

# The test is positive: What are the odds it's wrong?



## R. versus Denis John Adams

In 1991, a serious sexual offence was committed against a woman. In 1993, Denis John Adams (DJA) was arrested for a different offence, and his DNA was stored on a police database. A check showed that his DNA was a match for a DNA profile found at the scene of the 1991 offence. Was he guilty of this offence?

### Case for the Prosecution

The probability that such a match would occur at random is 1 in 200 million, so he must be guilty.

### Case for the Defence

- The probability of such a match is in fact 1 in 2 million, not 200 million.
- There were about 150,000 males aged between 18 and 60 in the local area at the time, plus others who might have come from elsewhere on that particular occasion, so, say 200,000 potential suspects.
- However the victim did not pick DJA out in an identity parade and said he did not resemble the person who attacked her.
- DJA's girlfriend said he spent the night of the attack with her.

In the video clip, Philip Dawid looked at a hypothetical population of 2 million. He used these probabilities:

$$P(G) = \frac{1}{200,000}$$

$$P(M | G) = 1$$

$$P(M | I) = \frac{1}{2,000,000}$$

where  $M$  means there is a DNA match,  $G$  is guilty and  $I$  is innocent.

Can you explain these?

NB:  $P(M | G)$ , for example, means the probability that there is a DNA match **given that** he is guilty.

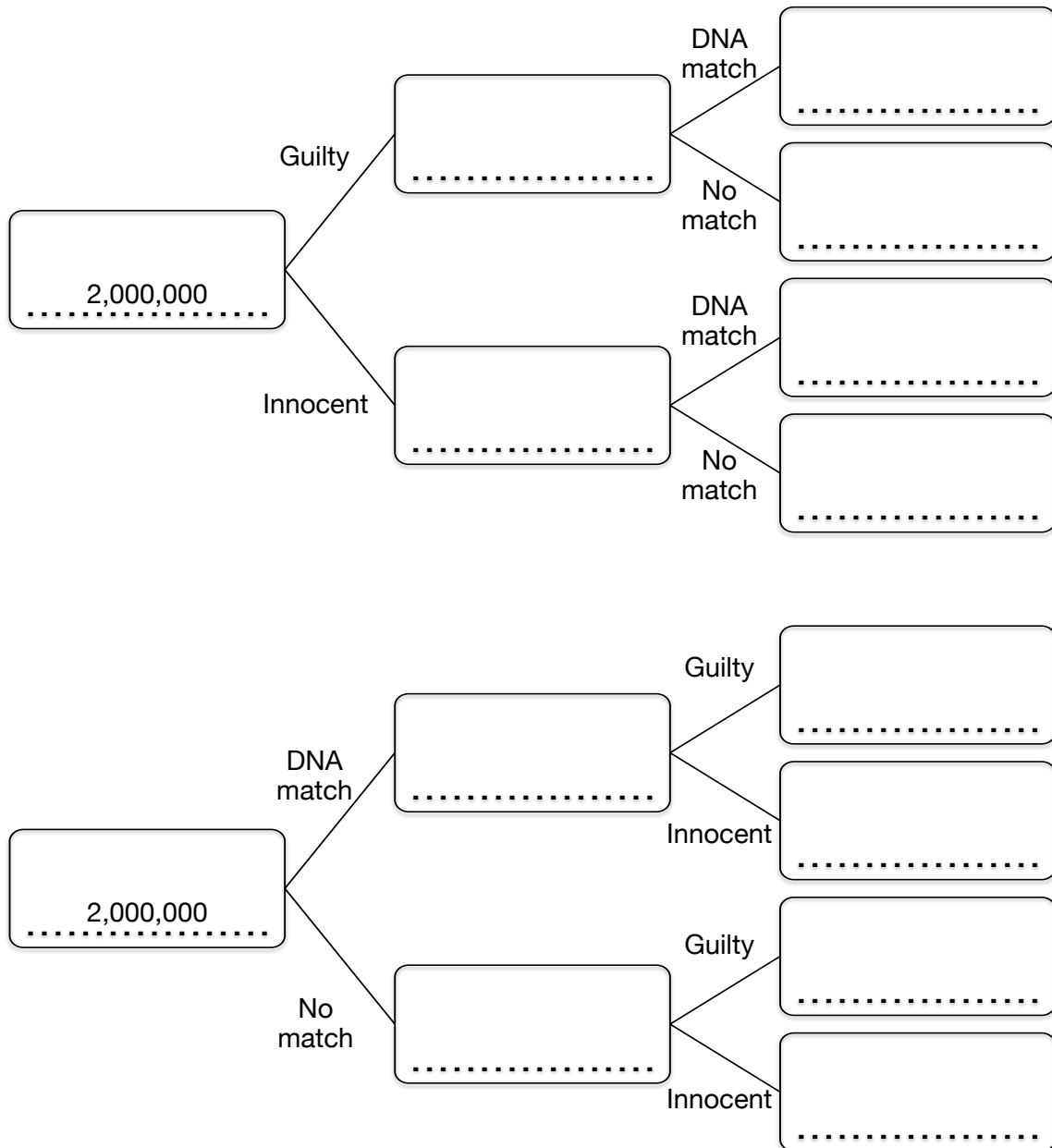
Now use all the information given to complete the table:

|          | DNA match | No DNA match | Totals    |
|----------|-----------|--------------|-----------|
| Guilty   |           |              |           |
| Innocent |           |              |           |
| Totals   |           |              | 2,000,000 |

# The test is positive: What are the odds it's wrong?

The same information can be represented on tree diagrams. Complete the tree diagrams, then compare them with the contingency table.

What are the advantages of each? What are the disadvantages?



Can you represent this data on a Venn Diagram also?

What are the advantages and disadvantages of this representation?