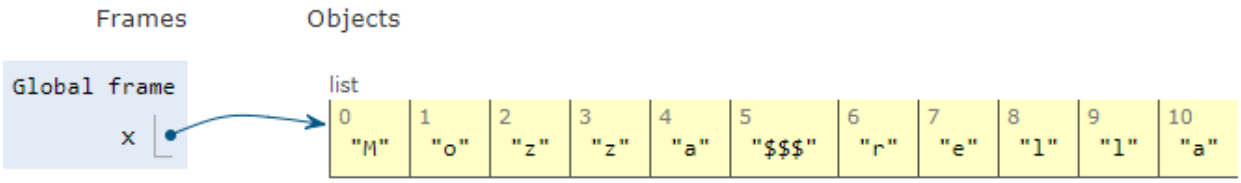
Common List Methods



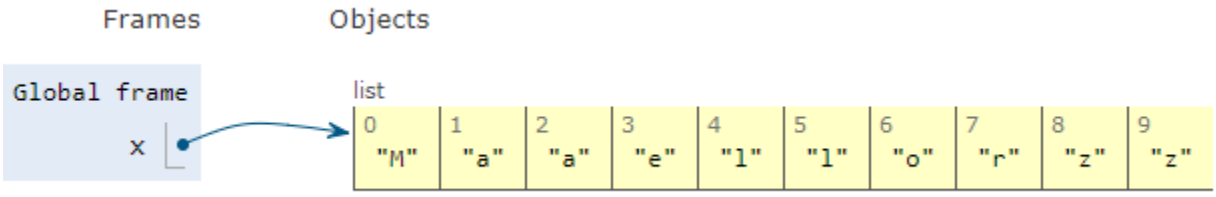

```
>>> x.append('$')
```



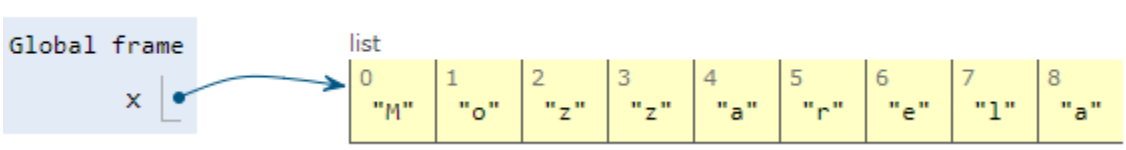

```
>>> x.insert(5, '$')
```




```
>>> x.sort()
```




```
>>> x.remove('l')
```



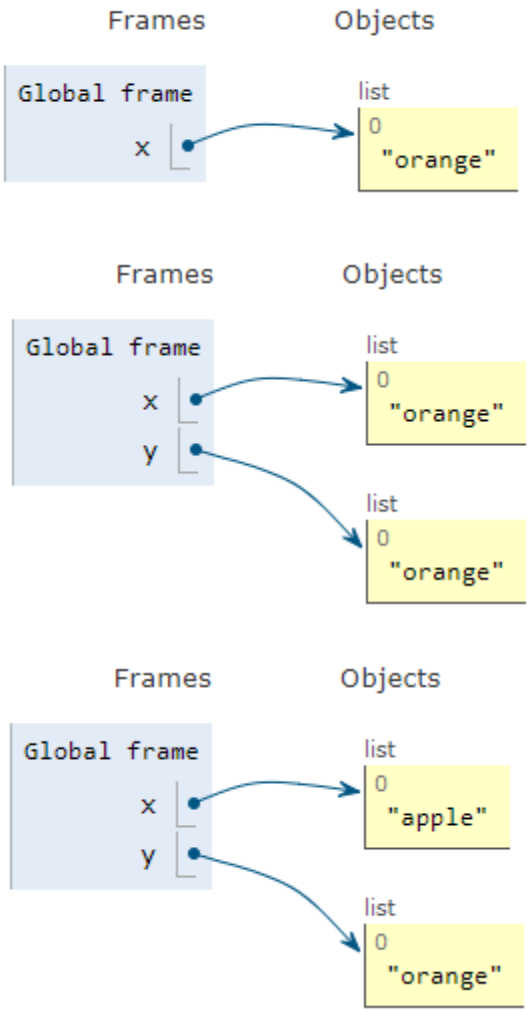
List Copy: Quiz

- what is the result of last print statement?

```
>>> x = [‘orange’]
>>> print(len(x))
>>> 1
>>> print(x[0])
>>> orange
>>> y = x
>>> x[0] = ‘apple’
>>> print(x[0], y[0])
```

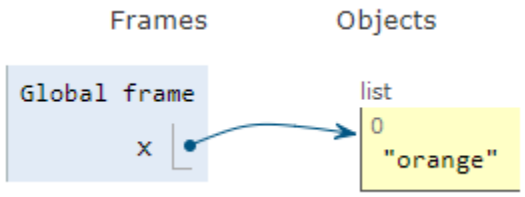
List Copy: Quiz (cont'd)

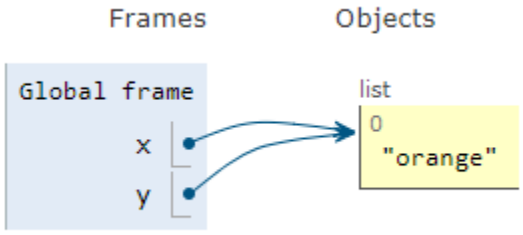
```
>>> x = ['orange']
>>> y = x
>>> x[0] = 'apple'
>>> print(x[0], y[0])
>>> ('apple', 'orange')
```

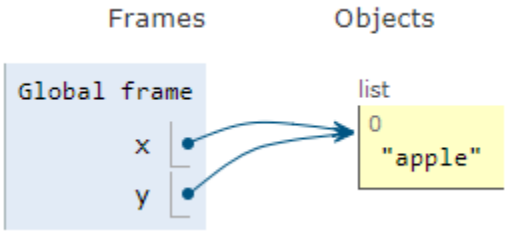


List Copy: Quiz (cont'd)

```
>>> x = ['orange']
>>> y = x
>>> x[0] = 'apple'
>>> print(x[0], y[0])
>>> ('apple', 'apple')
```







Review Problems

Interview Problem

- explain the difference between list *append*() and list *extend*() methods

Interview Problem

- what is *list comprehension*?

Interview Problem

- given the list x = [“One”, “Two”, “Three”]
- convert x to string “One, Two, Three”
- show two different ways to do so

Interview Problem

- how to count the occurrences of each item present in the list without explicitly mentioning them?

Interview Problem

- sort integers in list x

```
>>> x = [6, 9, 3, 91, 54, 122, 3]
```

Interview Problem

- given the list with odd and even numbers

```
>>> x = [1,3,8,3,6,8,11,19, 22]
```

- create two lists:
  (1) x_even with even numbers from x
  (2) x_odd with odd numbers from x

Interview Problem

- remove duplicates from a list

Interview Problem

- the following code is supposed to remove numbers less than 5 from list n, but there is a bug. Fix the bug.

```
n = [1,2,5,10,3,100,9,24]

for e in n:
if e < 5:
    n.remove(e)
print n
```

Interview Problem

- remove duplicates from a list

Interview Problem

- given the list
  >>> x = [‘1’, ‘13’, ‘61’, ‘99’, ‘17’]
- convert to list of numbers:
  y = [1, 13, 61, 99, 17]
- show two different ways to do so (including list comprehension)

Interview Problem

- how to generate random numbers?

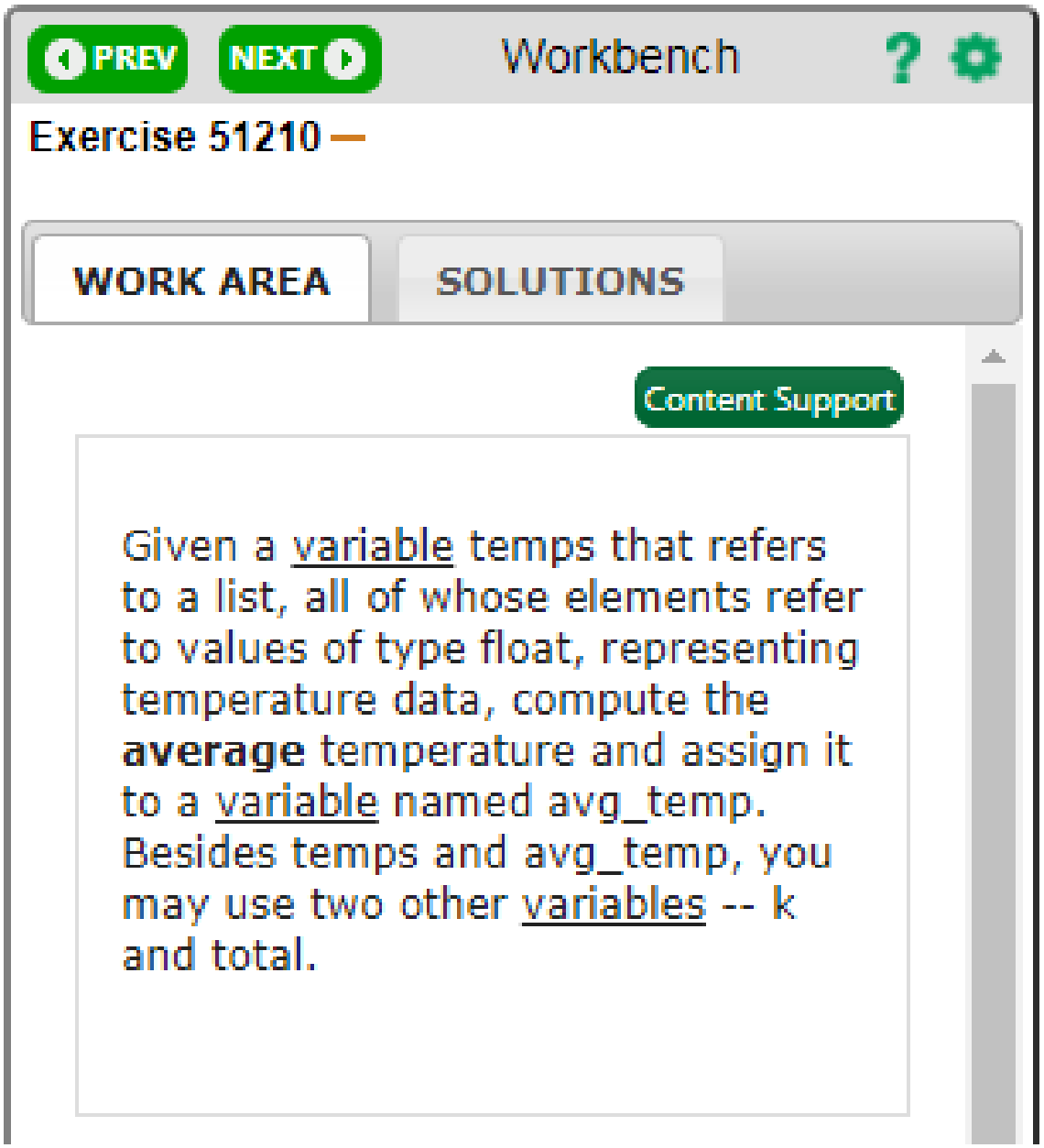
Interview Problem

- what built-in function can be used to iterate over a number sequence?

Interview Problem

- what is the difference between *range*() and *xrange*() functions?

Programming Exercise



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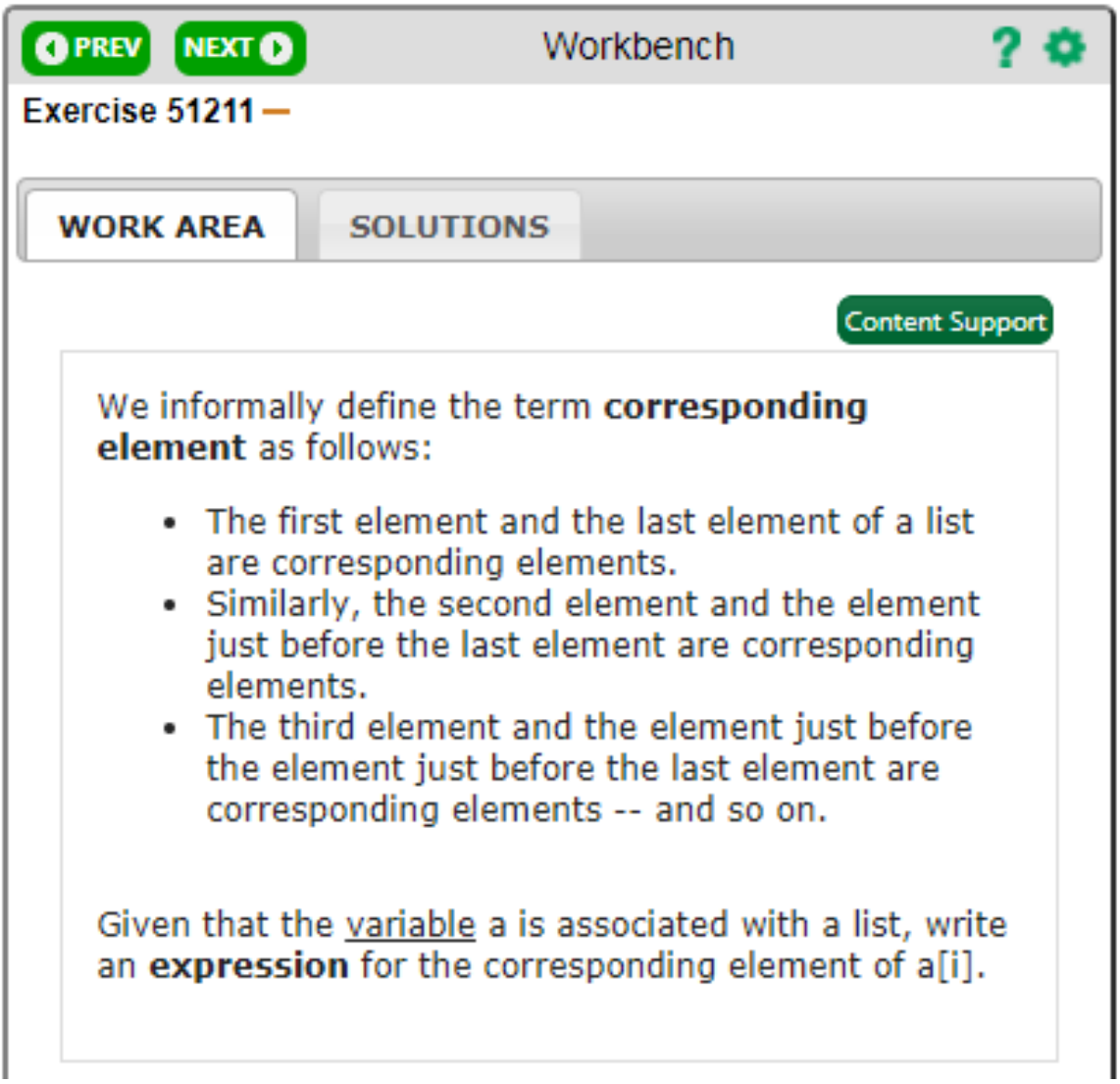

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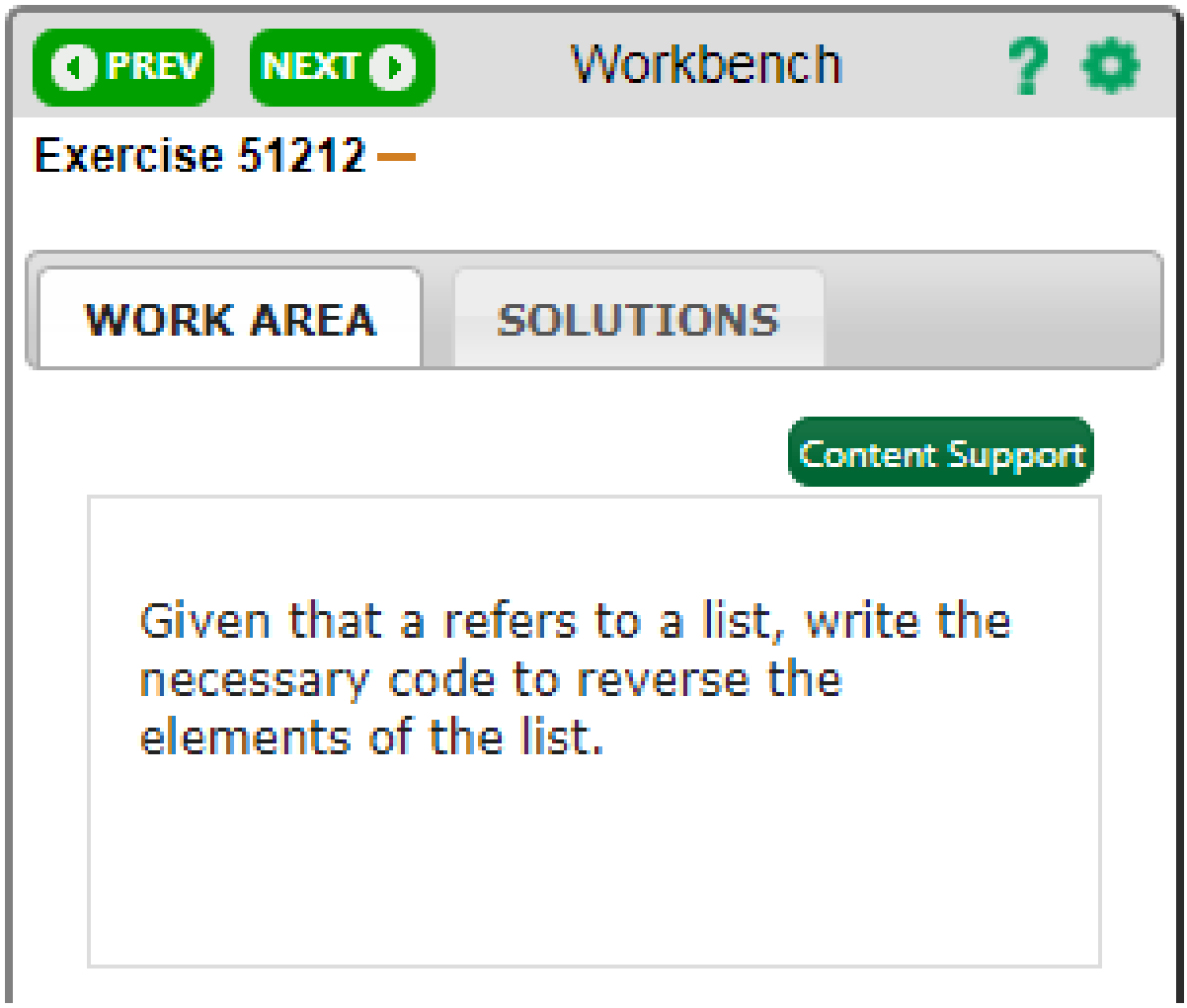

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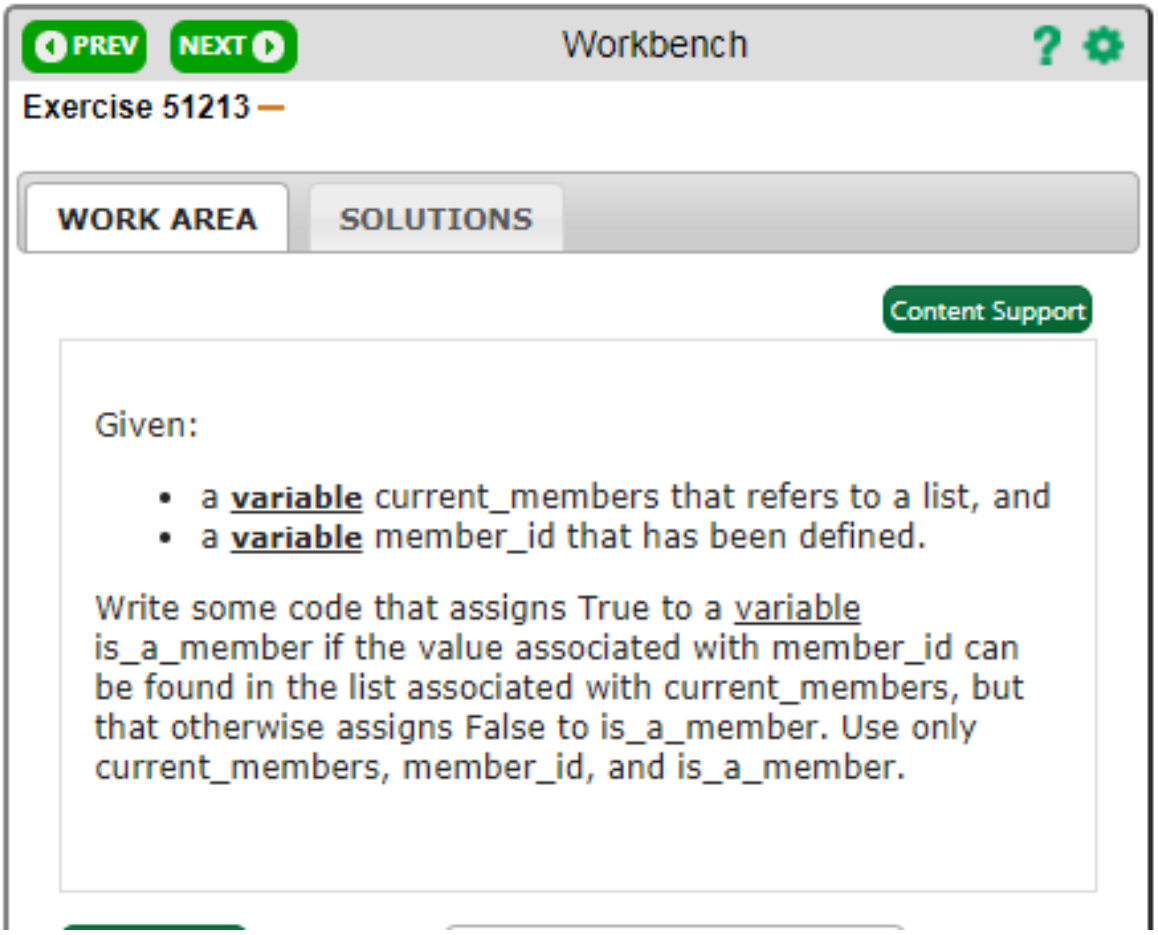

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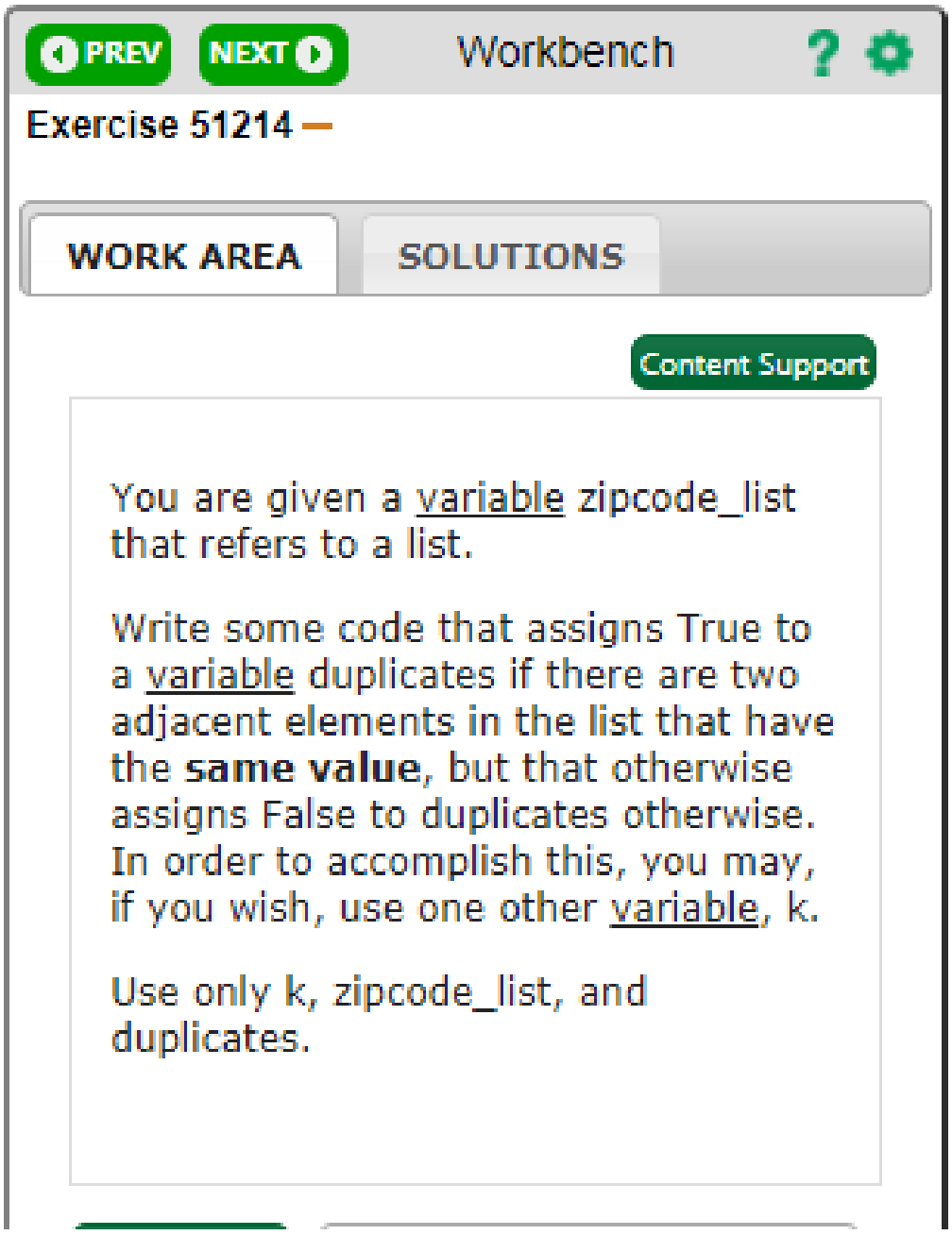

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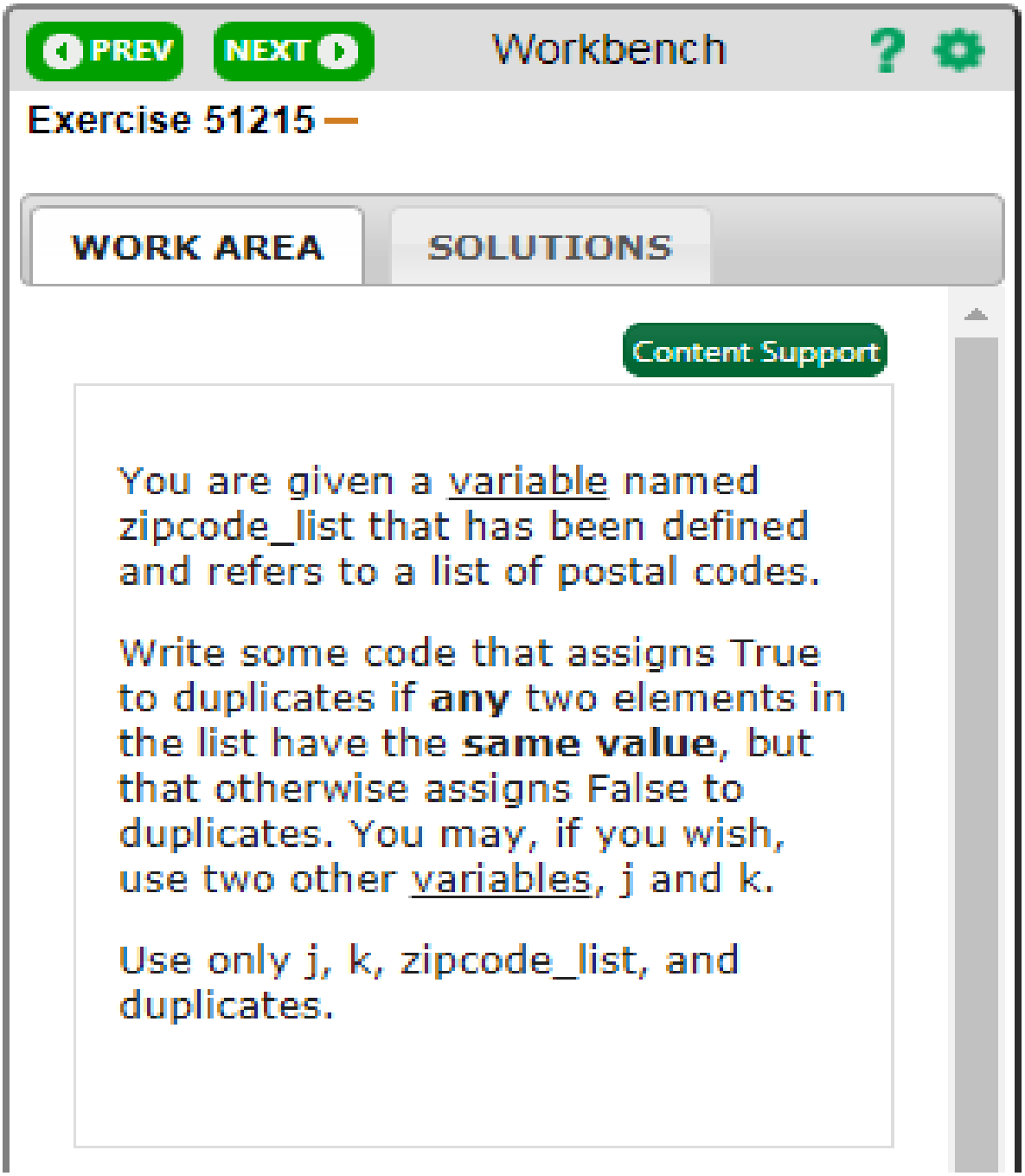

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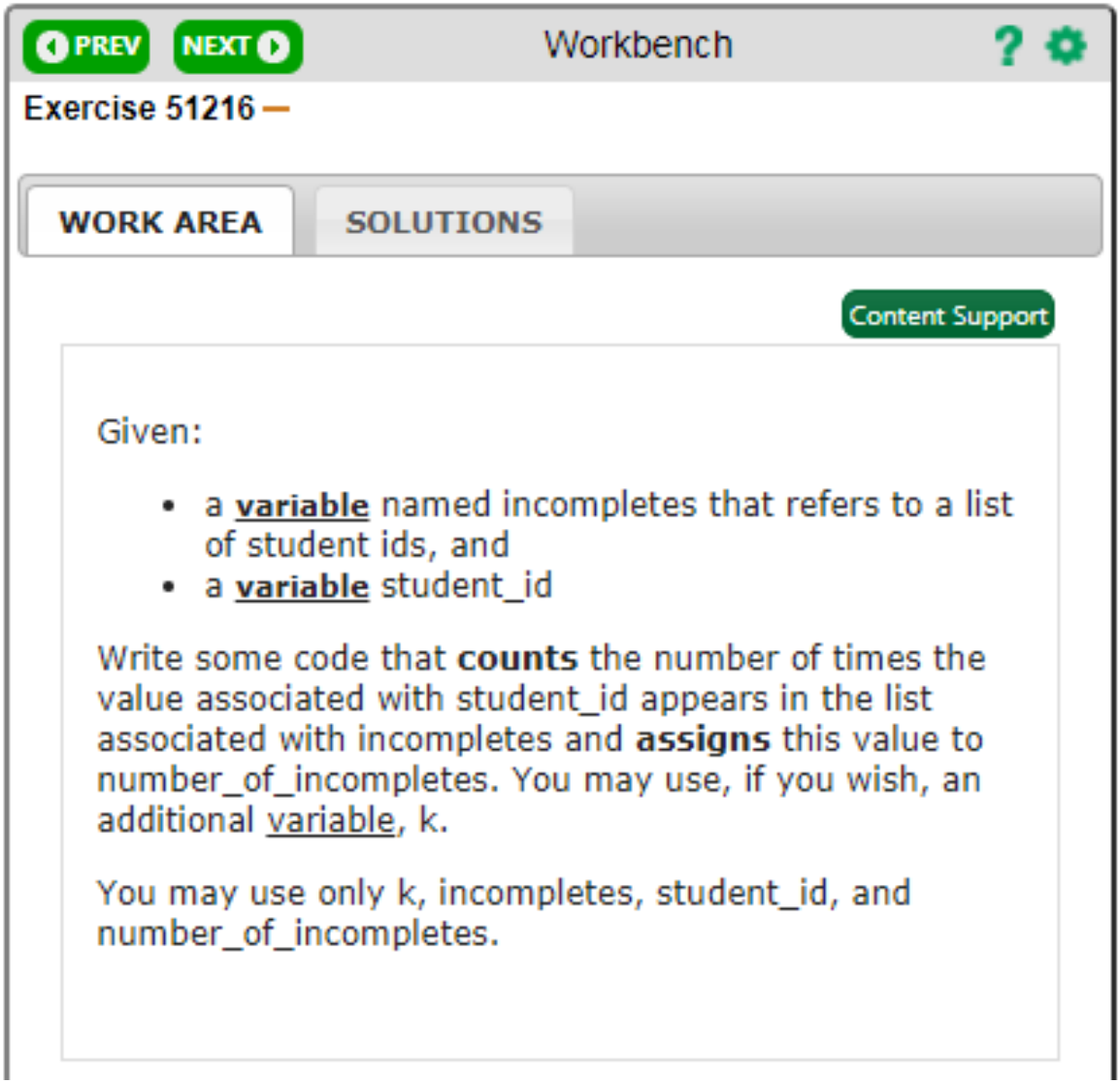

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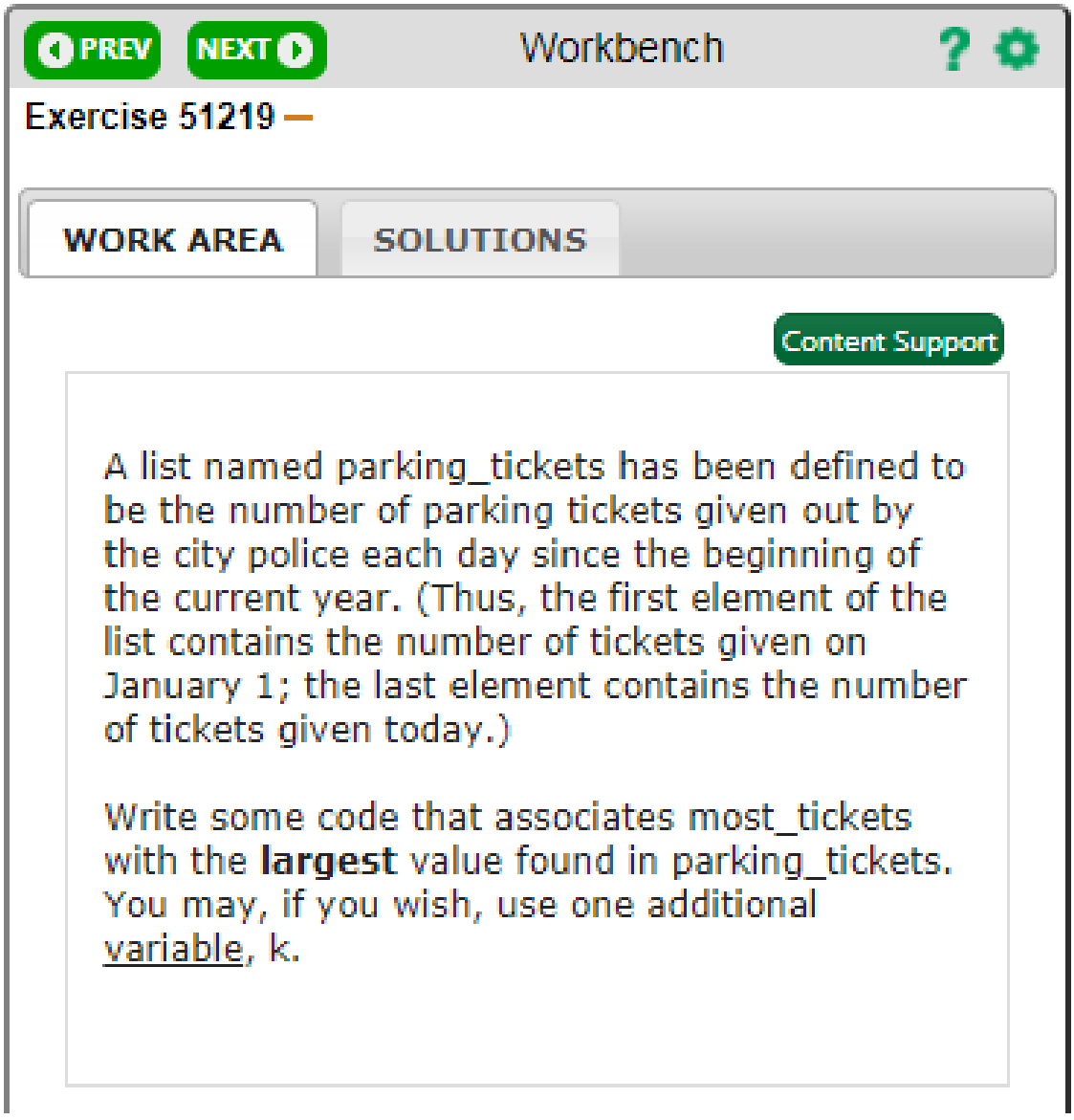

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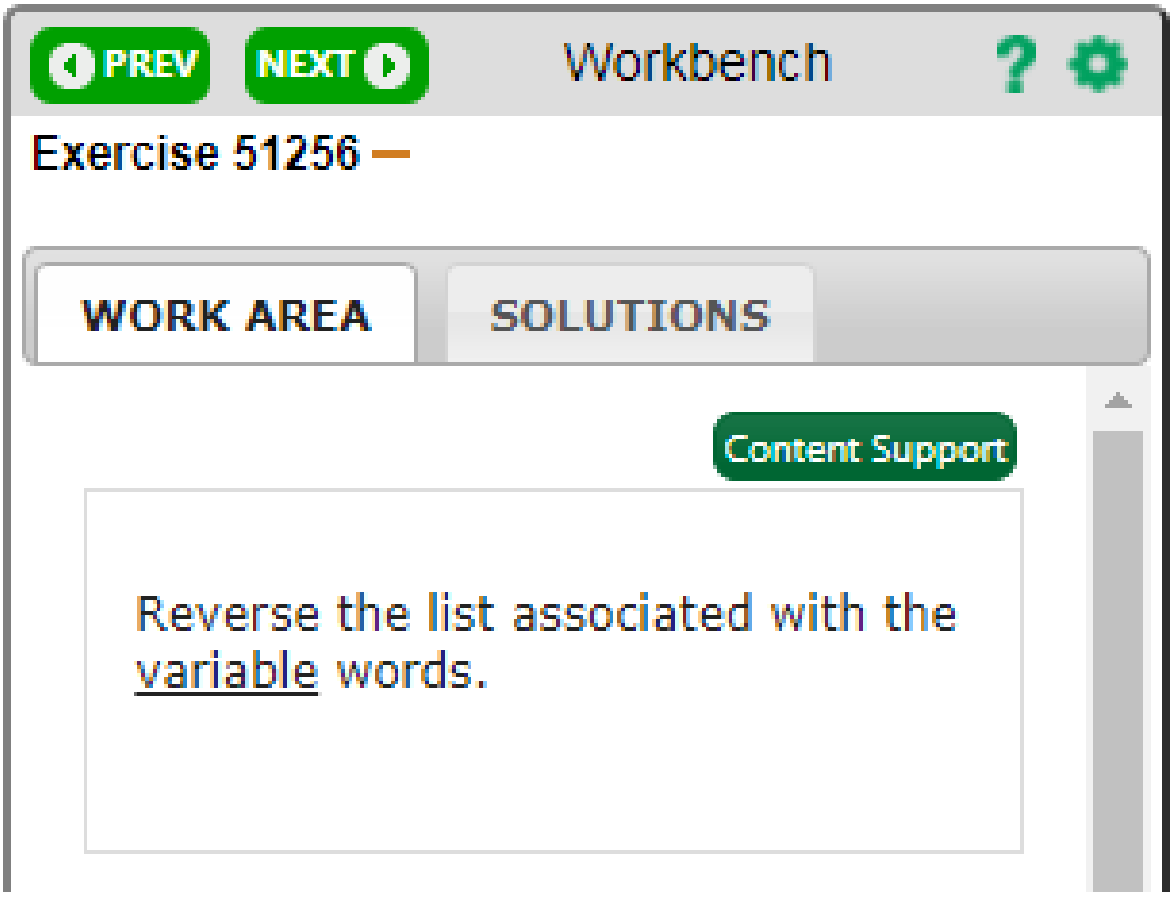

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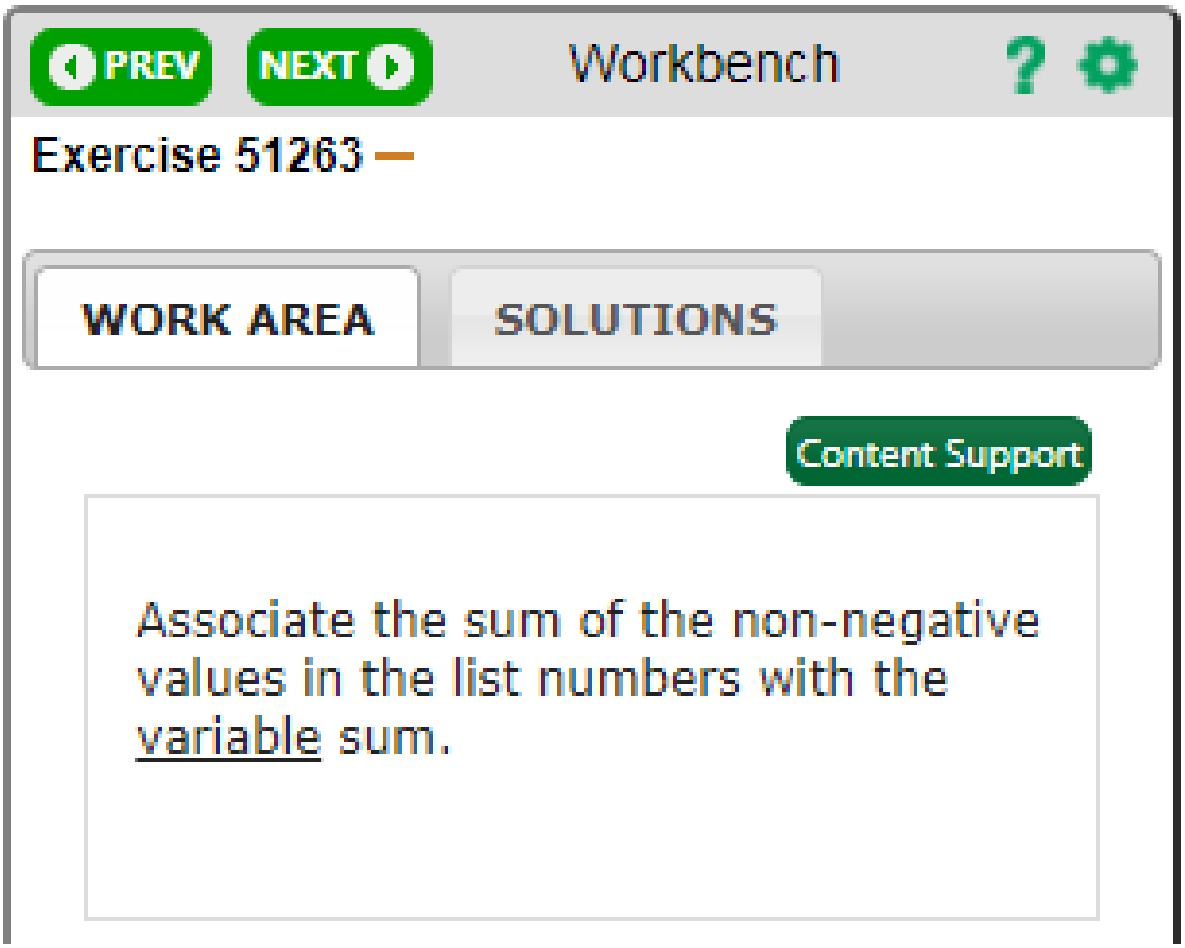

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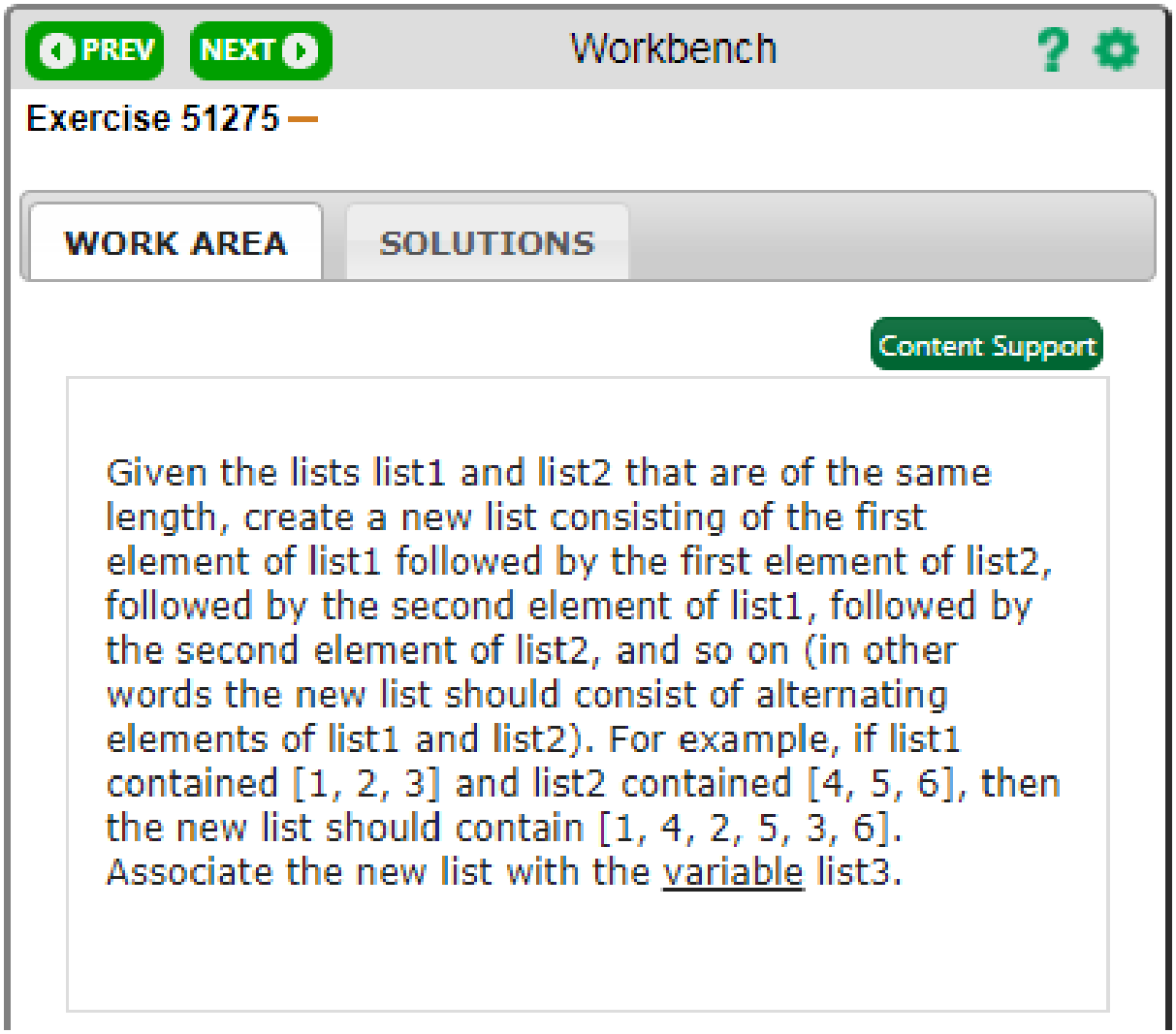

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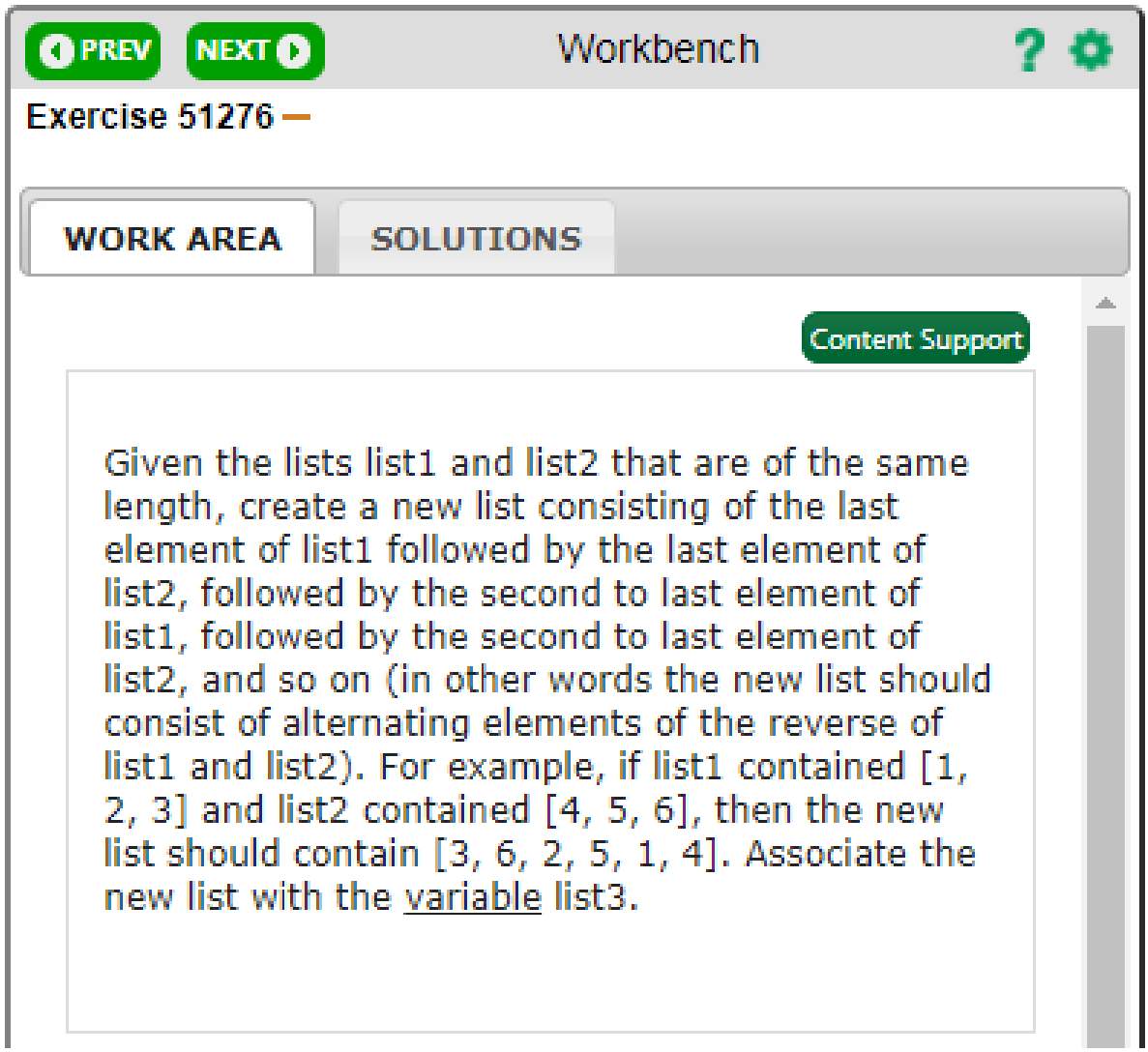

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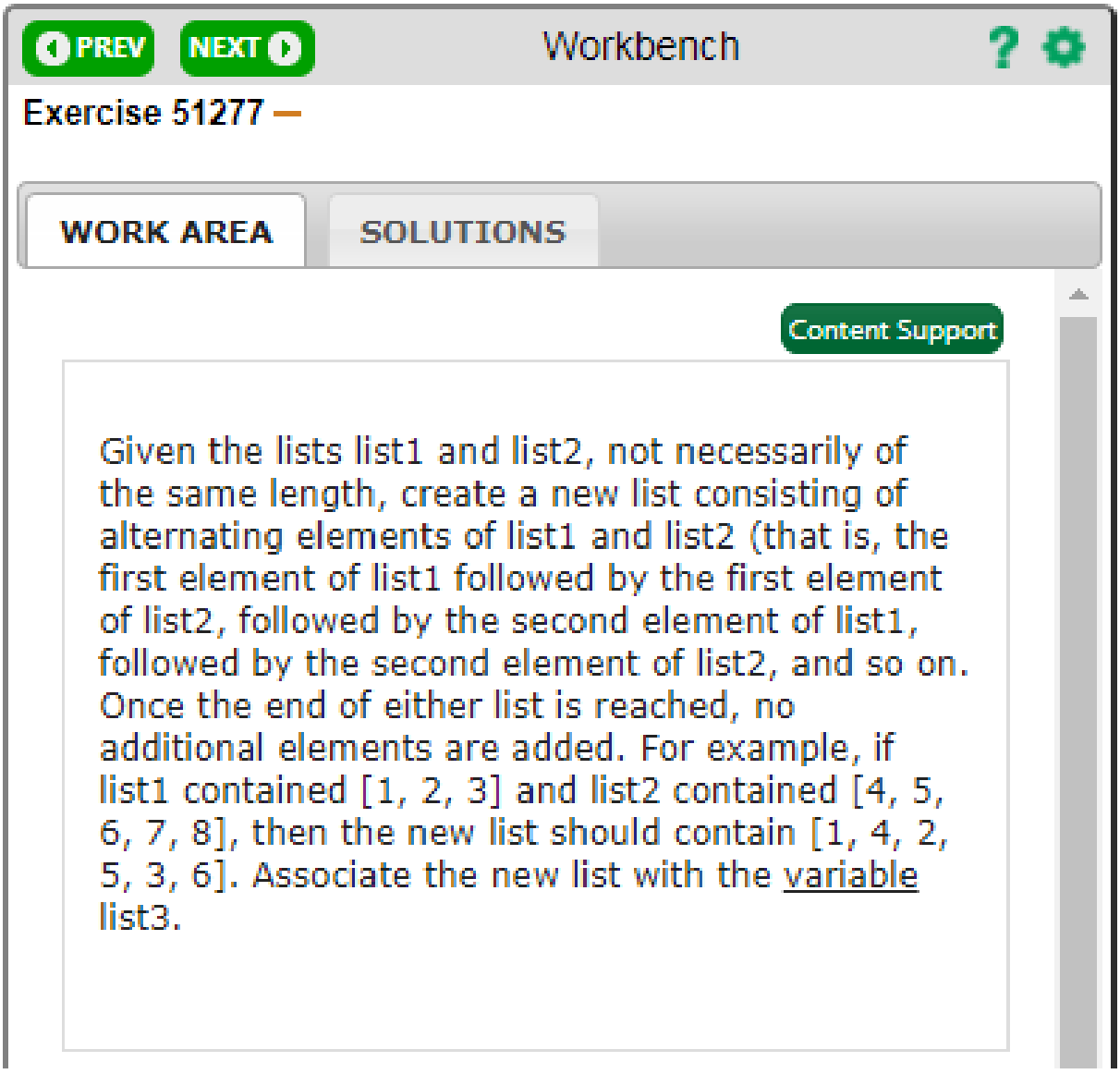

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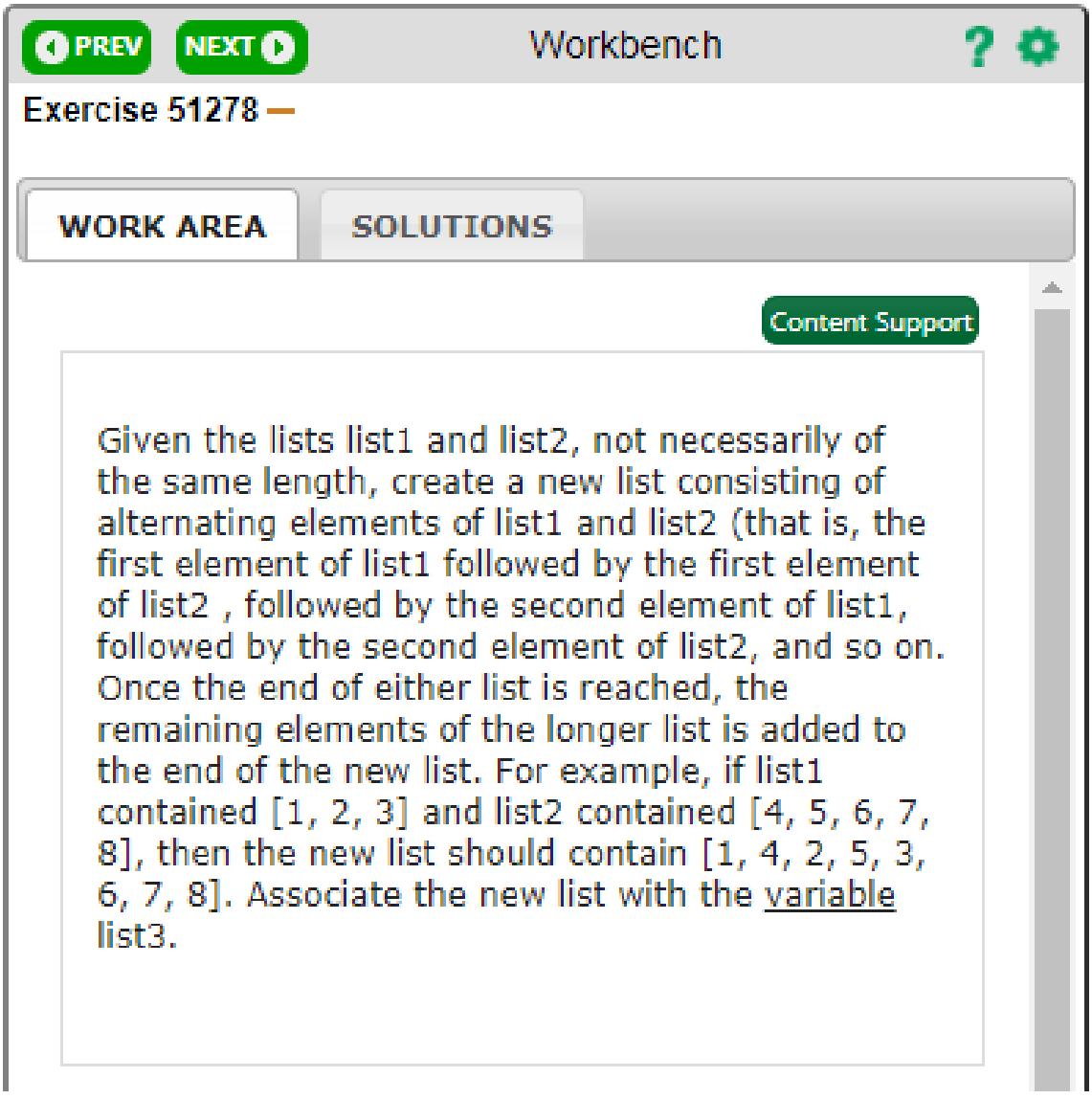

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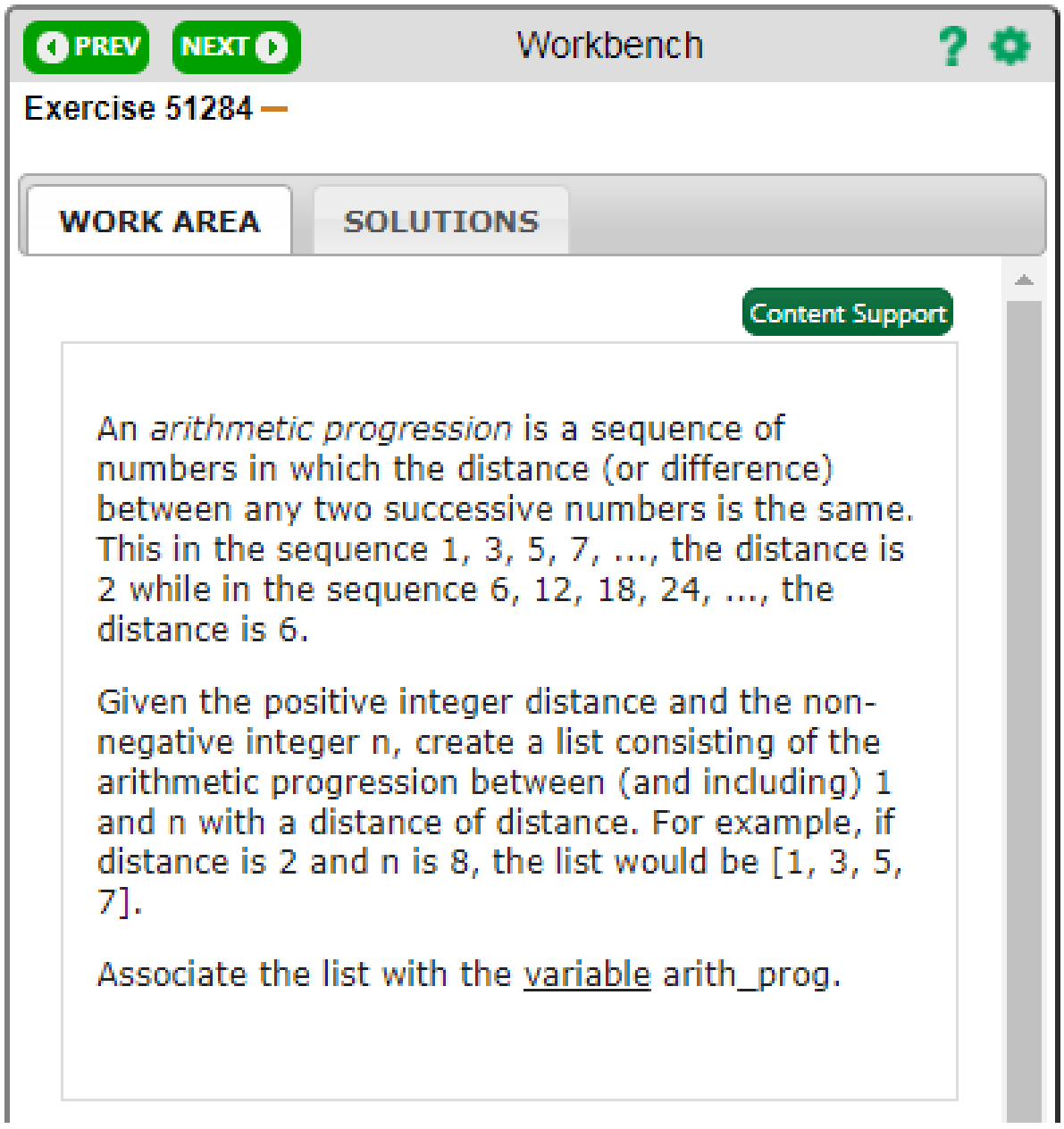

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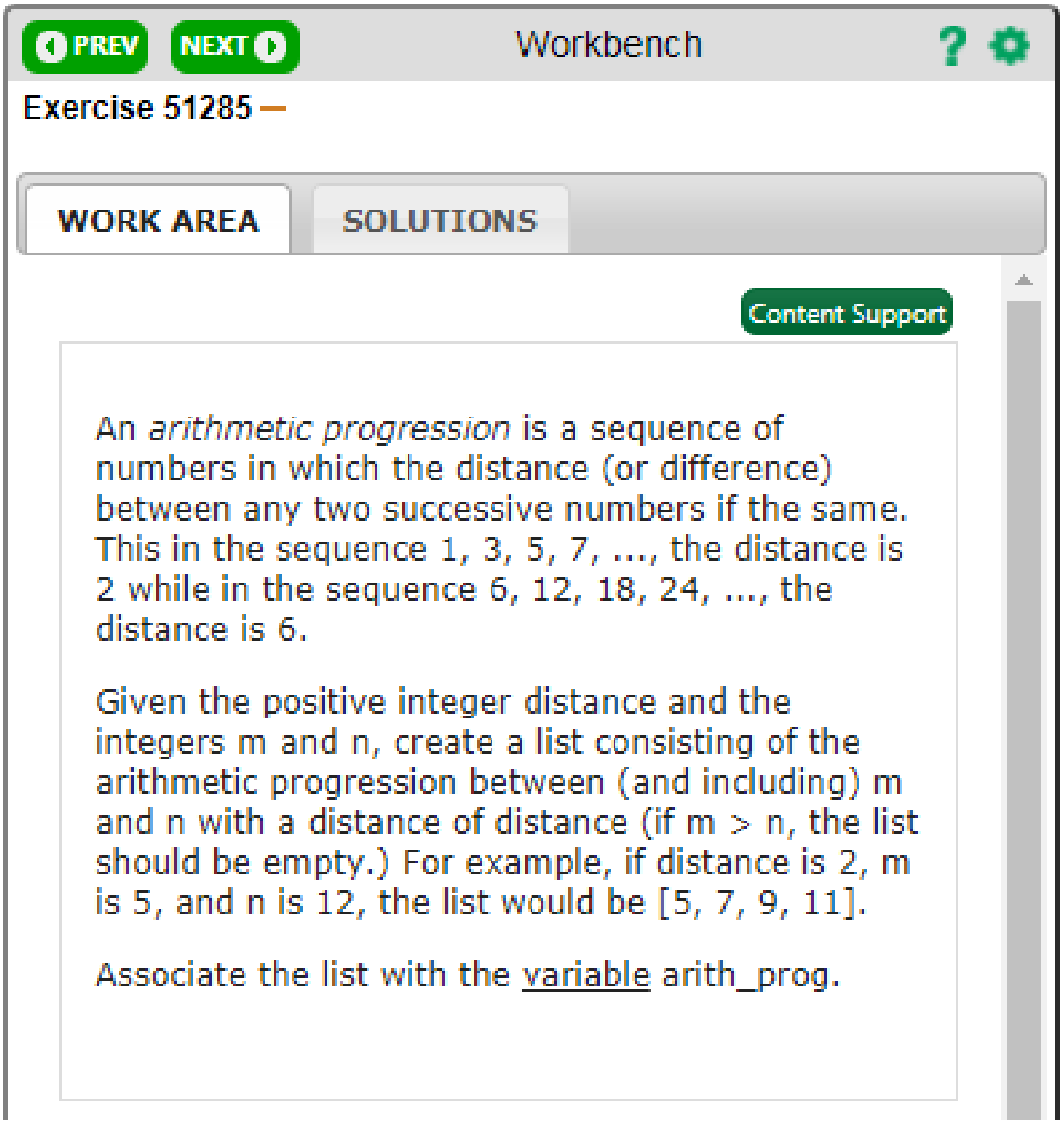

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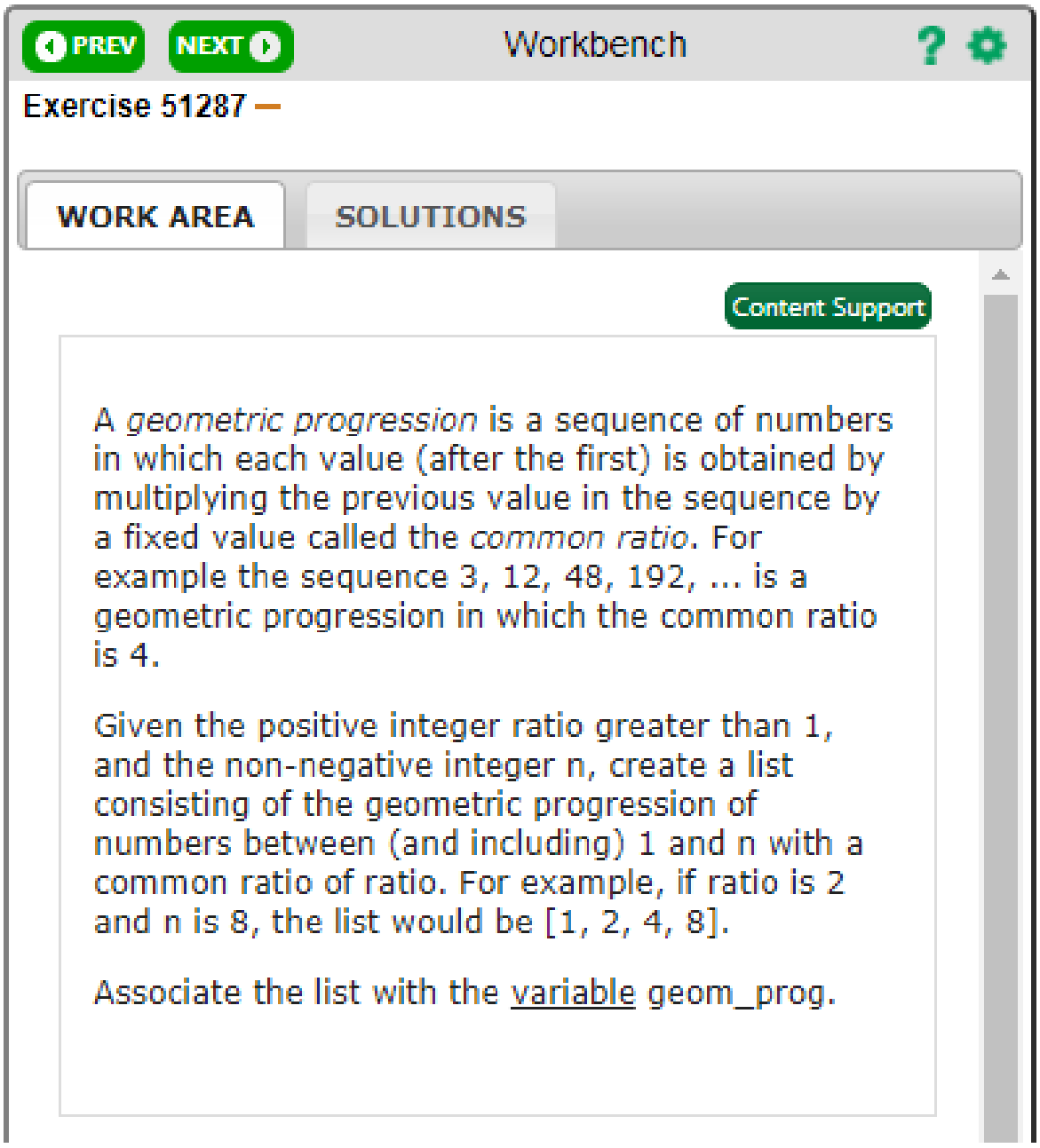

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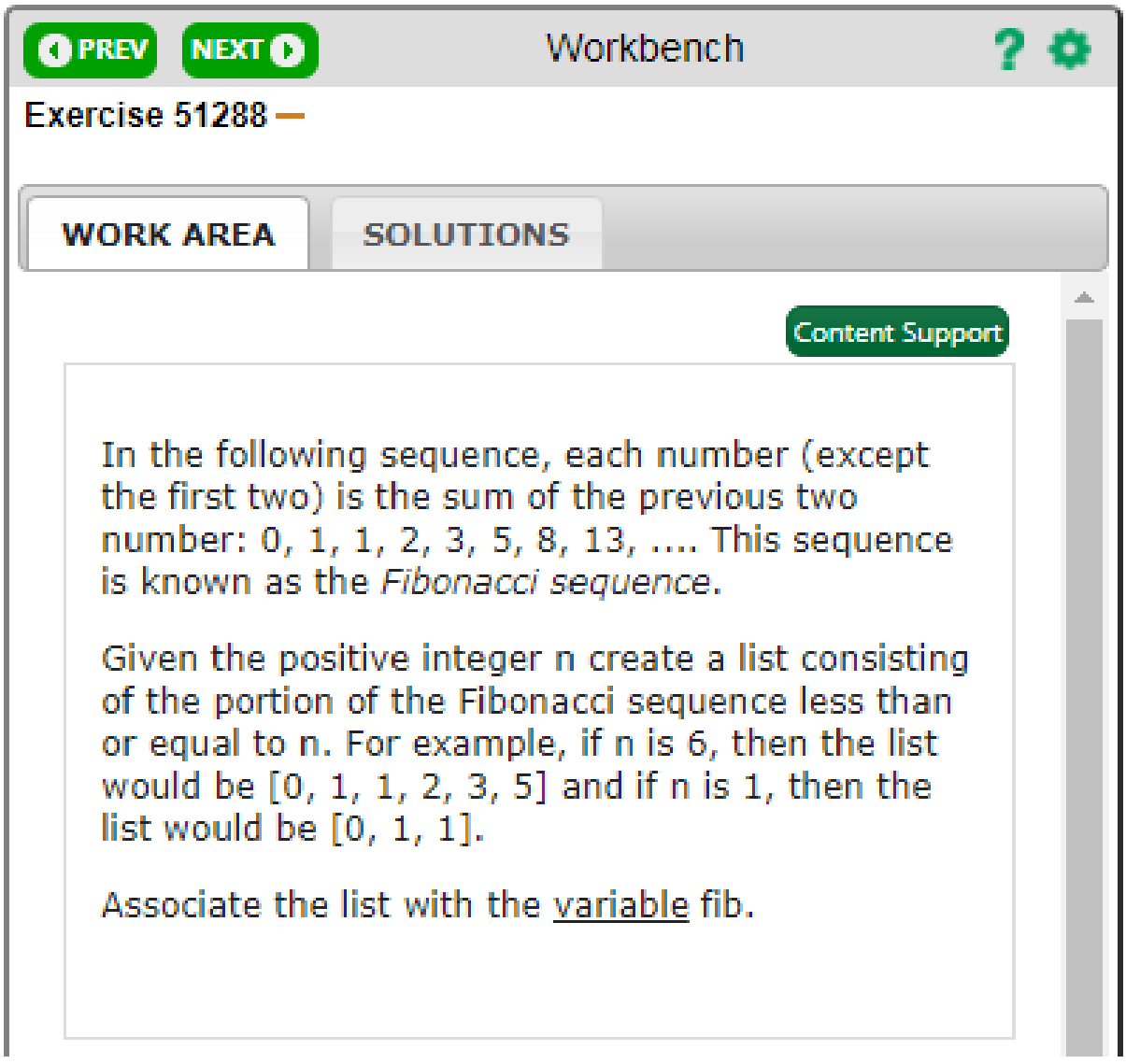

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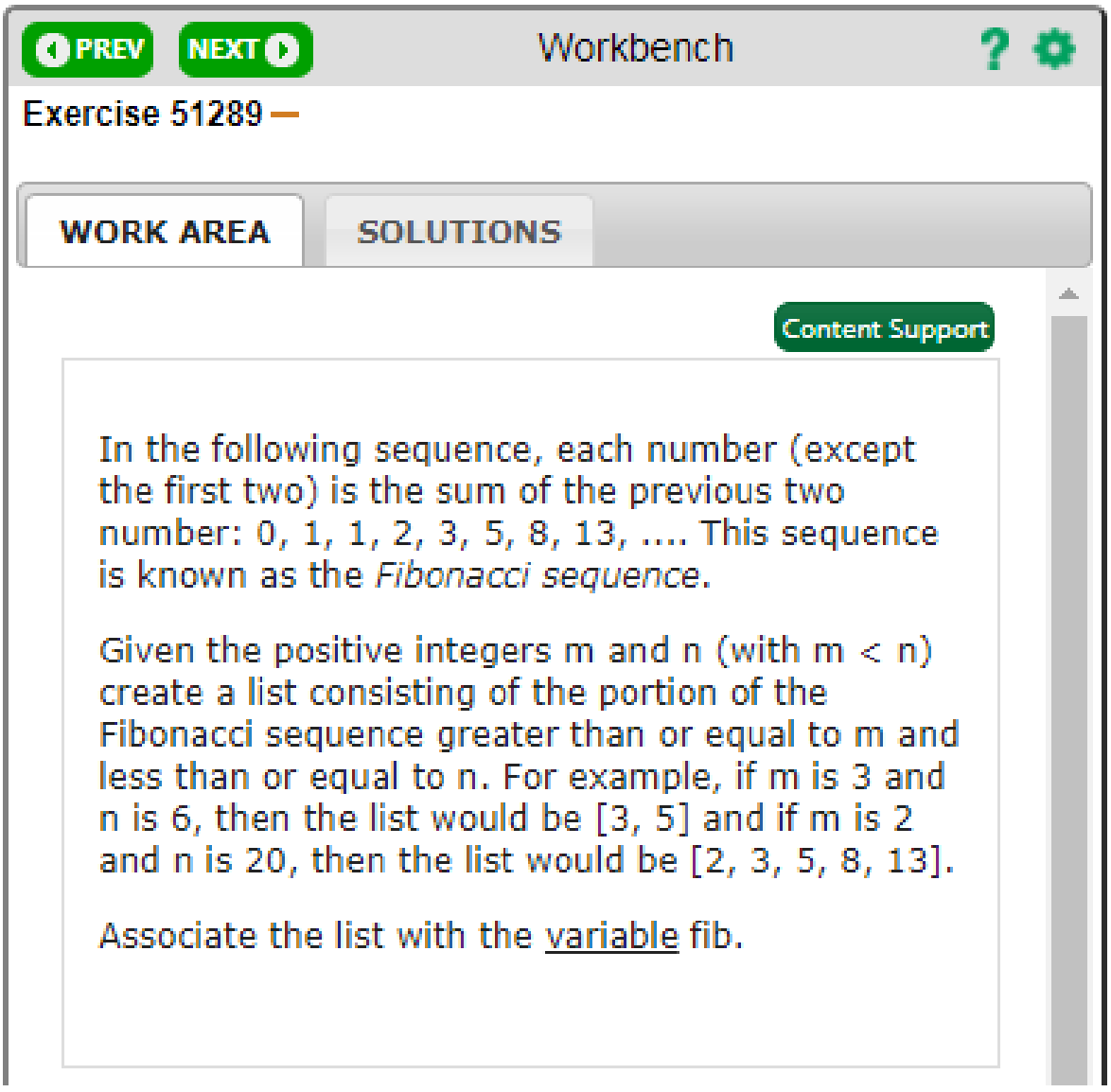

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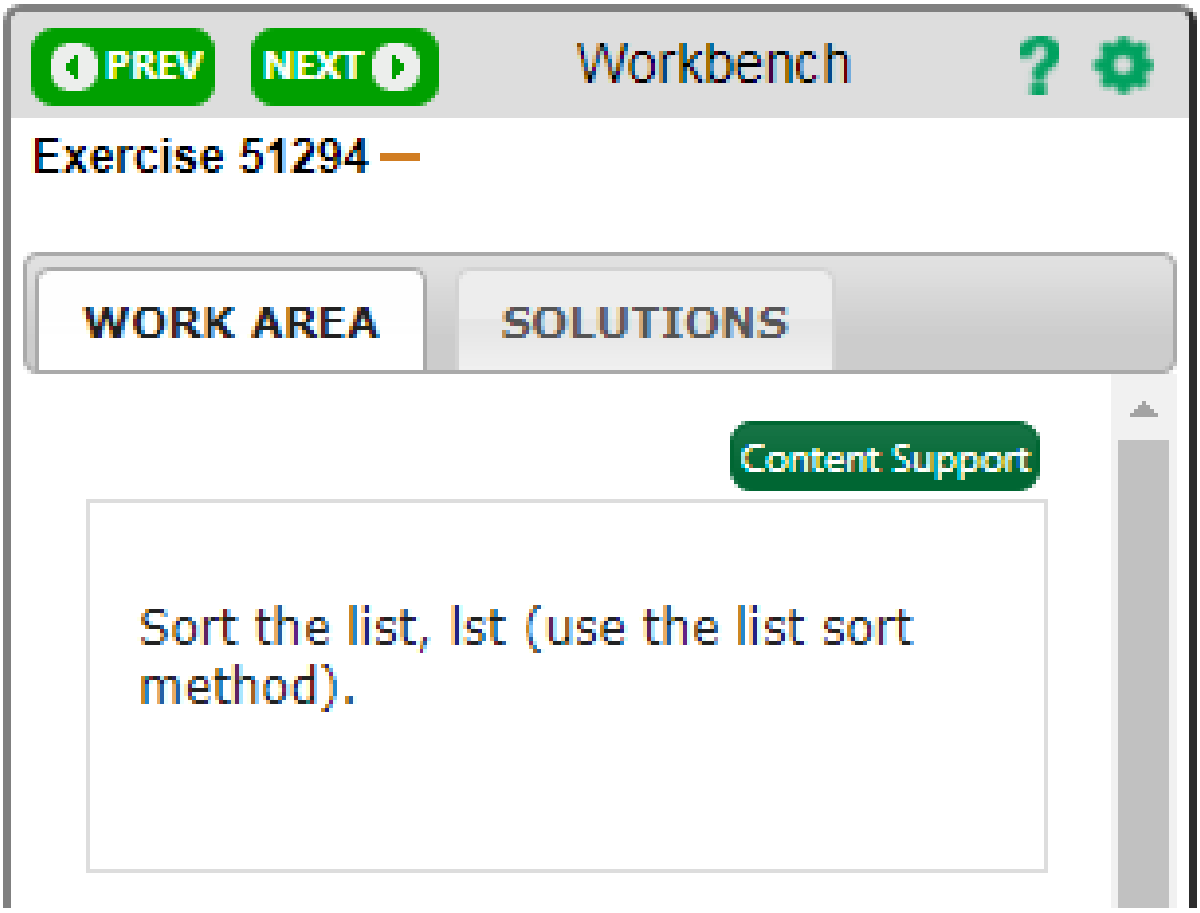

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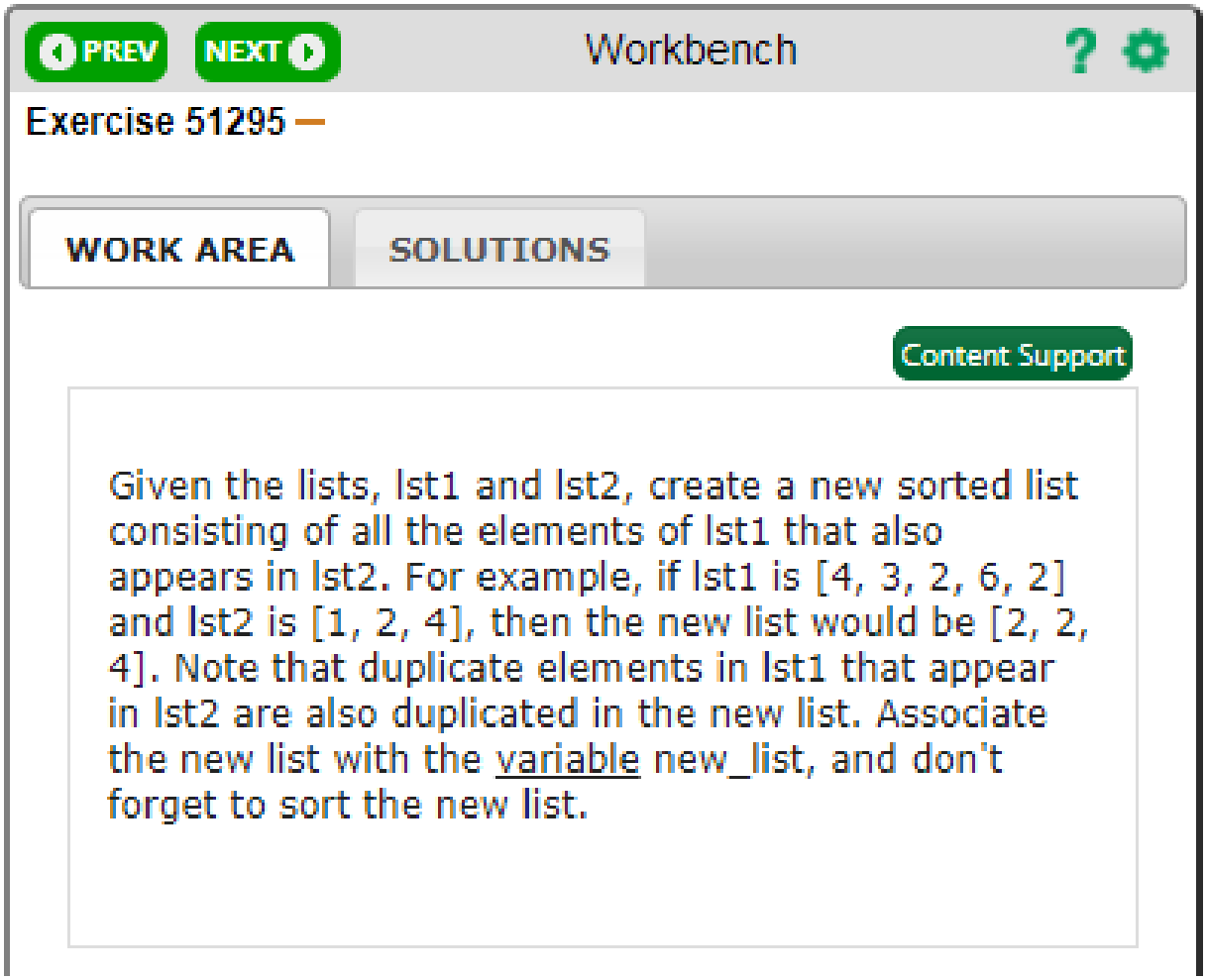

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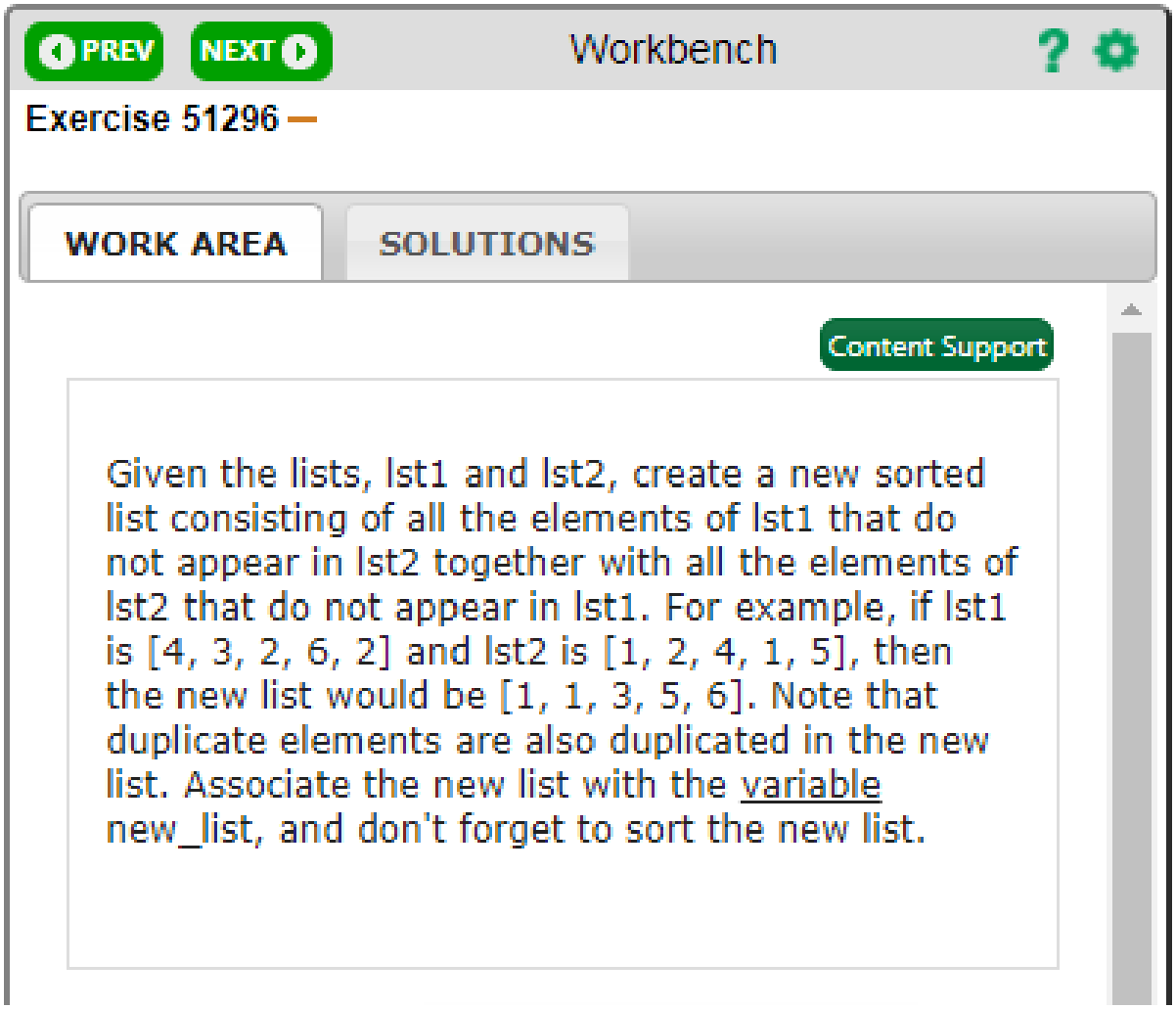

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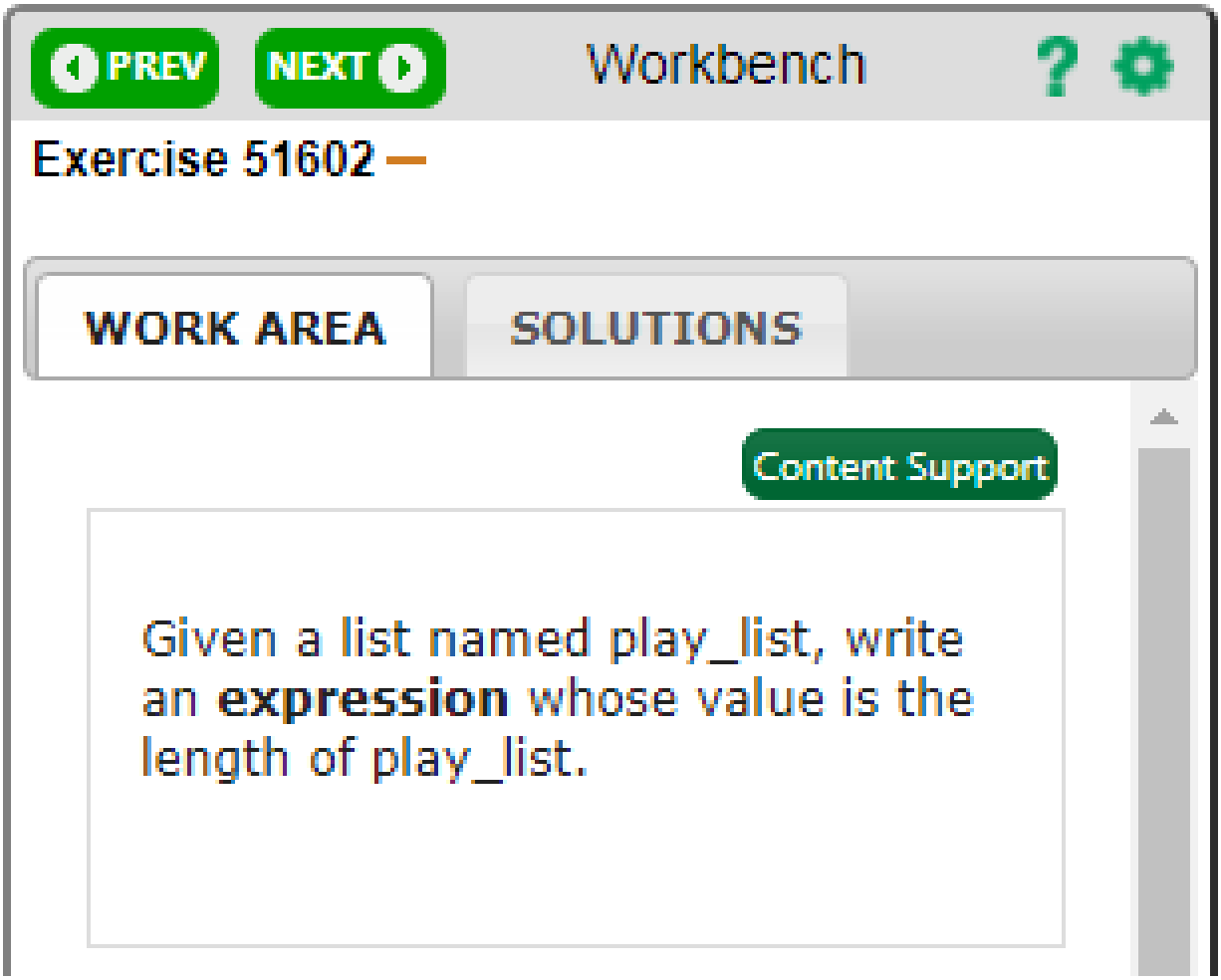

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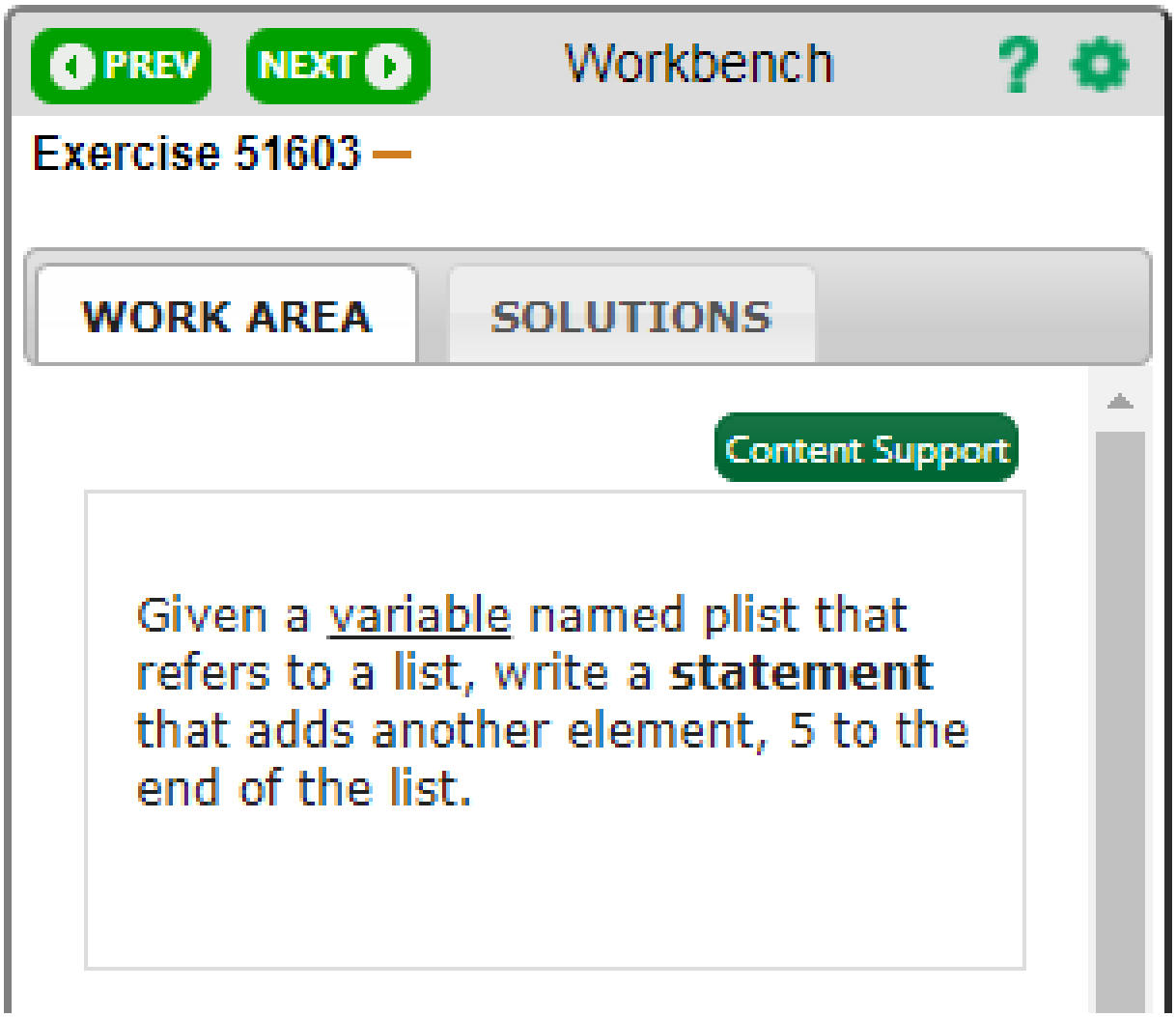

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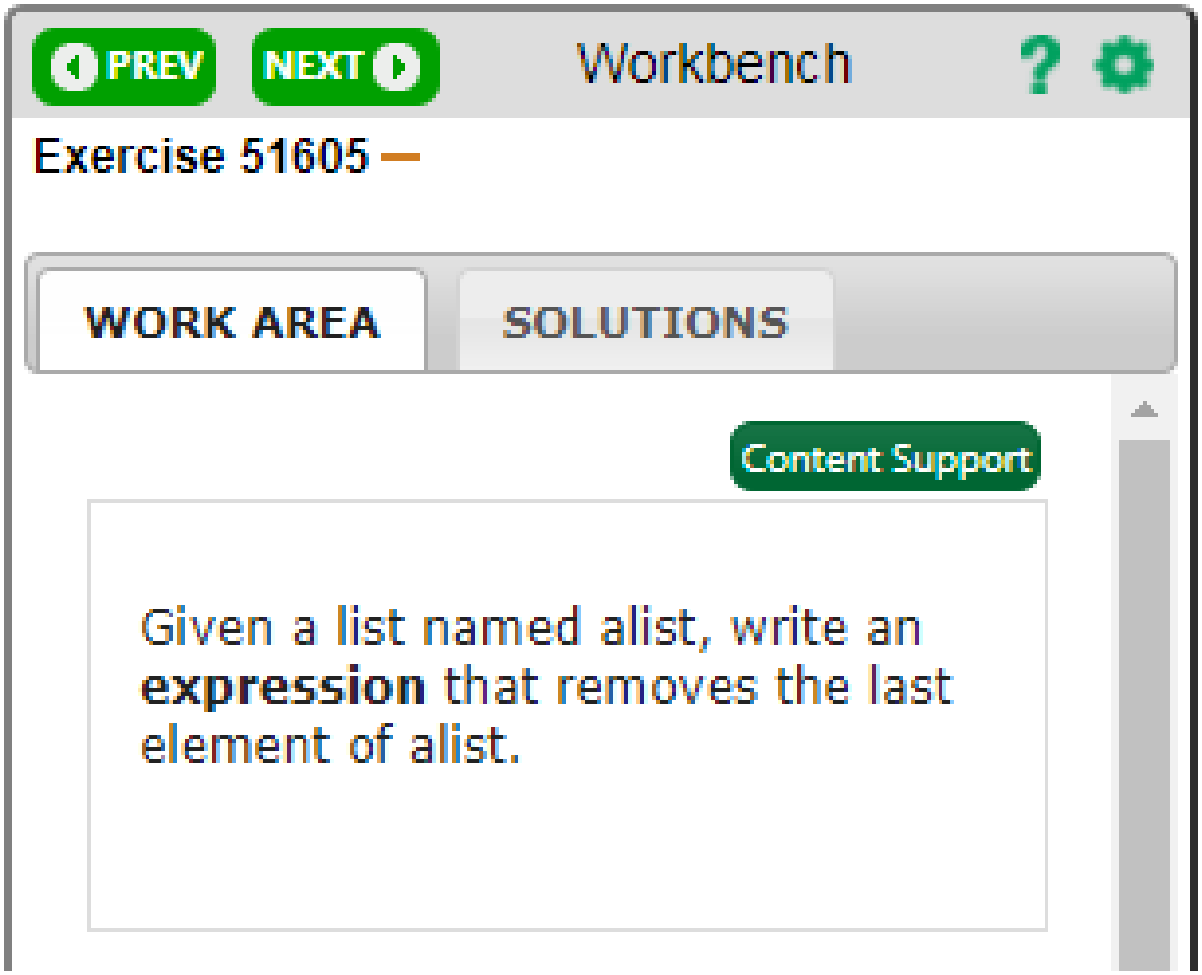

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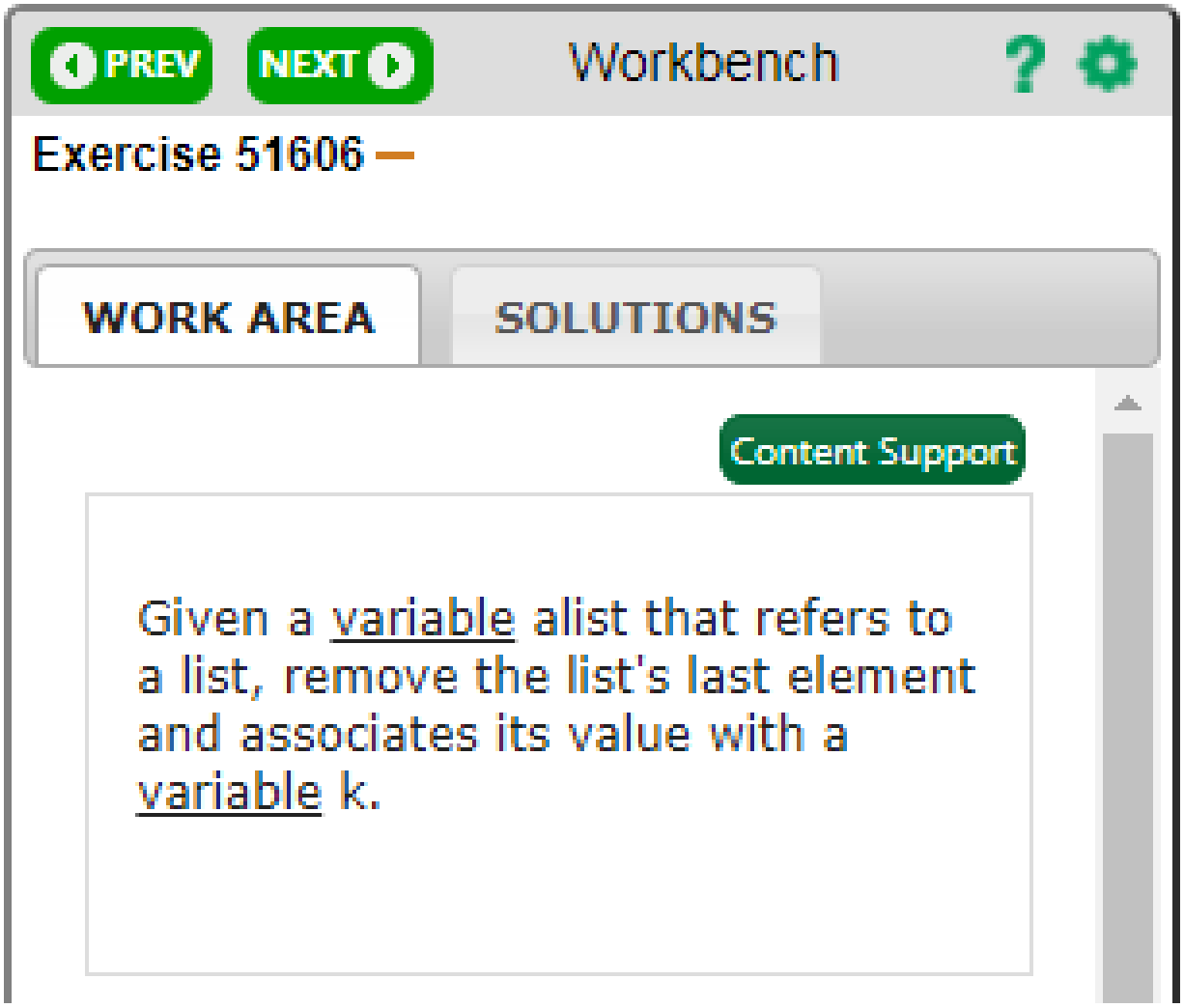

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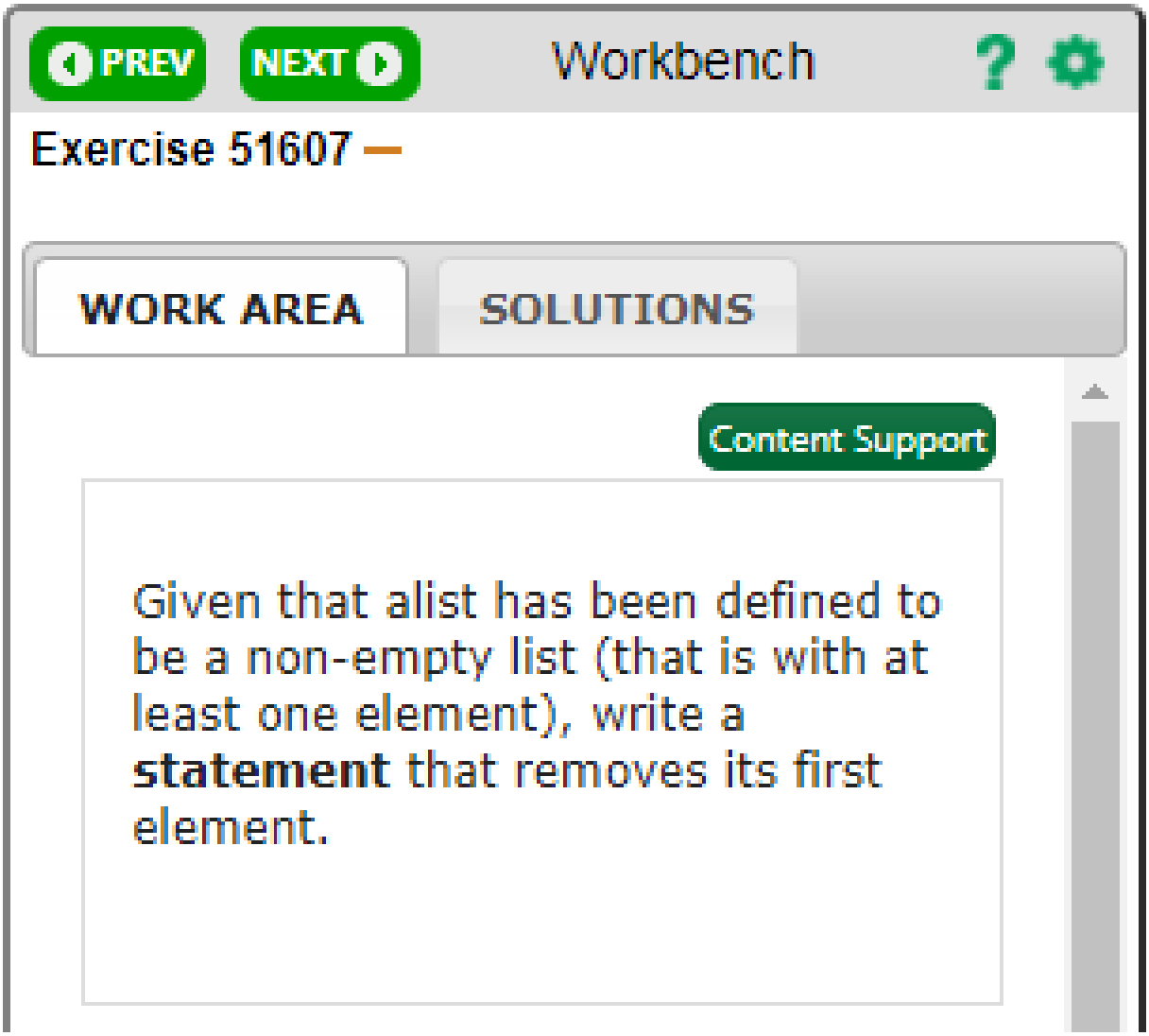

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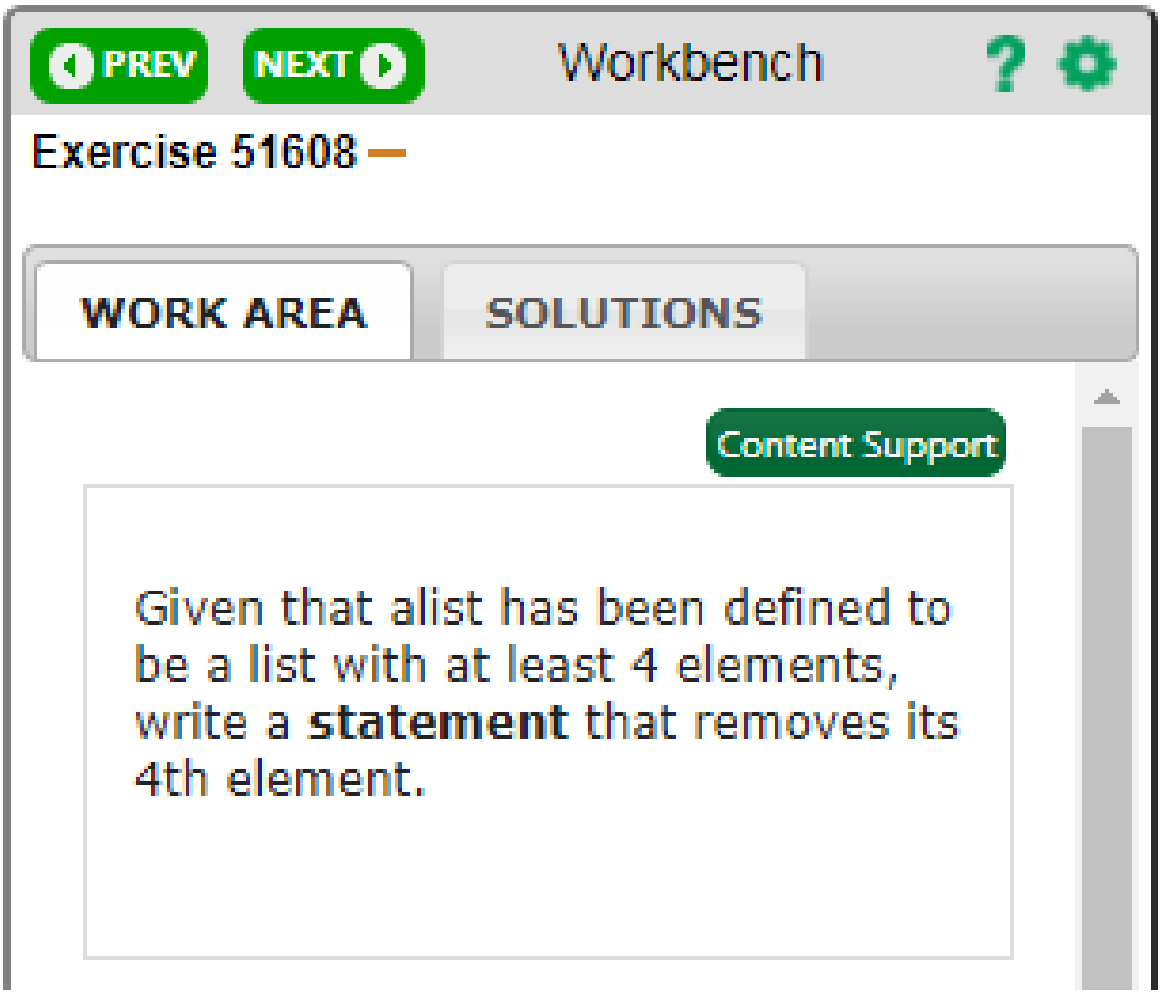

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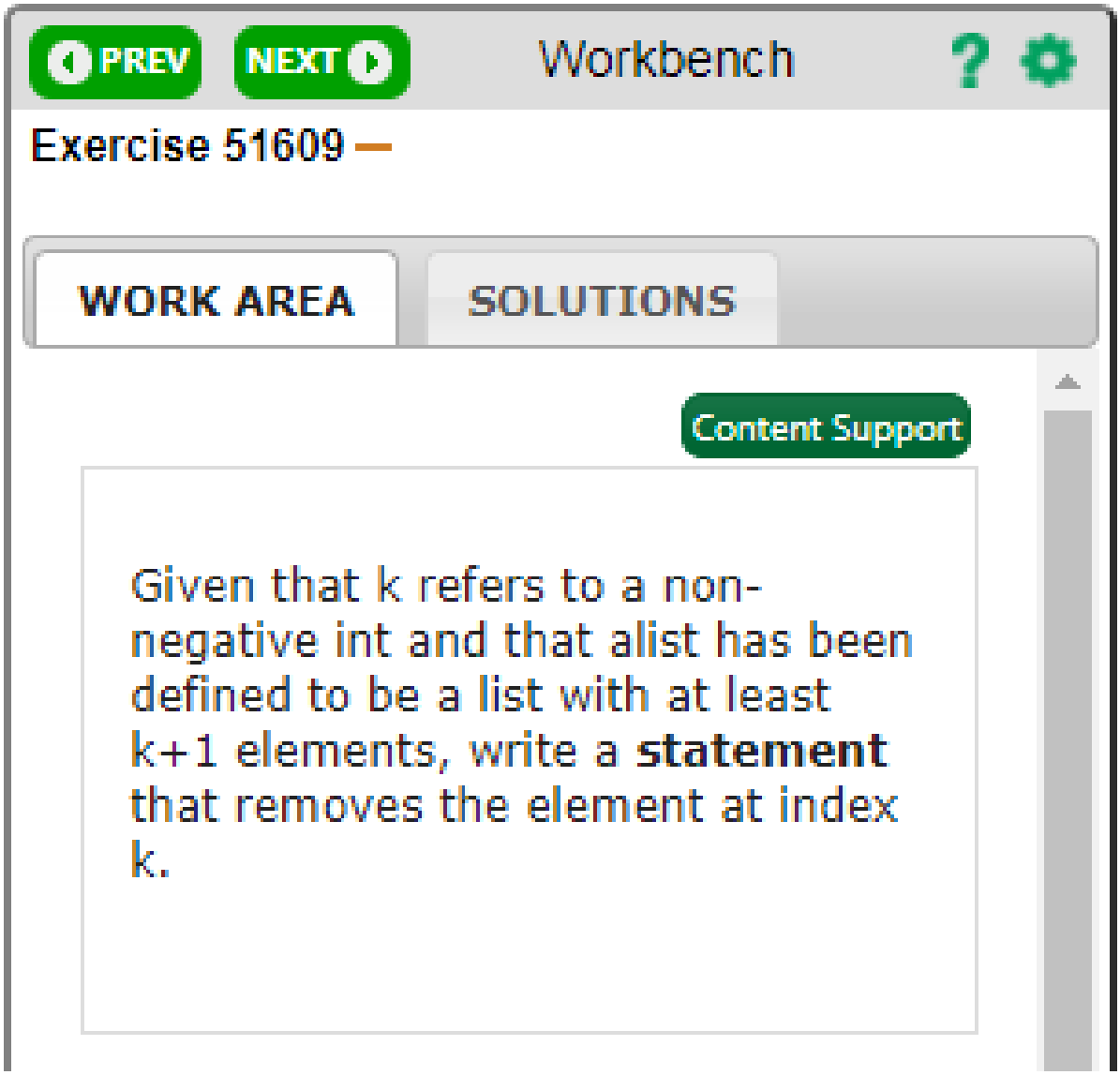

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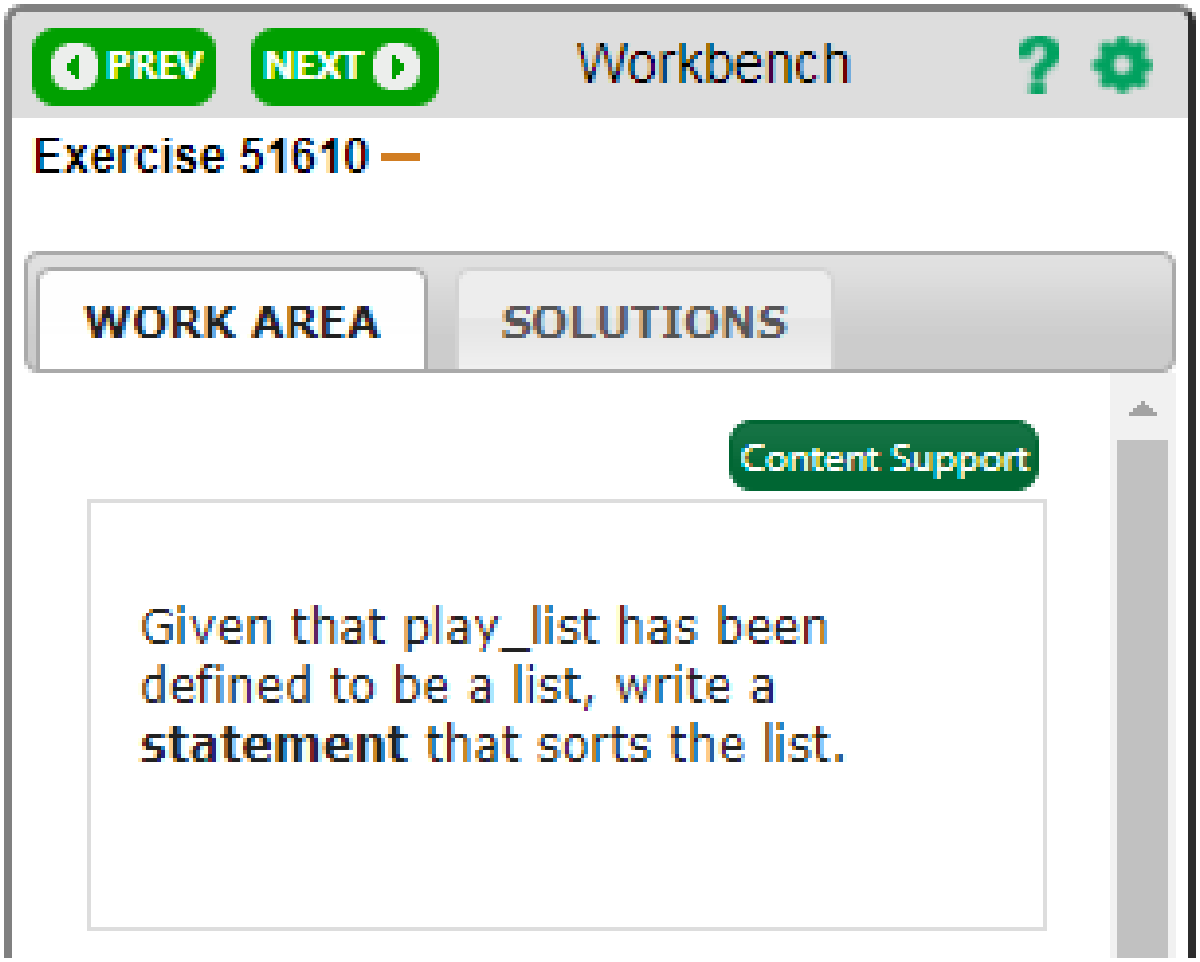

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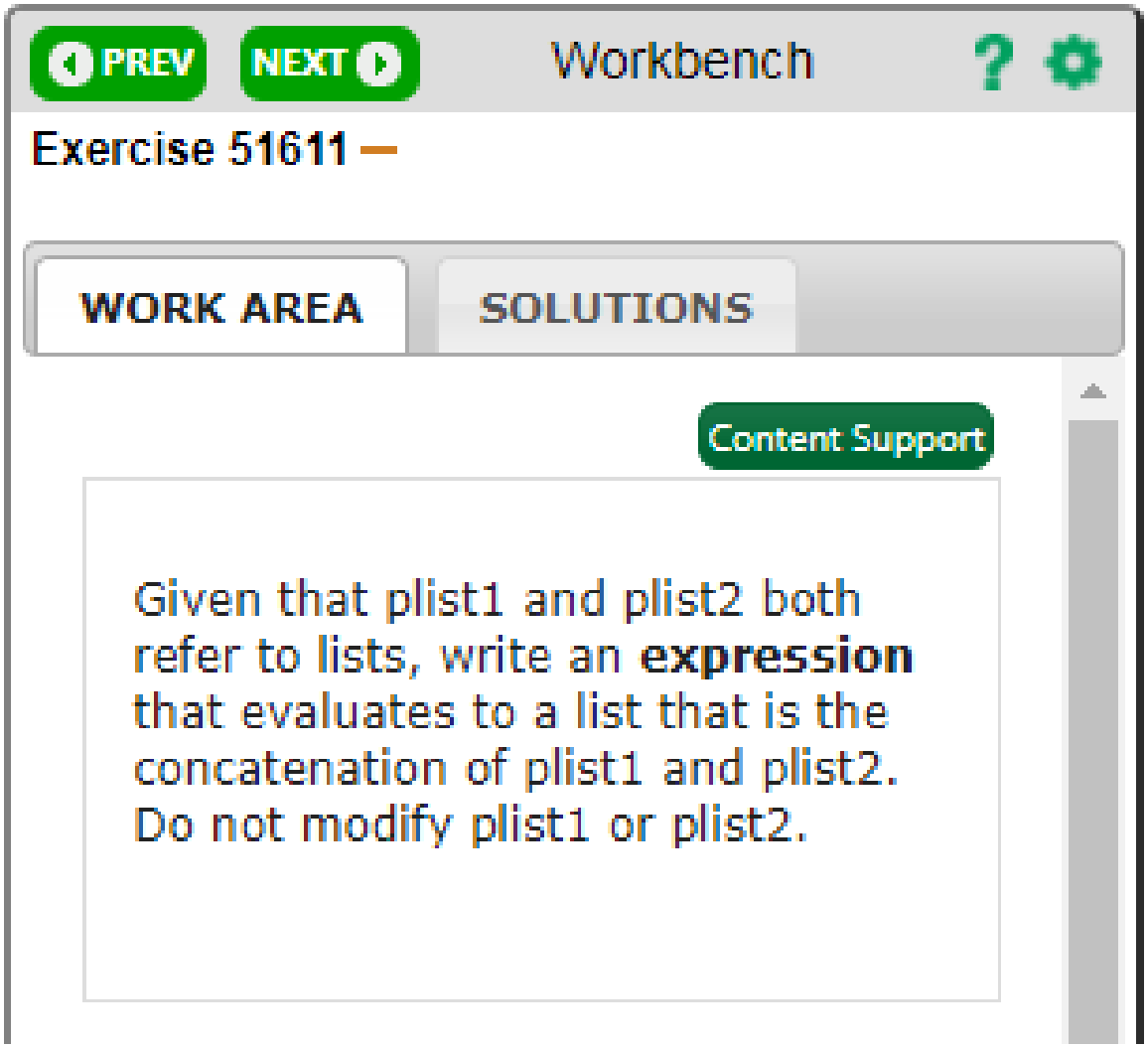

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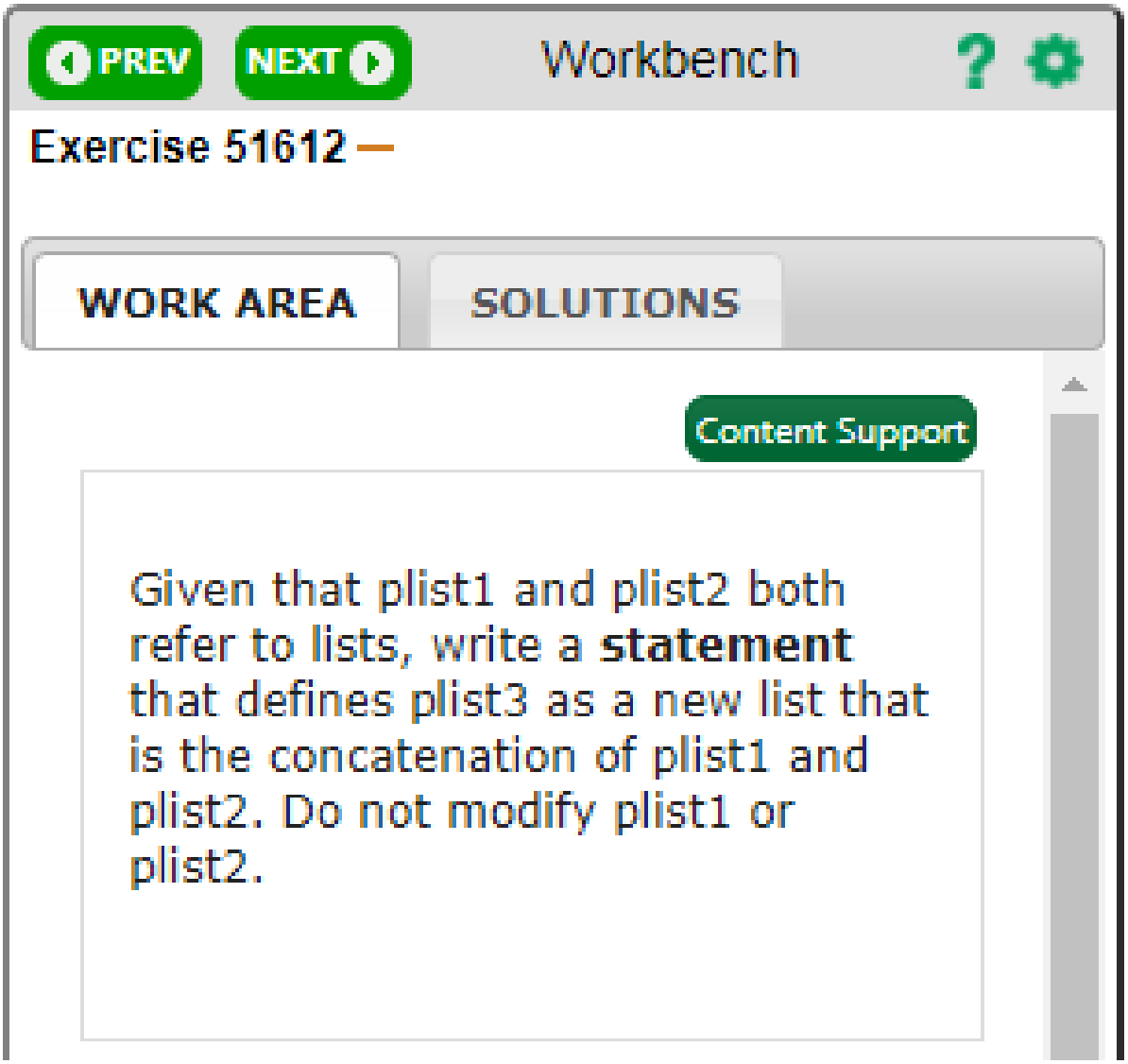

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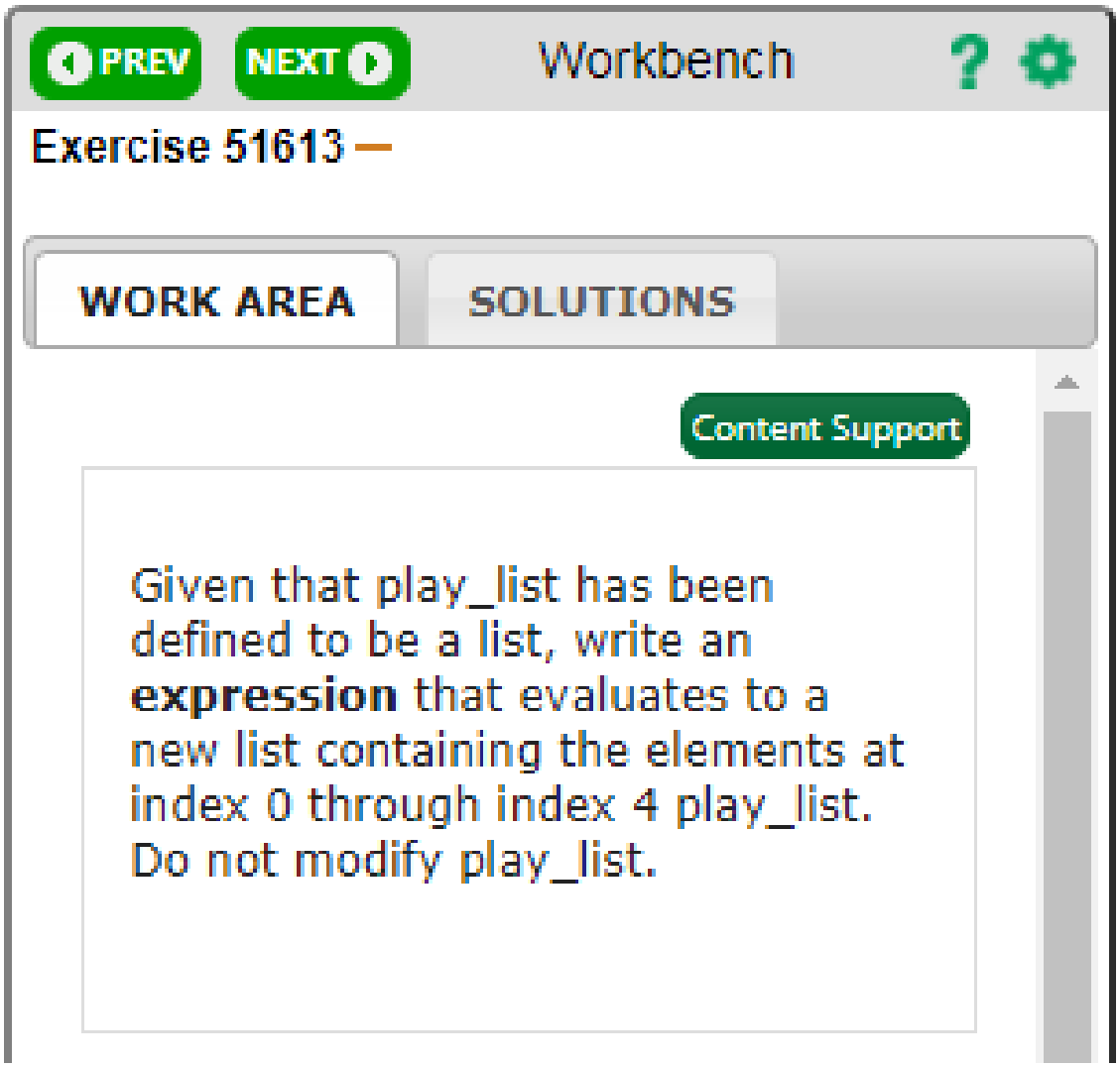

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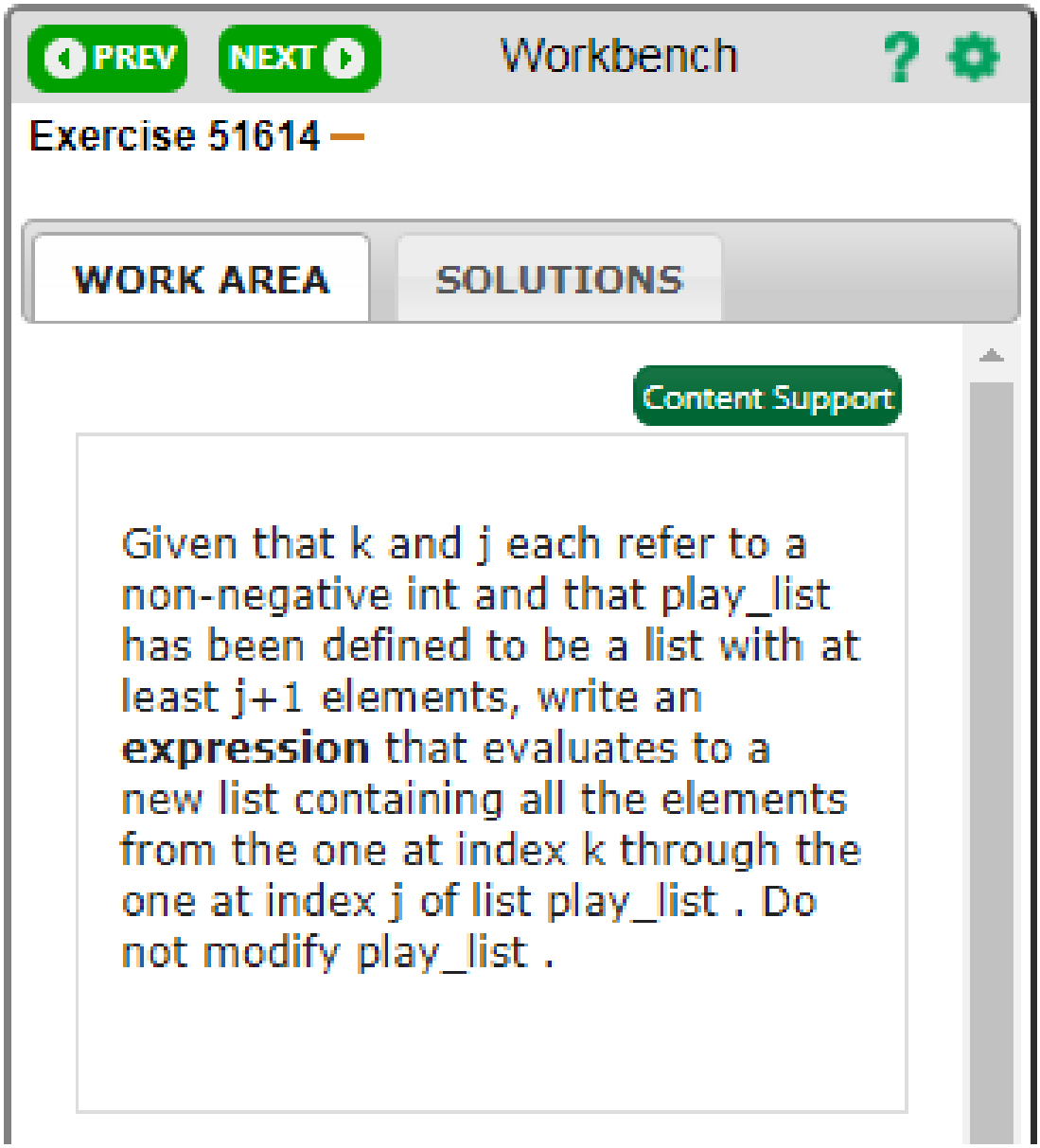

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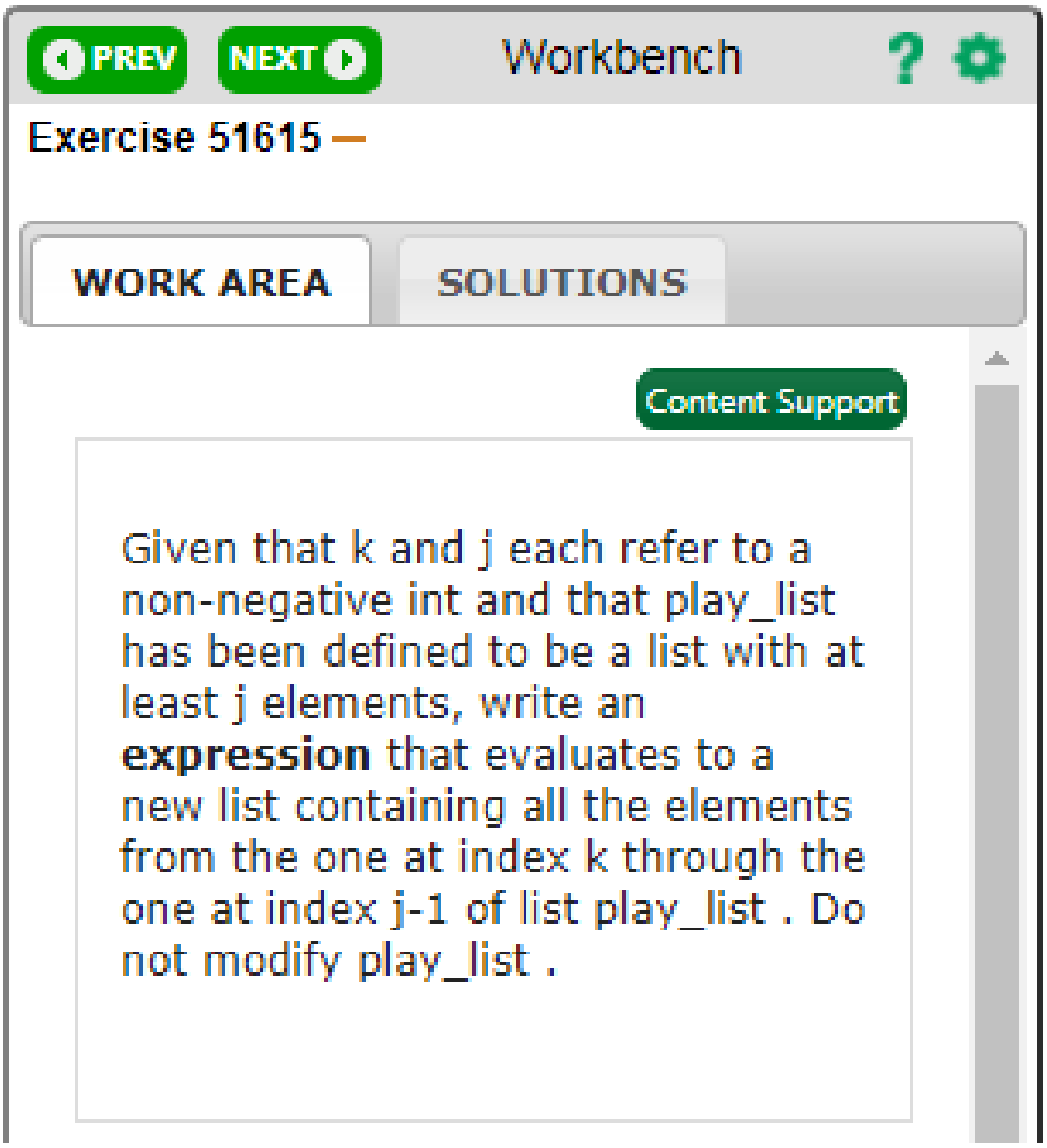

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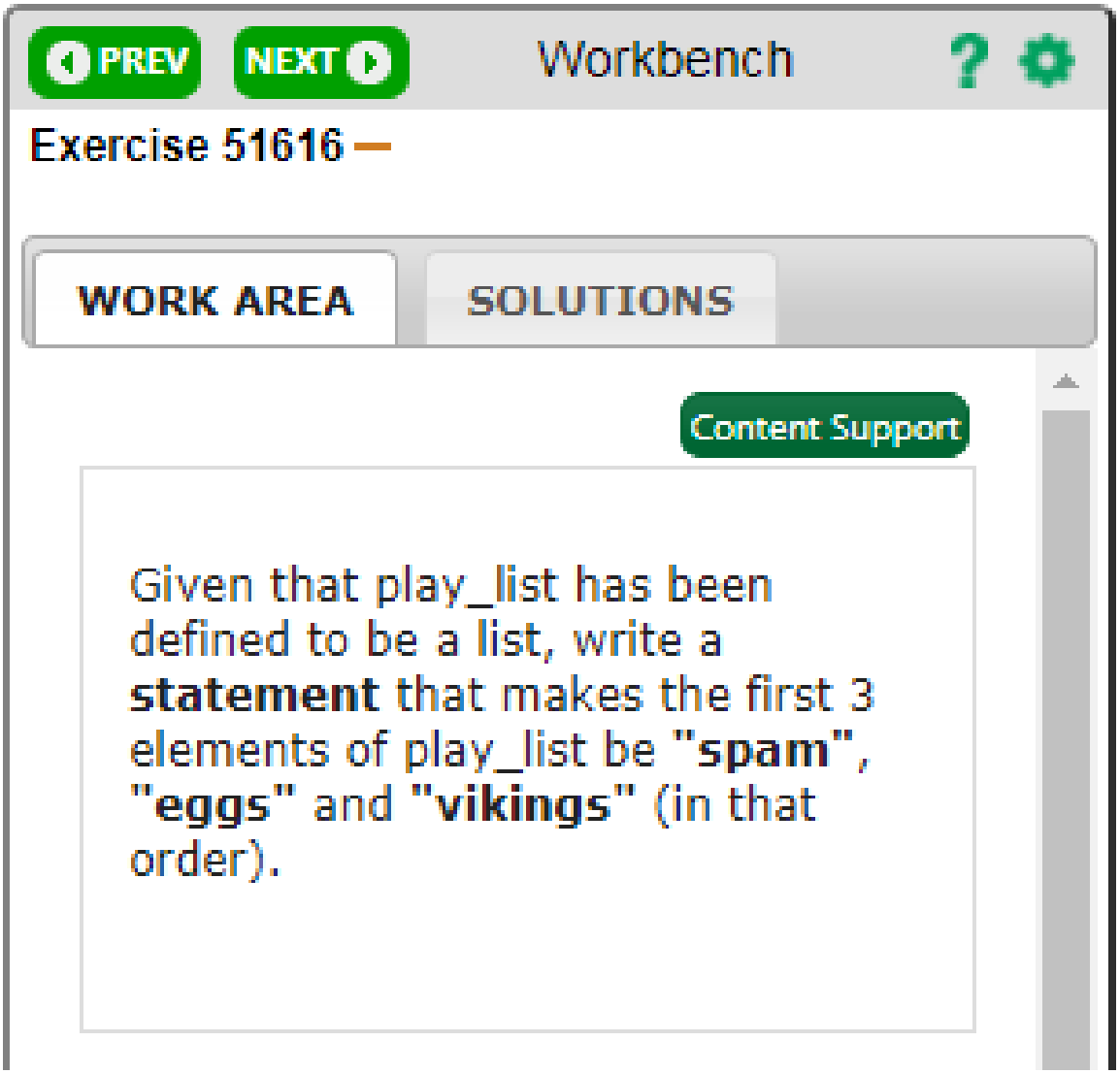

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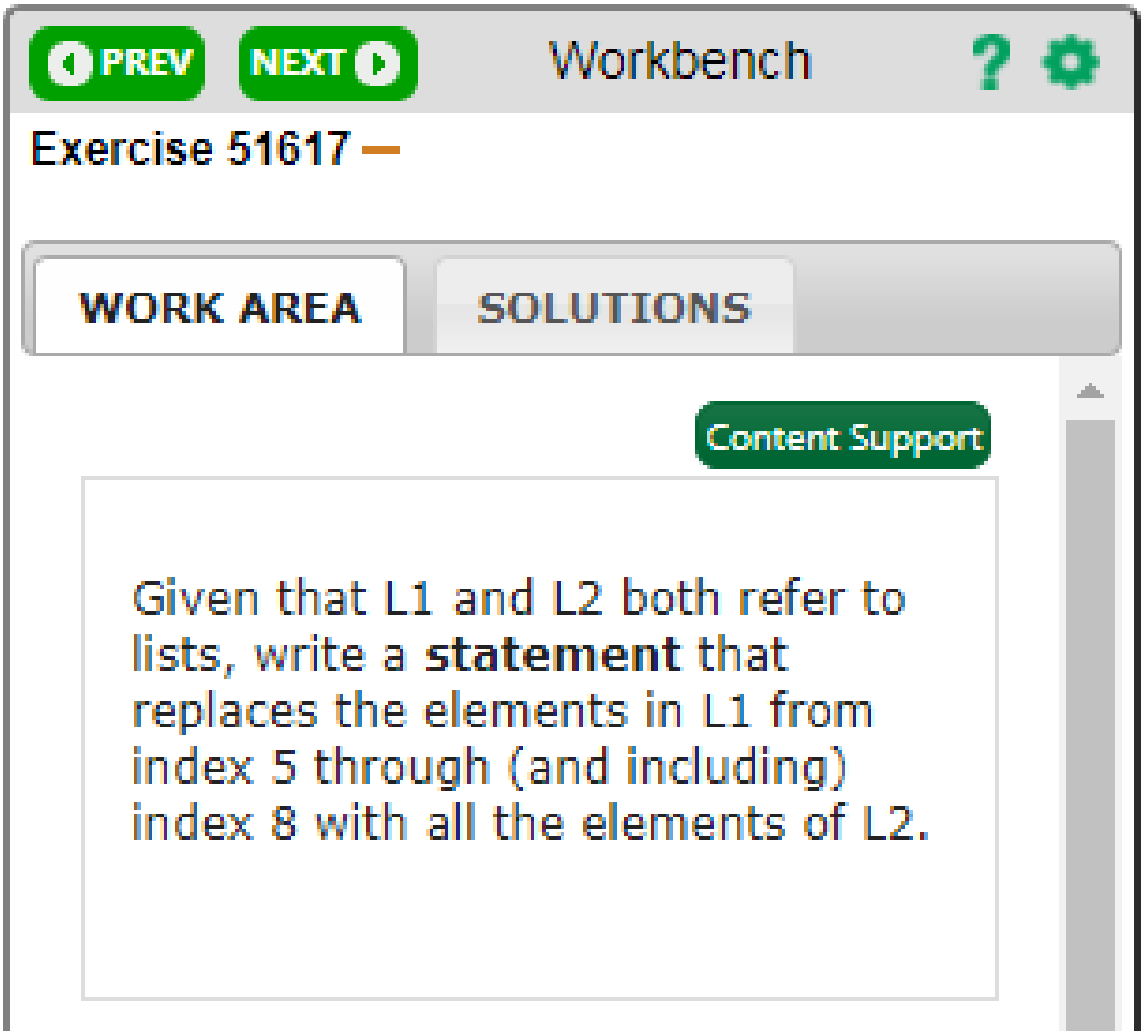

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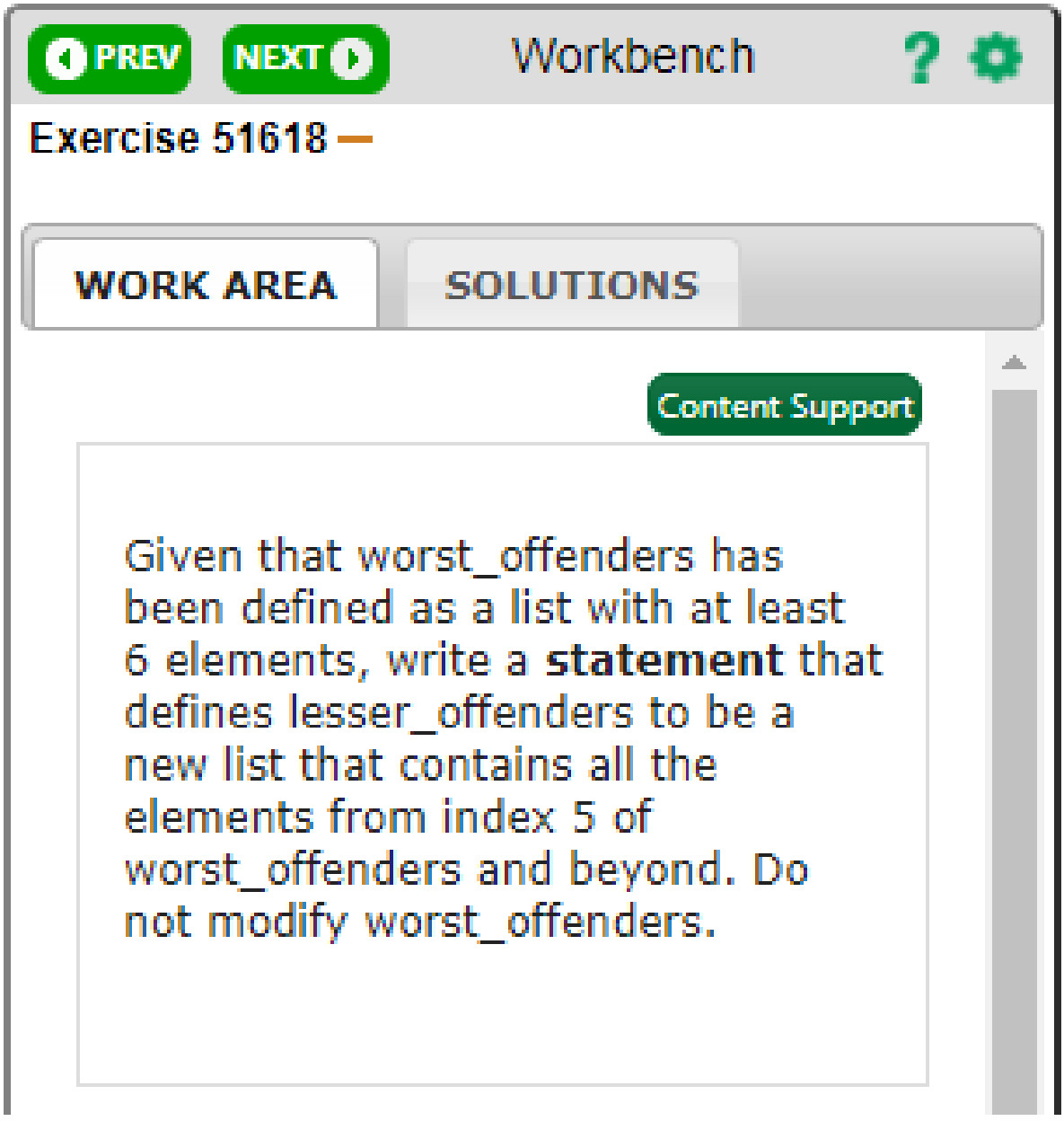

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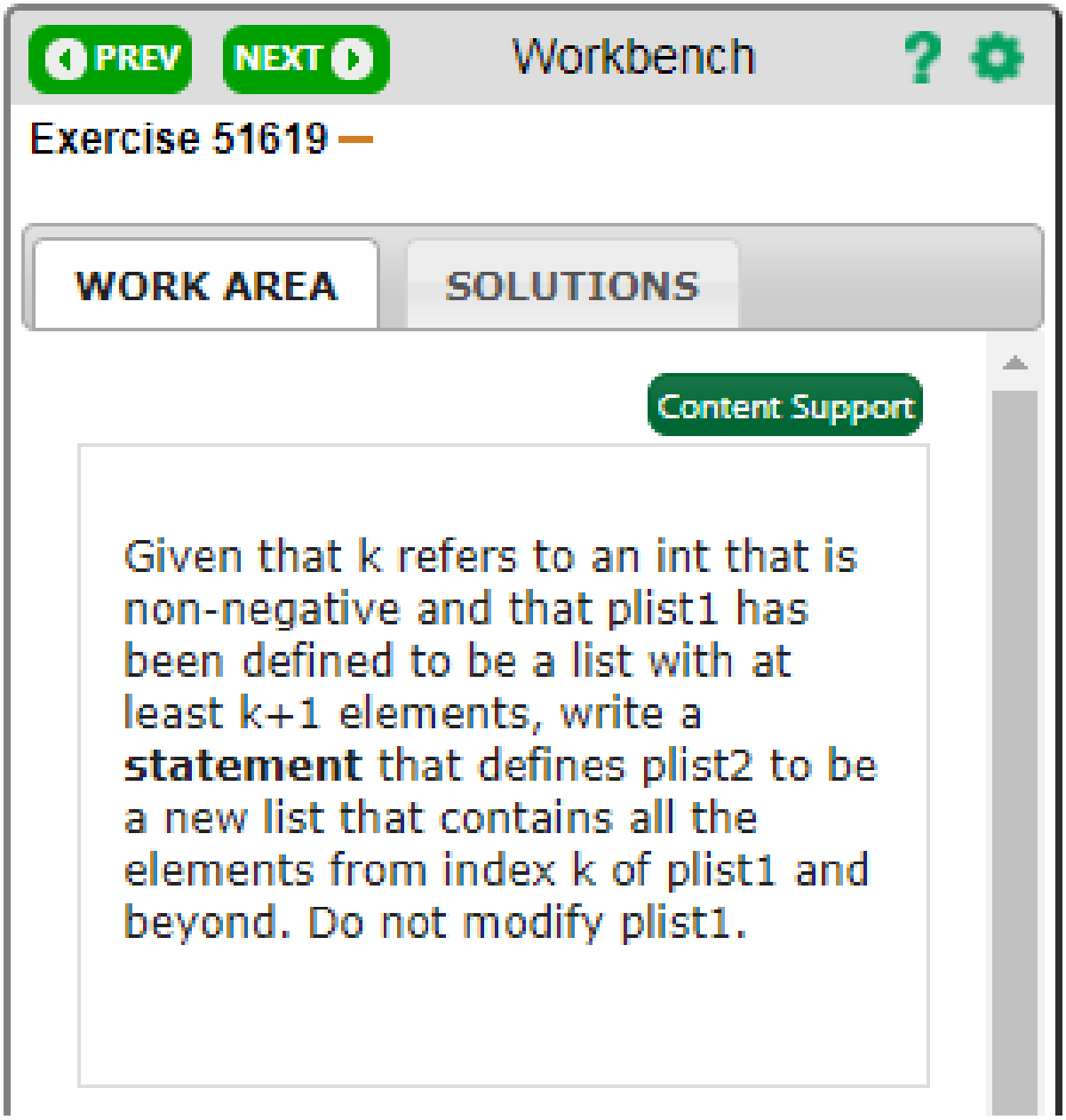

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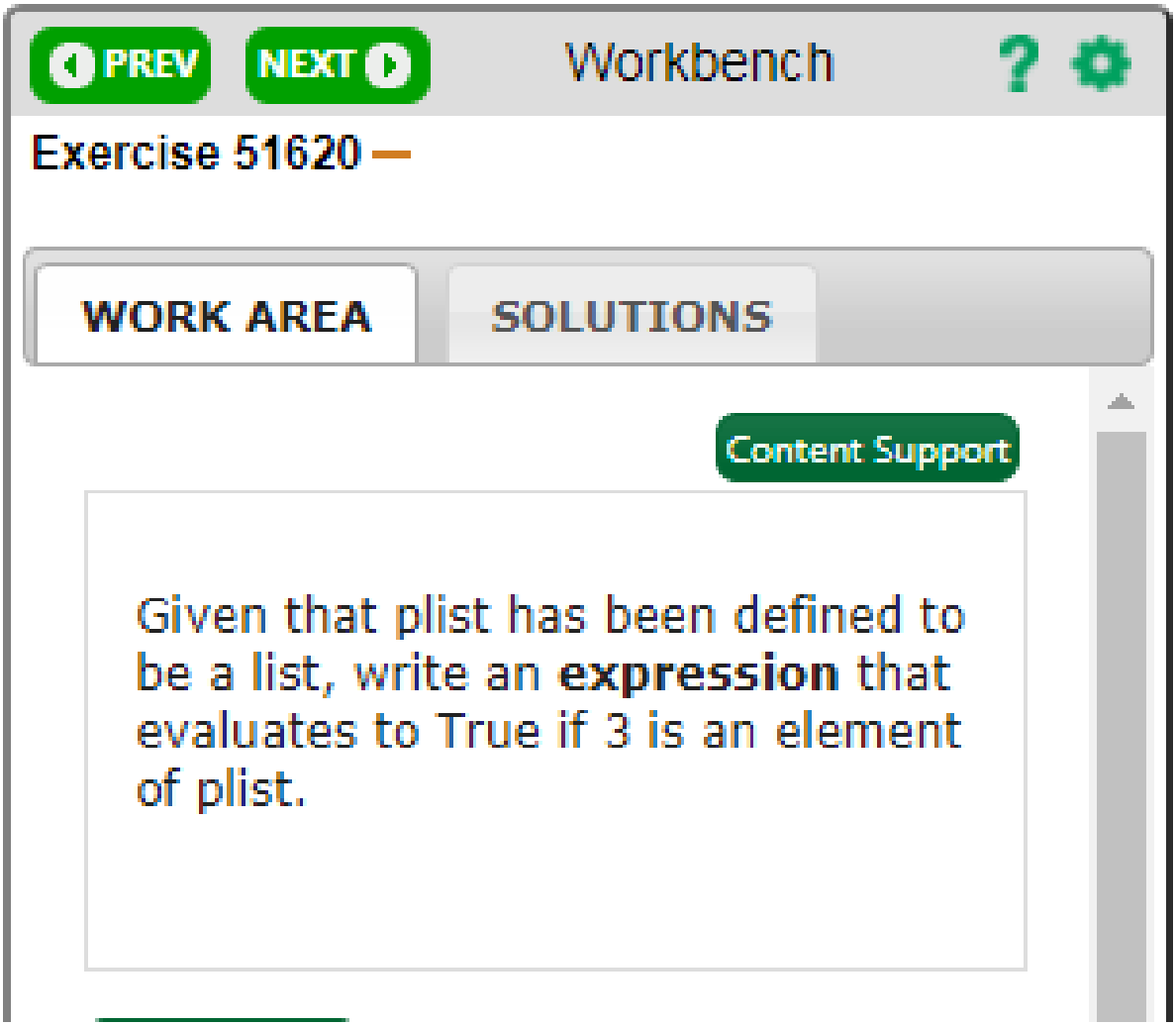

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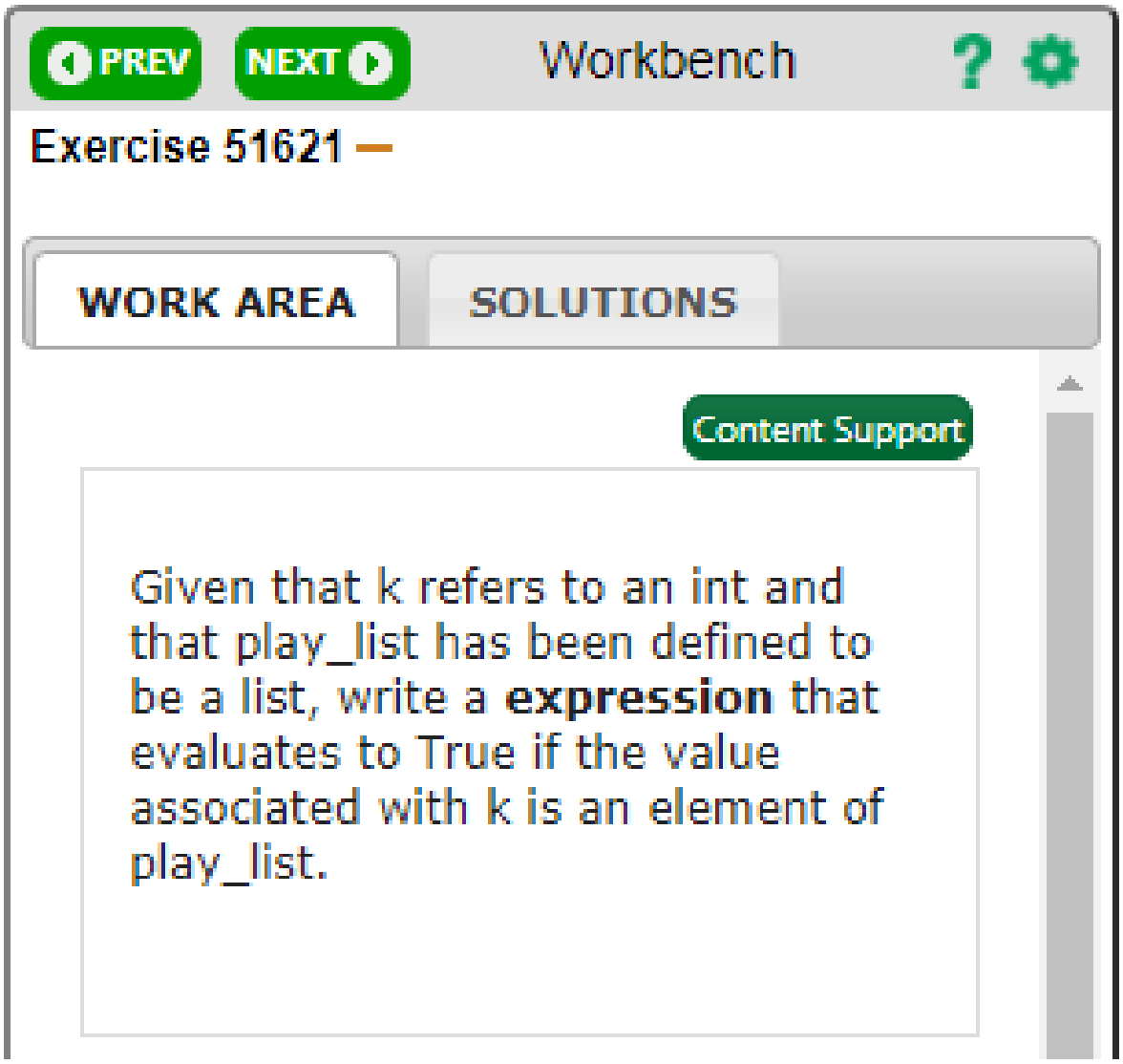

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