

Two fair dice are rolled. What is the probability that the number on the first die is at least 4, given that the sum of the two dice is 8?

It helps to assign notation to the two events in this problem.

Let A = "The number on the first die is at least 4"

and let B = "The sum is 8".

Because these are fair dice, all 36 possible outcomes to rolling the two dice are equally likely.

Therefore we can use the formula $P(A|B) = \frac{|A \cap B|}{|B|}$

$A \cap B$ = "The number on the first die is at least 4, and the sum is 8" = $\{(4, 4), (5, 3), (6, 2)\}$

B = $\{(2, 6), (3, 5), (4, 4), (5, 3), (6, 2)\}$

So $P(A|B) = \frac{|A \cap B|}{|B|} = \frac{3}{5}$