

: *What is Bayes' theorem?*

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Bayes' theorem is an equation to calculate the likelihood of event A occurring given that event B is true. For example, event A is purchase of product X and event B is the purchase of product Y. The Probability $P(X|Y)$ is a conditional probability and the Probability of Y is not equal to 0. Bayes' theorem states $P(X|Y) = (P(Y|X) * P(X)) / (P(Y))$. $P(\text{Purchase X} | \text{Purchase Y}) = (P(\text{Purchase Y} | \text{Purchase X}) * P(\text{Purchase X})) / (P(\text{Purchase Y}))$. If data indicates 20% of customers buy Y each week, 10% buy X, and 5% who buy X also buy Y, then what is $P(X|Y)$? $P(X|Y) = (.05 * .10) / .20 = .025$, so 2.5% is the likelihood of a customer buying Product X when they bought Product Y.

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