

Examples

Ex If event **X** represents spinning an even number on a circular wheel with 5 numbers with equal area and **Y** represents spinning a number less than 4, find the $P(\mathbf{X \text{ and } Y})$

$\mathbf{X = \{2, 4\}}$ $\mathbf{Y = \{1, 2, 3\}}$. They have “2” in common

$$P(\mathbf{X \text{ and } Y}) = \frac{\#(\mathbf{X \text{ and } Y})}{\#(\mathbf{sample \ space})} = \frac{1}{5}$$

Ex Using the same information from the previous example, what's the probability of X or Y?

It would seem the $P(X \cup Y) = P(X) + P(Y)$;

$X = \{2, 4\}$ $Y = \{1, 2, 3\}$. Notice, they have “2” in common.

That results in counting “2” twice. So when we have $P(X \text{ or } Y)$ we have to determine if there is an intersection. If there is, we will count those outcomes a multiple number of times.

To avoid that, we need to subtract out that duplication/intersection so we don't have double counting.

$$\begin{aligned} P(X \text{ or } Y) &= P(X \cup Y) = P(X) + P(Y) - P(X \text{ and } Y) \\ &= 2/5 + 3/5 - 1/5 = 4/5 \end{aligned}$$

