# Venn diagrams with 3 sets - applications

# Example 1

50 people were asked what they had for breakfast this morning.
27 people had eggs
24 had cheese
14 had bacon
13 had bacon and eggs
7 had eggs and cheese
3 had bacon and cheese
5 had none of the three products.

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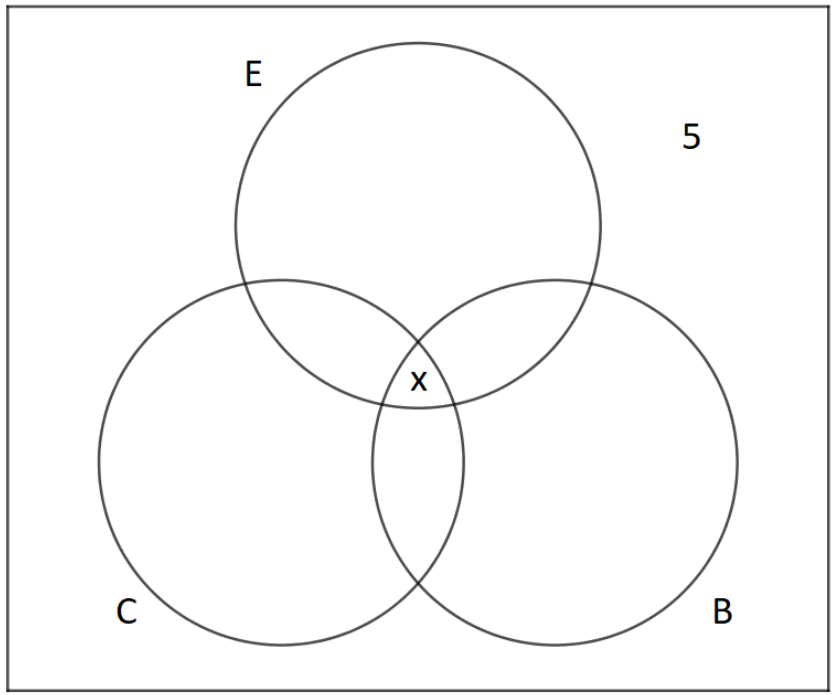
50 people were asked what they had for breakfast this morning.
27 people had eggs
24 had cheese
14 had bacon
13 had bacon and eggs
7 had eggs and cheese
3 had bacon and cheese
5 had none of the three products.

Find the number of people who had (i) all three products (ii) exactly one of the three for breakfast.

# Example 1

We start by putting 5 outside of the regions and $x$ in the intersection of all 3.



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Now we can put $13 - x$, $7 - x$ and $3 - x$ in appropriate regions:

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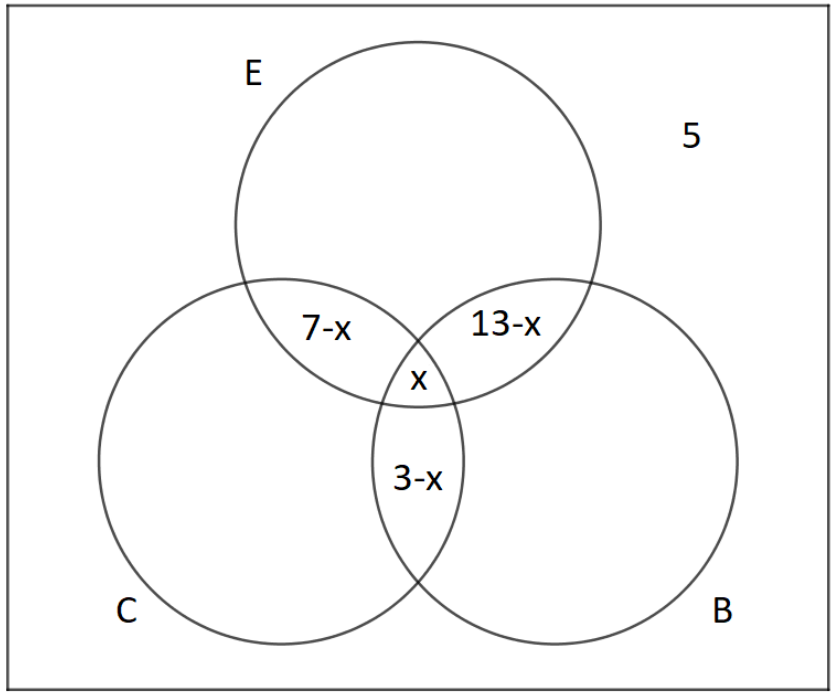

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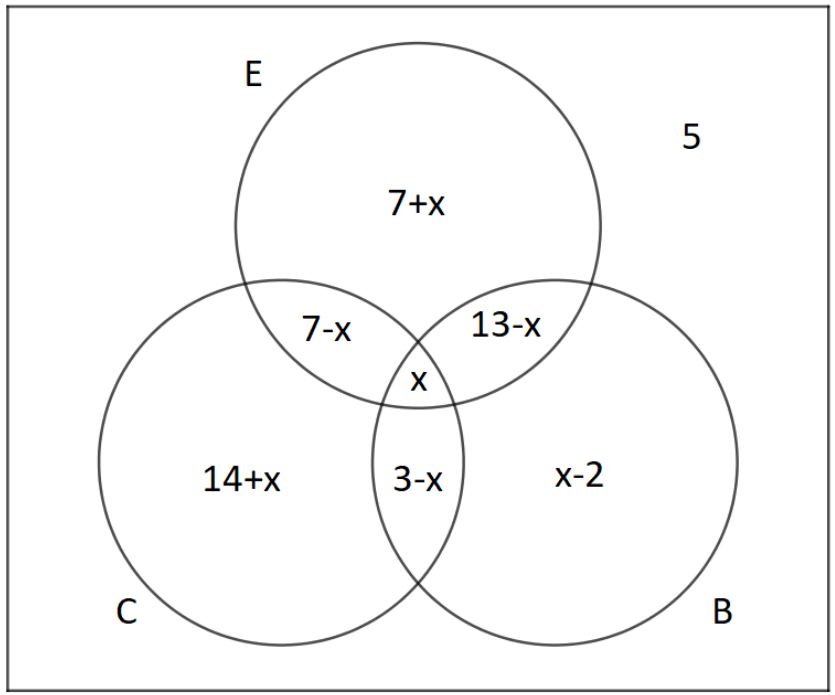

# Example 1

We can now form an equation, since the total number of people surveyed was 50, we have:

$$50 = x + (7 - x) + (3 - x) + (13 - x) + (7 + x) + (14 + x) + (x - 2) + 5$$

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which gives:

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$$50 = x + (7 - x) + (3 - x) + (13 - x) + (7 + x) + (14 + x) + (x - 2) + 5$$

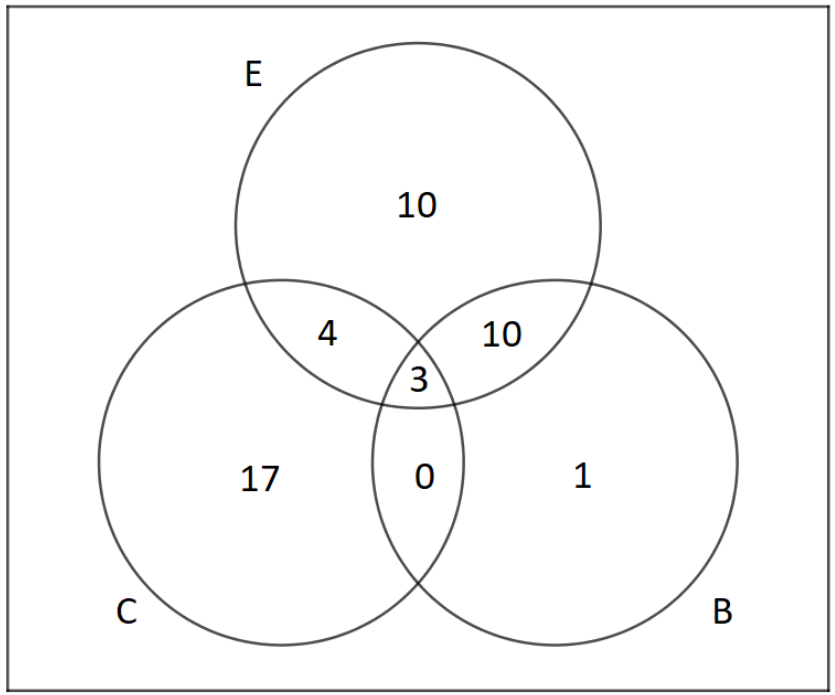
which gives:

$$50 = x + 47$$

So $x = 3$

# Example 1

We can now update the diagram:



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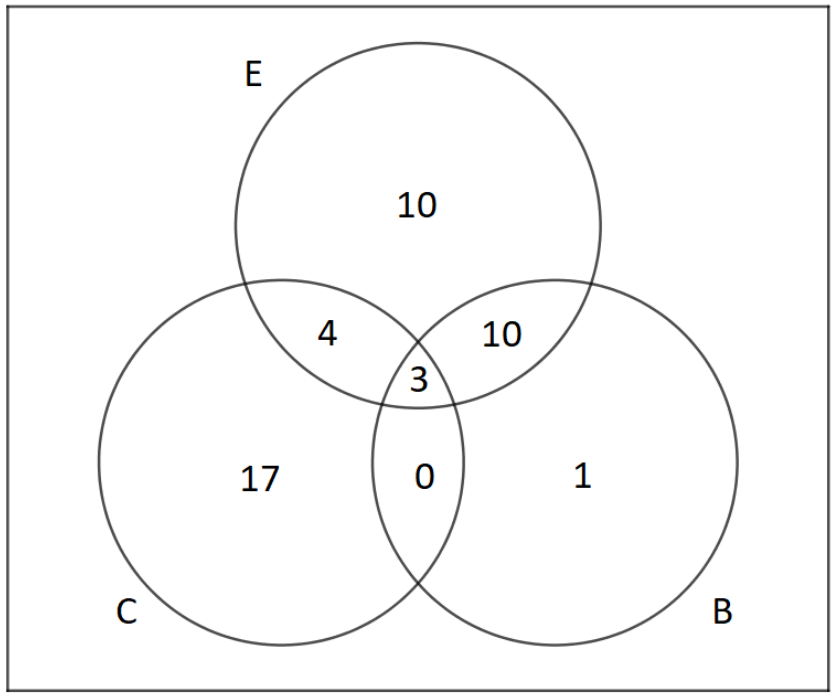



So 3 people had all three products and $17 + 10 + 1 = 28$ had exactly one of the 3 products.

# Example 2

100 people were asked what they had for breakfast this morning.
60 people had eggs
51 had cheese
32 had bacon
31 had bacon and eggs
19 had eggs and cheese
11 had bacon and cheese
8 had none of the three products.

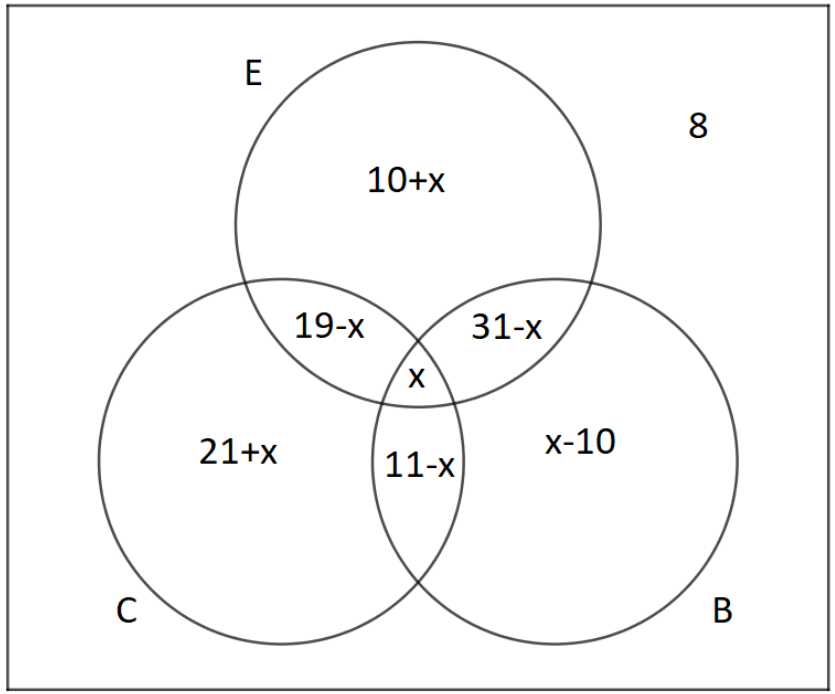
# Example 2

100 people were asked what they had for breakfast this morning.
60 people had eggs
51 had cheese
32 had bacon
31 had bacon and eggs
19 had eggs and cheese
11 had bacon and cheese
8 had none of the three products.

Find the number of people who had (i) all three products (ii) exactly one of the three for breakfast.

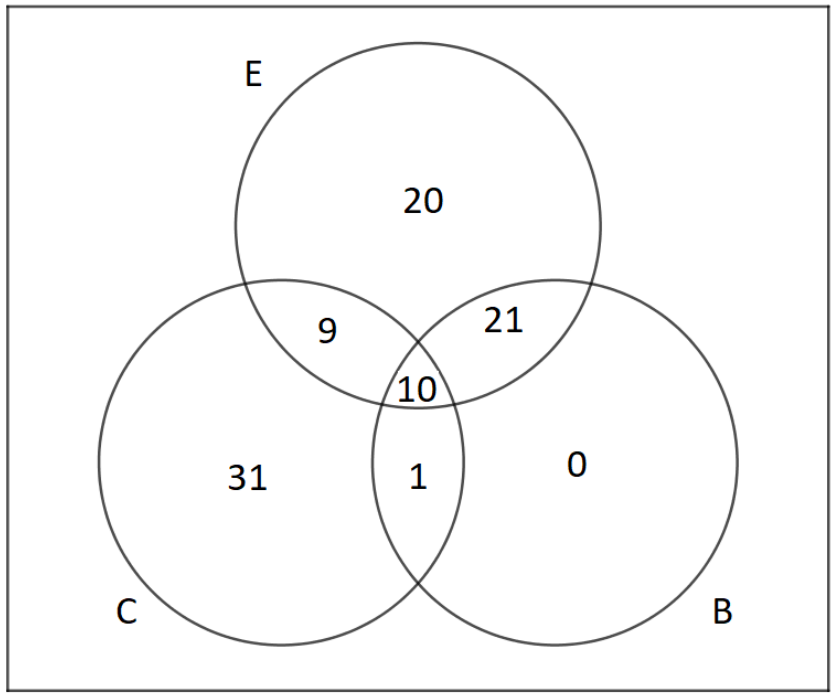
# Example 2

The diagram with $x$ as the variable representing the number of people who had all three products:



# Example 2

We solve for $x$ and find out the $x = 10$, so the diagram becomes:



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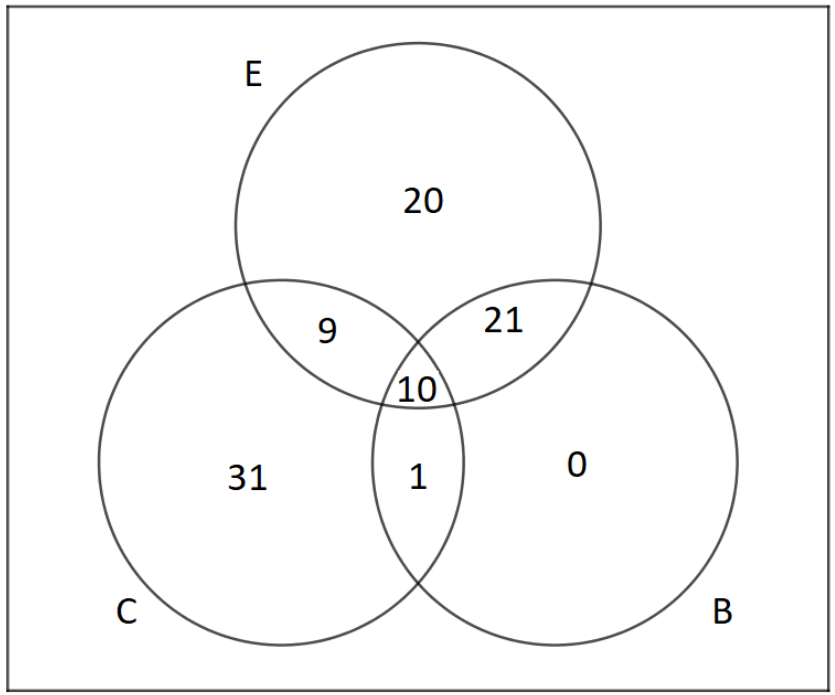


10 people had all three products and 51 had exactly one of the 3 products.

There will be a short test with a question similar to the above examples.