

## The In-Laws Make a Deal

Mrs. Feltman's in-laws offer her the following two deals. Each deal is based on Mrs. Feltman having exactly 2 children. After analyzing each deal, decide which deal Mrs. Feltman should take?

### **Mother-in-law's deal:**

Based on having exactly two children.

- She will pay Mrs. Feltman \$2750.00 if she has 2 girls.
- She will pay Mrs. Feltman \$100 if she has one boy and one girl, in any order.
- Mrs. Feltman has to PAY HER \$3000.000 if she has 2 boys.

### **Father-in-law's deal:**

Based on having exactly two children.

- He will pay Mrs. Feltman \$1000.00 if she has 2 boys.
- He will pay Mrs. Feltman \$800 if she has one boy and one girl, in any order.
- Mrs. Feltman has to PAY HIM \$2000.000 if she has 2 girls.

### **Decide which deal Mrs. Feltman should take!**

Hint: How many different ways can you have two children? Determine the following probabilities if Mrs. Feltman has exactly two children.

P(2 boys)

P(2 girls)

P(1 boy and 1 girl in any order)

## Expected Value Problems

- 1) Game ONE has the following rules.  
It costs \$3.50 to play the game. The player rolls one fair six-sided die.  
You win a dollar for every dot showing on top when the die lands.
  - a) What is the expected value for the player every time they play?
  - b) What is the expected value for the owner of the game every time a player plays?
  - c) Is this game fair? Explain.
  
- 2) Game TWO has the following rules.  
It costs \$2.00 to play the game. The players draw any one card from a standard deck of playing cards. The payoffs are as follows.  
Number card (2 – 10): You lose  
Face card (J, Q, or K): You win \$5.00  
Ace: You win (\$8.00)
  - a) What is the expected value for the player every time they play?
  - b) What is the expected value for the owner of the game every time a player plays?
  - c) Is this game fair? Explain.

Insurance companies decide what a fair rate to charge based on analyzing data from the past. People who analyze the data from the past and determine fair rates are called Actuaries. They make very good money and have an extensive background in mathematics and statistics.

- 3) One insurance company found that, on average, in 10,000 homeowners' policies the following claims have occurred.

Average value of claim	# of claims out of 10,000 policies
\$200,000	1
\$20,000	10
\$2,000	200
\$0 (makes no claim)	9789

- a) Find the following probabilities.

$P(\text{someone makes a claim worth } \$200,000)$

$P(\text{someone makes a claim worth } \$20,000)$

$P(\text{someone makes a claim worth } \$2,000)$

$P(\text{someone does NOT make a claim})$

- b) What is the average amount of money the insurance company should expect to pay on one average claim?

4) A nonprofit organization is holding a raffle. Each ticket costs \$1.00. Every ticket has an equal chance of winning (and losing). There is one grand prize of \$500, two \$100 prizes and ten \$5 prizes. The organization has sold all of its 2,000 raffle tickets.

a) Find the following probabilities.

P(grand prize, \$500)

P(winning \$100 prize)

P(winning \$5 prize)

P(Losing or not winning a prize)

b) What is the average amount of money **one person** can expect to gain or lose when buying one raffle ticket? Be sure to account for the \$1 you had to pay to purchase the ticket!

c) What is the average amount of money **the nonprofit organization** can expect to gain or lose per raffle ticket?