Expected Value

Expected Value is the amount you can expect to win or lose in situations in which the winners are determined randomly. To find the expected value of a sample space, separate the sample space into a number of events where no two events have any common outcomes.

To find expected value (E) use the event's probability and the event's *payoff.* The expected value is the sum of the products of probabilities multiplied by their payoffs.

Expected Value	$E = [P(A) \cdot \text{payoff for } A] + [P(B) \cdot \text{payoff for } B]$ for outcomes A and B.

The number of events equals the number of products in the formula. For two events there are two products.

Using the example from the Do-Now. The expected value of the sweepstakes could be found this way:

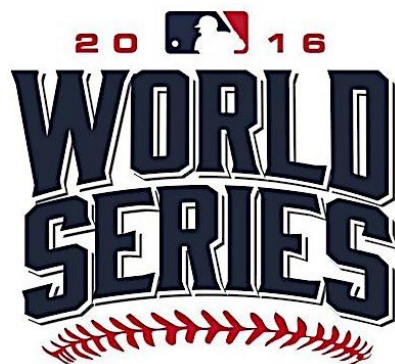| Prize	Probability of winning
$2,500	1 out of 20,000
$1,000	1 out of 20,000
$500	1 out of 20,000
$100	1 out of 5,000

The student council considers selling stickers to raise money. The Fan Club company states that the probability of making $3000 is 0.8 and the probability of losing $1000 is 0.2. Fan Club claims that on average, schools make over $2000. Is the claim accurate?

Devon and Carson play a game with three colored marbles. A bag contains one red, one blue, and one yellow marble. Each player pulls a marble from the bag. The player with the red marble wins 2 points. Otherwise, the player loses 1 point. Find the expected value to determine whether the game is fair.

A charity raffles off a $20,000 car by selling 5,000 tickets for $2 per ticket. What is the expected value?

The World Series is the championship between the National and American Leagues in baseball. The champion is the first to win four games. If two teams are evenly matched, the probability of the series ending in 4 games is $\frac{1}{8}$, 5 games $\frac{1}{4}$, 6 games $\frac{5}{16}$, and 7 games $\frac{5}{16}$. What is the expected number of games?

You toss a coin 20 times and follow the path shown in the diagram below. Is this game fair for both player A and player B? If not, which player has the advantage?