False Positive

Almost all medical tests have a small chance of a 'false positive' or a 'false negative'.

False Positive	False Negative
The test says you're sick, but you're actually fine.	The test says you're fine but you're actually sick.

Note: A 'positive' result from a medical test isn't usually good news. It means the test found evidence to suggest that you are sick.

The test for a certain disease is known to have a **false positive** rate of **5%**. *This means that 5% of people who **aren't** sick will be told that they **are**.*	The test is also known to have a **false negative** rate of **1%**. *This means that 1% of people who **are** sick will be told that they **aren't**.*	**1000** people are tested. We will assume that **10%** of them have this disease.

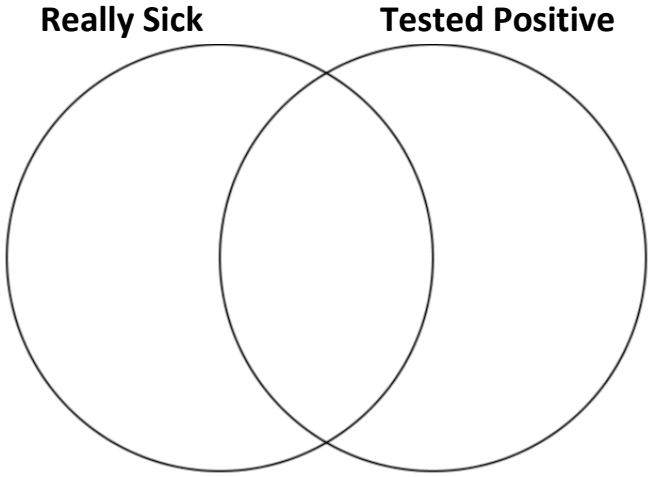
1. How many of the 1000 people are **sick**?

2. How many are **healthy**?

3. How many of the **healthy** people will be told they are **sick** by the test? (false positive)

4. How many of the **sick** people will be told they are **healthy** by the test? (false negative)

5. Complete the Venn diagram below using the numbers you have calculated above.



6. If the test says I'm sick, what is the chance that I really am?
Work out how many people are really sick compared to the number of people the test said was sick.

7. Investigate how the Venn diagram – and hence your answer to question 6 – would change if the original numbers were changed. For instance, what if only 1% of the sample were sick? Or if the false positive rate were lower?

For most medical tests, some false positives and false negatives are inevitable.
Doctors have to decide what level of blood glucose triggers a positive diabetes diagnosis, for instance, and setting it high means more false negatives (some sick people go undiagnosed), but too low means more false positives (some healthy people are incorrectly diagnosed).
Why do you think the test described above had a high false positive rate but a low false negative rate?

Which is worse - telling someone they're sick when they're fine, or telling someone they're fine when they're sick...?

False Positive SOLUTIONS

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The test for a certain disease is known to have a **false positive** rate of **5%**. *This means that 5% of people who **aren't** sick will be told that they **are**.*	The test is also known to have a **false negative** rate of **1%**. *This means that 1% of people who **are** sick will be told that they **aren't**.*	**1000** people are tested. We will assume that **10%** of them have this disease.

1. How many of the 1000 people are **sick**?

$$10\%\ of\ 1000 = \mathbf{100\ people}$$

2. How many are **healthy**?

$$90\%\ of\ 1000 = \mathbf{900\ people}$$

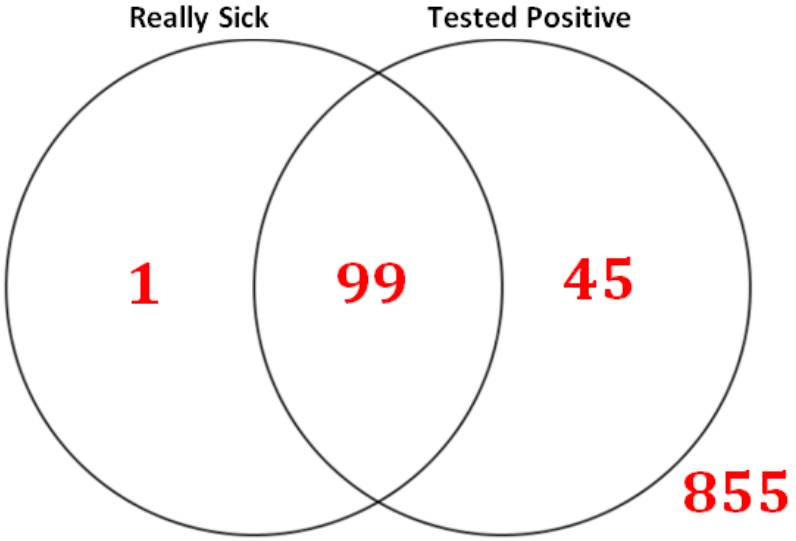
3. How many of the **healthy** people will be told they are **sick** by the test? (false positive)

$$5\%\ of\ 900 = \mathbf{45\ people}$$

4. How many of the **sick** people will be told they are **healthy** by the test? (false negative)

$$1\%\ of\ 100 = \mathbf{1\ person}$$

5. Complete the Venn diagram below using the numbers you have calculated above.



6. If the test says I'm sick, what is the chance that I really am?

Work out how many people are really sick compared to the number of people the test said was sick.

$$\frac{99}{99+45} = \frac{99}{144} = \frac{\mathbf{11}}{\mathbf{16}} = \mathbf{68.75\%}$$

7. Investigate how the Venn diagram – and hence your answer to question 6 – would change if the original numbers were changed. For instance, what if only 1% of the sample were sick? Or if the false positive rate were lower?

(discussion)

Why do you think the test described above had a high false positive rate but a low false negative rate?

(discussion)

Which is worse - telling someone they're sick when they're fine, or telling someone they're fine when they're sick...?

(discussion)