LESSON MAKER PRO

Payoff Decision Lab

Use expected value to compare possible outcomes.

HIGH SCHOOL · HSS-MD.B.5

CCSS.Math.Content.HSS-MD.B.5 "(+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values."

NAME _____ DATE _____

EXPECTED VALUE

To find an expected value, multiply each payoff by its probability, then add the products. A negative payoff represents money lost. Expected value tells the average payoff you would expect over many repeats.

WORKED EXAMPLE

A game pays $18 with probability 1/4 and loses $6 with probability 3/4. Find the expected value.

1. $18 x 1/4 = $9/2
2. -$6 x 3/4 = -$9/2
3. $9/2 + (-$9/2) = $0

Answer: $0

PRACTICE 6 problems

1 A spinner gives a payoff of $10 with probability 1/2 and $2 with probability 1/2. Find the expected payoff.

ANSWER _____

2 A game pays $12 with probability 1/3 and loses $3 with probability 2/3. Find the expected value.

ANSWER _____

3 A coupon is worth $7 with probability 2/5 and $1 with probability 3/5. Find the expected value.

ANSWER _____

4 An investment has a payoff of -$8 with probability 1/6 and $16 with probability 5/6. Find the expected value.

ANSWER _____

5 A prize wheel pays $13 with probability 3/8 and $26 with probability 5/8. Find the expected payoff.

ANSWER _____

6 A game pays $30 with probability 2/7 and $4 with probability 5/7. Find the expected value.

ANSWER _____

APPLY IT Show your work

1 A concert raffle ticket costs $5. You have a 1/10 chance to win $40, a 2/10 chance to win $10, and a 7/10 chance to win no prize. What is the expected net payoff from buying one ticket? Is the ticket favorable based on expected value?

WORK SPACE

ANSWER _____

2 A student enters a design contest with an $8 entry fee. The student has a 1/5 chance to win $60, a 2/5 chance to win $20, and a 2/5 chance to win no prize. Find the expected net payoff.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

A student can sell custom stickers at Market A or Market B. At Market A, the possible profits are $48 with probability 1/3, $24 with probability 1/2, and -$12 with probability 1/6. At Market B, the possible profits are $40 with probability 2/3 and -$4 with probability 1/3. Which market should the student choose based only on expected value? Explain with calculations.

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_____

ANSWER KEY

Payoff Decision Lab

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A spinner gives a payoff of $10 with probability 1/2 and $2 with probability 1/2. Find the expected payoff.	**$6**
2	A game pays $12 with probability 1/3 and loses $3 with probability 2/3. Find the expected value.	**$2**
3	A coupon is worth $7 with probability 2/5 and $1 with probability 3/5. Find the expected value.	**$17/5**
4	An investment has a payoff of -$8 with probability 1/6 and $16 with probability 5/6. Find the expected value.	**$12**
5	A prize wheel pays $13 with probability 3/8 and $26 with probability 5/8. Find the expected payoff.	**$169/8**
6	A game pays $30 with probability 2/7 and $4 with probability 5/7. Find the expected value.	**$80/7**

PART 2 · APPLY IT

1. **$1; yes, the expected net payoff is positive.** The net payoffs are $35, $5, and -$5. Calculate $35(1/10) + $5(2/10) + (-$5)(7/10) = $1.
2. **$12** Subtract the $8 fee from each prize outcome, giving payoffs of $52, $12, and -$8. Calculate $52(1/5) + $12(2/5) + (-$8)(2/5) = $12.

CHALLENGE

Choose Market A. Market A: $48(1/3) + $24(1/2) + (-$12)(1/6) = $26. Market B: $40(2/3) + (-$4)(1/3) = $76/3 = $25 1/3. Market A has the greater expected value by $2/3.

Accept equivalent fractions, mixed numbers, or terminating decimals for expected values. For the decision items, accept the stated choice only when it is supported by correct expected-value calculations.