

(TEACHER EXAMPLE) Let's Play the Lottery!

Step 1 - Pick your game! Here are the rules...

- There must be at least 5 ways to win (You can click on "How to Win" once you click on each game)
- You can not pick the same game as anyone else in the class
- If your game has at least 1 "way to win" that involves a "Combination" (the technical math term) you will get extra credit! Honors students MUST have at least 7 ways to win.

<https://www.masslottery.com/games/draw-and-instants>



Step 2 - Answer each of these questions about your game:

- a) How do you play & win? (3-5 sentences in your own words)

Answers will vary. Must be 3-5 sentences in your own words

- b) Why did you choose this game? (2-3 sentences in your own words)

Answers will vary. Must be 2-3 sentences in your own words

- c) What is the most you could possibly win and what is the probability that you will win that prize?

\$1,000,000 is the maximum prize and the odds of winning it are 1 in 3,024,000

Step 3 - Do the math!

- a) List all of the possible prizes and the probability of winning each prize.
b) Convert each probability to a decimal and multiply each probability by the prize amount.

- c) Add each of these products together to get the “expected value” of a ticket.
(You can do all the math by hand or use a spreadsheet. Examples of both options posted below)

every number, unless there is already a negative sign
every whole number
every variable, unless there is already a different variable
numerals have a denominator of 1.

$a \cdot b = a \cdot b$
 $a(b) = a \cdot b$
 ab

$a + b$
 $\frac{a}{b} \quad a/b \quad b/a$

Any nonzero number to the zero power equals one.
 $\sqrt{4} = \sqrt[4]{4}$

Every number has an exponent of one.
 $\frac{1}{x} = x^{-1}$

There is a multiplication sign between every coefficient and variable.
A negative sign to the left of a variable is the same as negative one times the variable.
Every radical has an index of two, unless there is already another index.

One over a variable is the same as the variable to the negative first power.

add, subtract, multiply, divide, more than, less than, addend, subtrahend, product, quotient, double, triple, fourth power, square, cube, fourth root, fifth root, sixth root, seventh root, eighth root, ninth root, tenth root, hundredth, thousandth, millionth, billionth, trillionth, quadrillionth, quintillionth, sextillionth, septillionth, octillionth, nonillionth, googolplex.

no cell phones
no talking

Theoretical Probability vs Empirical Probability - what happened when we actually played

The Results if we played 1000000000 times

price
probability
 $1000000 \left(\frac{1}{3024000} \right) + 5000 \left(\frac{1}{72000} \right) + 1000 \left(\frac{1}{7200} \right) + 500 \left(\frac{1}{1636} \right) + 100 \left(\frac{1}{132} \right) + 50 \left(\frac{1}{150} \right) + 20 \left(\frac{1}{50} \right) + 15 \left(\frac{1}{150} \right) + 10 \left(\frac{1}{10} \right) + 5 \left(\frac{1}{10} \right)$

$.3307 + .0694 + .1389 + .3056 + .7576 + .3333 + .4000 + .1000 + 1 + .5 = \3.94

Prize value	probability of winning	decimal	Prize Value x Probability
1000000	1/3024000	0.000000331	0.330687831
5000	1/72000	0.000013889	0.069444444
1000	1/7200	0.000138889	0.138888889
500	1/1636	0.000611247	0.305623472
100	1/132	0.007575757	0.757575757
50	1/150	0.006666666	0.333333333
20	1/50	0.02	0.4
15	1/150	0.006666666	0.1
10	1/10	0.1	1
5	1/10	0.1	0.5
Total Expected Value			3.935553726

Step 4 - Answer & Reflect

- a) How does the “expected value” of each ticket compare to the price you would have paid for each ticket? Is it worth it to buy a ticket? Why or why not?

Since the price of each ticket is \$5 and the “expected value” of each ticket is \$3.94, I would conclude that ____ (answers will vary) ____

- b) What do you expect would happen if you purchased \$10,000 of these lottery tickets?

If I purchased \$10,000 worth of tickets, I would likely win approximately \$7,880 (math below)

$$10000 \times (3.94/5) = 7880$$

- c) If you won the lottery, you would probably have to pay a lot of taxes. Do some internet research to find out what percentage of your winnings you would have to pay back in taxes. What did you find? (Cite your sources)

Answers may vary. Cite your sources

- d) Does your answer to question “c” change your answer to question “a”? Why or why not?

Answers will vary. Explain your reasoning.