Payoff Predictions

Use probability to predict the average result of a game.

HIGH SCHOOL · HSS-MD.B.5a

CCSS.Math.Content.HSS-MD.B.5a "Find the expected payoff for a game of chance. For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant."

NAME ______________________ DATE ____________

EXPECTED PAYOFF

Expected payoff is the long-run average amount you gain or lose per play. Multiply each payoff, using a negative sign for a loss, by its probability, then add the results.

WORKED EXAMPLE

A game pays $29 with probability 11/14 and costs you $23 with probability 3/14. Find the expected payoff.

1. Expected payoff = (11/14)($29) + (3/14)(-$23).
2. = $319/14 - $69/14.
3. = $250/14 = $125/7.

Answer: Expected payoff: $125/7 per play.

PRACTICE

6 problems

1 A game pays $6 with probability 1/2 and costs $2 with probability 1/2. Find the expected payoff.

ANSWER ____________________

2 A game pays $10 with probability 1/5 and costs $1 with probability 4/5. Find the expected payoff.

ANSWER ____________________

3 A spinner pays $18 with probability 1/9 and pays $0 with probability 8/9. Find the expected payoff.

ANSWER ____________________

4 A game has possible payoffs of $4 with probability 1/4, $8 with probability 1/2, and $12 with probability 1/4. Find the expected payoff.

ANSWER ____________________

5 A game has payoffs of -$9 with probability 2/5, $15 with probability 1/5, and $6 with probability 2/5. Find the expected payoff.

ANSWER ____________________

6 A ticket costs $1. It pays $16 with probability 1/8, pays $6 with probability 1/4, and pays $0 otherwise. Find the expected net payoff.

ANSWER ____________________

APPLY IT
Show your work

1 A mystery merch bag costs \$8. You have a 1/20 chance of getting a \$48 gift card, and otherwise the bag has no value. Find the expected net payoff from buying one bag.

WORK SPACE

ANSWER ____________________

2 A music club sells a \$6 prize-wheel ticket. You have a 1/8 chance to win a \$46 concert voucher, a 1/4 chance to win an \$18 voucher, and otherwise win nothing. Find the expected net payoff.

WORK SPACE

ANSWER ____________________

CHALLENGE
One step up

CHALLENGE

Choose the game with the greater expected payoff and explain using calculations. Game A pays \$18 with probability 1/6 and costs \$6 with probability 5/6. Game B pays \$10 with probability 1/2 and costs \$2 with probability 1/2.

____

____

Payoff Predictions

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A game pays $6 with probability 1/2 and costs $2 with probability 1/2. Find the expected payoff.	**$2**
2	A game pays $10 with probability 1/5 and costs $1 with probability 4/5. Find the expected payoff.	**$6/5**
3	A spinner pays $18 with probability 1/9 and pays $0 with probability 8/9. Find the expected payoff.	**$2**
4	A game has possible payoffs of $4 with probability 1/4, $8 with probability 1/2, and $12 with probability 1/4. Find the expected payoff.	**$8**
5	A game has payoffs of -$9 with probability 2/5, $15 with probability 1/5, and $6 with probability 2/5. Find the expected payoff.	**$9/5**
6	A ticket costs $1. It pays $16 with probability 1/8, pays $6 with probability 1/4, and pays $0 otherwise. Find the expected net payoff.	**$5/2**

PART 2 · APPLY IT

1. **-$28/5** The net payoff is $40 if you get the gift card and -$8 otherwise. Compute (1/20)($40) + (19/20)(-$8) = -$28/5.
2. **$17/4** The net payoffs are $40, $12, and -$6. Compute (1/8)($40) + (1/4)($12) + (5/8)(-$6) = $17/4.

CHALLENGE

Choose Game B. Game A has an expected payoff of -$2, while Game B has an expected payoff of $4.

Accept equivalent fraction, mixed-number, or decimal forms when they are exact. For ticket situations, require students to include the ticket cost in every possible net payoff.