Design a Carnival Game: Fair or Fundraiser?

Use probability and expected value to design a school-fair game that raises money and still feels winnable.

Unit 15: Probability & Expected Value | 3 class periods | Small groups (3–4)

Name(s) _____ Period ___ Due _____

Introduction

Your class runs a booth at the school fair to raise money for a trip. Your team will analyze three sample games, run a simulation, then design your own game with a target expected profit, and convince the student council it is honest and fun.

> Each play costs $2. The council expects about 400 plays at your booth. Prizes are gift cards bought in advance. The council's rule: players must have at least a 1 in 10 chance of winning something.

Learning goals

- Compute probabilities for single and compound events.
- Find each game's expected value for players and expected profit for the class.
- Compare a simulation with theoretical probability.
- Design a game that meets a profit goal and a fairness rule.
- Explain the risk that the booth loses money.

Supporting documents and data

Sample games

Game	Rules	P(win)	Prize
Lucky Six	Roll one die; a 6 wins $8.	16.7%	$8
Double Trouble	Roll two dice; doubles win $10.	16.7%	$10
Big Spin	Spin a 20-section wheel; 1 section wins $30.	5%	$30

Tasks

Task 1: Analyze

1. Find each sample game's probability of winning and the player's expected value.
2. Find the class's expected profit from 400 plays of each.

Deliverable: Analysis table.

Task 2: Simulate

1. Simulate 50 plays of one game with dice, a spinner or a spreadsheet.
2. Compare your simulated profit with the expected profit. Why are they different?

Deliverable: Simulation results.

Task 3: Design

1. Design your own game. It must give players at least a 1 in 10 chance of winning something.
2. Choose prizes so the expected profit is between $200 and $350 for 400 plays.

Deliverable: Game rules and math.

Task 4: Risk

1. What is the most the booth could lose in one play? In a bad hour?
2. How many prizes should you buy in advance? Use the expected number of winners.

Deliverable: Risk plan.

Task 5: Pitch

1. Pitch your game to the council with the math, the fairness rule and a sample poster.

Deliverable: 4–5 slides and a poster.

Reflection

1. Is a game with a negative EV for players unfair? What makes a fundraiser game acceptable?

2. How did your simulation compare with the theory?

3. How does this connect to lotteries and casinos?

Submission checklist

- ☐ Analysis table
- ☐ Simulation
- ☐ Game design with EV

- ☐ Risk plan
- ☐ Pitch and poster
- ☐ Reflection

Scoring rubric

Category (points)	Exemplary (100%)	Proficient (~80%)	Developing (~60%)	Beginning (~30%)
Financial understanding (20)	Uses vocabulary precisely and explains every financial concept involved, including assumptions.	Mostly accurate explanations with minor vocabulary gaps.	Partial understanding; some concepts misapplied.	Little evidence of understanding.
Mathematical accuracy (25)	Probabilities, expected values and expected profit correct.	1–2 minor errors that do not change conclusions.	Several errors or missing work.	Calculations largely missing or incorrect.
Analysis & comparison (20)	Compares every option on the same basis and tests at least one changed assumption.	Compares options with small gaps.	Comparison superficial or uneven.	Little analysis.
Justification (15)	Recommendation is supported by specific numbers and weighs non-financial factors and risks.	Mostly supported.	Mostly opinion.	No justification.
Communication & presentation (10)	Clear, organized, well-labeled tables, charts, and writing.	Minor clarity issues.	Hard to follow in places.	Disorganized.
Completion (10)	Every checklist item complete.	One item missing.	Two or three items missing.	Most items missing.

Total: 100 points. Alternative recommendations earn full credit when supported by accurate evidence.

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