

Probability of India winning match against Pakistan is 0.5 find the probability that India's 2nd win occurs in 3rd test in a 5 match series?

**Solution**

The probability of India winning a test match against Pakistan =  $\frac{1}{2}$ .

=> The probability of India losing a test match against Pakistan =  $1 - \frac{1}{2} = \frac{1}{2}$ .

The criteria here is "India's second win should occur at the third test".

The following table summarizes all the possibilities:

|                                      | 1 <sup>st</sup> Match | 2 <sup>nd</sup> Match | 3 <sup>rd</sup> Match | $P(E) = P(E_1) * P(E_2) * P(E_3)$                       |
|--------------------------------------|-----------------------|-----------------------|-----------------------|---|
| India losing all of the first three  | L                     | L                     | L                     | $\frac{1}{2} * \frac{1}{2} * \frac{1}{2} = \frac{1}{8}$ |
| India winning one of the first three | W                     | L                     | L                     | $\frac{1}{2} * \frac{1}{2} * \frac{1}{2} = \frac{1}{8}$ |
|                                      | L                     | W                     | L                     | $\frac{1}{2} * \frac{1}{2} * \frac{1}{2} = \frac{1}{8}$ |
|                                      | L                     | L                     | W                     | $\frac{1}{2} * \frac{1}{2} * \frac{1}{2} = \frac{1}{8}$ |
| India winning two of the first three | <b>L</b>              | <b>W</b>              | <b>W</b>              | $\frac{1}{2} * \frac{1}{2} * \frac{1}{2} = \frac{1}{8}$ |
|                                      | <b>W</b>              | <b>L</b>              | <b>W</b>              | $\frac{1}{2} * \frac{1}{2} * \frac{1}{2} = \frac{1}{8}$ |
|                                      | W                     | W                     | L                     | $\frac{1}{2} * \frac{1}{2} * \frac{1}{2} = \frac{1}{8}$ |
| India winning all of the first three | W                     | W                     | W                     | $\frac{1}{2} * \frac{1}{2} * \frac{1}{2} = \frac{1}{8}$ |

Out of all the 8 possibilities, the desired possibilities are two only (shown bold italic)

Probability that India's 2nd win occurs in 3rd test in a 5 match series  $P = \frac{1}{8} + \frac{1}{8} = \frac{2}{8} = \frac{1}{4}$ .

**Answer:**  $\frac{1}{4}$ .