Baye's Theorem:

It describes the probability of an event based on prior knowledge of conditions that might be related to the event.

$$P(A|B) = \frac{P(B|A) \cdot P(A)}{P(B)}$$

Let's go back to our previous example. In the example we have assumed that your crush likes 'RJ'. Now let's calculate for doesn't like 'T'.

$$P(\text{doesn't like 'T' \& likes 'RJ'} \mid \text{doesn't like 'T'}) = \frac{P(\text{doesn't like 'T' \& like 'RJ'})}{P(\text{doesn't like 'T'})}$$

$$= \frac{6/16}{9/16} = \frac{6}{9} = \frac{2}{3} = 0.63$$

Now let's compare the probability with the previous probability it's not the same. In both cases we want to know about the same property/event, that your crush doesn't like 'T' but 'RJ'. However we have different knowledge in each case we scale the probabilities of the events [separately] differently and ultimately we get different probabilities.

P.O.

Can we solve the conditional probability without knowing P(doesn't like 'T' & like 'RJ')?

$$P(\text{doesn't like 'T' \& likes 'RJ'} \mid \text{like 'RJ'}) = \frac{P(\text{doesn't like 'T' \& like 'RJ'})}{P(\text{like 'RJ'})}$$

Multiply the above equation with P(like 'RJ')

P(doesnot like 'T' & like 'RJ' | like 'RJ') × P(like 'RJ')

$$= \frac{P(\text{doesn't like 'T' \& like 'RJ'})}{P(\text{like 'RJ'})} \times P(\text{like 'RJ'})$$

After computing,

P(doesn't like 'T' & like 'RJ' | like 'RJ') × P(like 'RJ')
= P(doesn't like 'T' & like 'RJ')

Likewise we can compute the previous equation of given doesn't like 'T'

P.O

[P(doesn't like 'T' & like 'RJ' | like 'RJ')].

P(doesn't like 'T' & like 'RJ' | doesn't like 'T')
× P(doesn't like 'T') = P(doesn't like 'T' & like 'RJ')

Now let's equate the equations

P(doesn't like 'T' & like 'RJ' | like 'RJ') × P(like 'RJ')
= P(doesn't like 'T' & like 'RJ' | like 'RJ').
× P(doesn't like

Now, let's divide both sides by P(doesnt like 'T'). After we compute let's rewrite the equation.

$$P(\text{doesn't like 'T' \& like 'RJ'} \mid \text{likes 'RJ'})$$

$$= \frac{P(\text{doesn't like 'T' \& likes 'RJ'} \mid \text{doesn't like 'T'}) \times P(\text{likes 'RJ'})}{P(\text{doesn't like 'T'})}$$

So, we derived Baye's theorem.