

key

THEORETICAL VS. EXPERIMENTAL PROBABILITY

Let's think about it!

If you select one card from a standard, 52-card deck, what is the probability (%) that you pull a heart? What about a spade? Diamond? Club?

$$\frac{13}{52}, \frac{13}{52}, \frac{13}{52}, \frac{13}{52}$$

$$.25 \quad .25 \quad .25 \quad .25$$

If I select four cards from a standard deck, I should pull one card from each suit, right? Let's try it!

# of Cards Drawn	Tally				Probability (%)			
	Hearts	Spades	Diamonds	Clubs	Hearts	Spades	Diamonds	Clubs
4					$\frac{1}{4} = 25\%$	$\frac{2}{4} = 50\%$	$\frac{1}{4} = 25\%$	0%
8					$\frac{3}{8} = 38\%$	$\frac{3}{8} = 38\%$	$\frac{1}{8} = 13\%$	0%
16					$\frac{4}{16} = 25\%$	$\frac{5}{16} = 32\%$	$\frac{4}{16} = 25\%$	$\frac{3}{16} = 19\%$
Total = 28 Cards	8	10	6	4	$\frac{8}{28} = 28.6\%$	$\frac{10}{28} = 35.7\%$	$\frac{6}{28} = 21.4\%$	$\frac{4}{28} = 14.3\%$

Was the predicted probability the same as the actual probability? Why or why not?

NO, because it was a small sample

<u>Theoretical Probability</u>	vs.	<u>Experimental Probability</u>
what should happen		what actually does happen
$\frac{\# \text{ favorable outcomes}}{\text{total \# of outcomes}}$		$\frac{\text{actual results}}{\text{total results}}$

What conclusion can you draw from the probability of each suit as you pull a larger number of cards?

the more cards you pull, the closer it gets to the theoretical probability.

Try It!

Wilma picks a card at random from a standard deck, looks at it, and then replaces it. She does this 100 times.

a. How many times would you expect her to draw a spade?

(theoretical) $\frac{13}{52} = \frac{1}{4} = .25 \times 100 = 25$ cards that are spades.

b. Is she guaranteed to draw a spade this many times? Explain why or why not!

no! because theoretical is not guaranteed.

c. Is this example illustrating experimental or theoretical probability?

1. Amanda used a standard deck of 52 cards and selected a card at random. She recorded the suit of the card she picked, and then replaced the card. The results are in the table below.

Diamonds		7
Hearts		9
Spades		11
Clubs		3

total: 30

- a. Based on her results, what is the experimental probability of selecting a heart?

$$9/30 = 3/10 = .3 \text{ or } 30\%$$

- b. What is the theoretical probability of selecting a heart?

$$13/52 = 1/4 = .25 \text{ or } 25\%$$

- c. Based on her results, what is the experimental probability of selecting a diamond or a spade?

$$18/30 = 3/5 = 60\%$$

- d. What is the theoretical probability of selecting a diamond or a spade?

$$26/52 = 1/2 = 50\%$$

2. You are playing Monopoly and roll one, six-sided die.

Side	# of times
1	8
2	3
3	9
4	6
5	4
6	6

total: 36

- a. What is the theoretical probability that the dice will land on an even number?

$$3/6 \quad 1/2 \quad \boxed{50\%}$$

- b. What was the experimental probability of how many times an even number was actually rolled using the table?

$$3 + 6 + 6 = 15$$

$$\frac{15}{36} = \boxed{41.6\%}$$

- c. If you roll a die 36 times, how many times would you expect to roll a "1"?

$$\frac{1}{6} \times 36 = 6 \text{ times.}$$

- d. How many times did you actually roll a "1" in the experiment?

8 times

- e. What is the theoretical probability for rolling a number greater than 4?

$$2/6 \quad 33.3\%$$

- f. What was the experimental probability of rolling a number greater than 4?

$$\frac{10}{36} = 27.7\%$$

↔ close!

3. You are taking a multiple choice test. Each of the five questions has four answer options - A, B, C, and D.

- a. How many different ways can your teacher make the answer key?

$$\underline{4} \cdot \underline{4} \cdot \underline{4} \cdot \underline{4} \cdot \underline{4} = 1,024$$

- b. Find the theoretical probability that the answer to the first question is "B."

$$1/4$$