LESSON MAKER PRO

Choices by Chance

Use expected value to compare decisions.

HIGH SCHOOL · HSS-MD.B

CCSS.Math.Content.HSS-MD.B "Use probability to evaluate outcomes of decisions"

NAME _____ DATE _____

EXPECTED VALUE

Use expected value to predict the average result of a choice over many repeats. Multiply each outcome by its probability, add the results, then subtract any cost to compare net values.

WORKED EXAMPLE

A game pays $51 with probability 2/17 and $0 otherwise. It costs $5 to play. Should you play?

1. Expected payout = (2/17) x 51 + (15/17) x 0.
2. Expected payout = $6.
3. Expected net = $6 - $5 = $1.

Answer: Yes. The expected net gain is $1 per play.

PRACTICE 6 problems

1 A game costs $8. You win $14 with probability 3/7 and otherwise win no prize. What is the expected net gain or loss per play?

ANSWER _____

2 A ticket costs $7. It has probability 4/9 of winning $18 and otherwise wins no prize. What is the expected net gain or loss?

ANSWER _____

3 Option A pays $16 with probability 7/8. Option B pays $13 for sure. Which option has the greater expected payout?

ANSWER _____

4 A prize has probability 9/11 of paying $22 and otherwise pays no prize. What is the expected payout?

ANSWER _____

5 Option A has probability 3/4 of paying $28 and otherwise pays no prize. Option B pays $19 for sure. Which option has the greater expected payout?

ANSWER _____

6 A game costs $9. It has probability 4/11 of paying $33 and otherwise pays no prize. What is the expected net gain or loss per play?

ANSWER _____

APPLY IT Show your work

1 You are choosing a plan for selling phone charms at a school event. Plan A costs $18 for supplies and has probability 7/10 of earning $40 in sales, with no sales otherwise. Plan B costs $11 and guarantees $23 in sales. Which plan has the greater expected profit, and by how much?

WORK SPACE

ANSWER _____

2 You can enter a gaming tournament for $13. You have probability 4/9 of winning a $45 prize and otherwise win no prize. Instead, you could tutor for a guaranteed $11. Which choice has the greater expected net amount, and by how much?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Your phone has probability 7/12 of needing a $48 repair this year, with no repair cost otherwise. A protection plan costs $25 and covers the repair. Which choice has the lower expected cost? Explain your reasoning.

WORK SPACE AND ANSWER

ANSWER KEY

Choices by Chance

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A game costs $8. You win $14 with probability 3/7 and otherwise win no prize. What is the expected net gain or loss per play?	**Expected net loss: $2**
2	A ticket costs $7. It has probability 4/9 of winning $18 and otherwise wins no prize. What is the expected net gain or loss?	**Expected net gain: $1**
3	Option A pays $16 with probability 7/8. Option B pays $13 for sure. Which option has the greater expected payout?	**Option A, with an expected payout of $14.**
4	A prize has probability 9/11 of paying $22 and otherwise pays no prize. What is the expected payout?	**$18**
5	Option A has probability 3/4 of paying $28 and otherwise pays no prize. Option B pays $19 for sure. Which option has the greater expected payout?	**Option A, with an expected payout of $21.**
6	A game costs $9. It has probability 4/11 of paying $33 and otherwise pays no prize. What is the expected net gain or loss per play?	**Expected net gain: $3**

PART 2 · APPLY IT

1. **Plan B has the greater expected profit by $2.** Plan A has expected profit (7/10 x 40) - 18 = 10. Plan B has profit 23 - 11 = 12.
2. **Tutoring has the greater expected net amount by $4.** The tournament has expected net amount (4/9 x 45) - 13 = 7. Tutoring earns $11.

CHALLENGE

Buy the protection plan. Without it, the expected repair cost is (7/12) x 48 = $28, which is $3 more than the $25 plan.

Accept correct expected values written as a gain, loss, profit, payout, or cost when the meaning is clear. For comparison items, students should identify the choice and support it with the correct expected values.