Math 2

take ut
worksheet
from yesterday

Probability

Name: _____

Probability (A) = $\dfrac{\text{Number of ways an event can occur}}{\text{Total number of possible outcomes}}$

"The probability of the event A happening is equal to ..."

- -

experiment

a scenario that involves *chance* or an uncertain result & can have different *outcomes*

outcome

the ___result___ of a single performance of an experiment

event

a particular outcome of an ___experiment___

Probability

a measure of ___how___ ___likely___ a particular event is

Example

A box of donuts contains 6 sprinkled, 3 coconut, and 3 chocolate donuts. If you reach in and pull one out without looking, what is the probability that you get a chocolate donut?

$$\dfrac{3}{12} = \dfrac{1}{4}$$

(1/4 is less than half, so it's not as likely as getting a sprinkled donut would be)

$$0 \leq P \leq 1$$

Probability is always between zero and one.

(Decimal)

1 = certain

0 = impossible

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Try it!

1 Find the probability of rolling an even number on a standard 6-sided die.

Ways the event can occur: rolling a 2, a 4, or a 6 (3 ways)

Possible outcomes: rolling a 1, 2, 3, 4, 5, or 6 (6 total)

Probability: $\frac{3}{6}$ → Simplify: $\boxed{\frac{1}{2}}$

2 Find the probability of getting "heads" on three coin flips in a row.

Ways the event can occur: 1

Possible outcomes: 8

Probability: $\boxed{\frac{1}{8}}$

3 Find the probability of rolling both even numbers when you roll two 6-sided dice at once.

36 total outcomes

9 possible (both evens)

$\frac{9}{36}$ = $\boxed{\frac{1}{4}}$

HHH	HTT
HHT	THT
HTH	TTH
THH	TTT

11	21
12	22
13	23
14	24
15	25
16	26

...ause of the symmetry in a fair die – each side is equally likely to end up on top when the die is rolled – it is easy to ...the probabilities of various outcomes. As you work on the problems in this investigation, look for answers to this ...estion

How can you find and organize the probabilities associated with random events like the roll of two dice?

1.) Suppose a red die and green die are rolled at the same time.

a. What does the entry "3,2" in the chart mean? **Roll a 3 & Roll a 2.**

b. Complete a copy of the chart at the right, showing all possible outcomes of a single roll of two dice.

c. How many possible outcomes are there? **36**

d. What is the probability of rolling a (1,2), that is, a 1 on the red die and a 2 on the green die? What is the probability or rolling a (2,1)? A (4,4)? $\frac{1}{36}$, $\frac{1}{36}$, $\frac{1}{36}$

e. Would the chart be different of both dice had been the same color?

No, because we are looking at the numbers on the dice, not the color.

Number on Green Die

Number on Red Die	1	2	3	4	5	6
1	1,1	2,1	3,1	4,1	5,1	6,1
2	1,2	2,2	3,2	4,2	5,2	6,2
3	1,3	2,3	3,3	4,3	5,3	6,3
4	1,4	2,4	3,4	4,4	5,4	6,4
5	1,5	2,5	3,5	4,5	5,5	6,5
6	1,6	2,6	3,6	4,6	5,6	6,6

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SAMPLE SPACE **List of all possible outcome** (list, table, tree diagram)

EQUALLY LIKELY **Each outcome has the same probability.**
Equally

P(event) = $\dfrac{\#\ \text{of sucessful outcome (desired)}}{\#\ \text{of possible outcomes}}$

2.) If two dice are rolled, what is the probability of getting:

a. Doubles? $6/36 = \boxed{1/6}$

b. A sum of 7? $6/36 = \boxed{1/6}$

c. A sum of 11? $2/36 = \boxed{1/18}$

d. A 2 on at least one die or a sum of 2? $12/36 = \boxed{\dfrac{1}{3}}$

e. Doubles and a sum of 8? $\boxed{1/36}$

f. Doubles or a sum of 8? $10/36 = \boxed{5/18}$

3.) Suppose two dice are rolled.

a. What is the probability that the sum is no more than 9? $30/36 = \boxed{5/6}$

b. What is the probability that the sum is at least 9? $10/36 = \boxed{5/18}$

c. What is the probability that the sum is 2 or 3? Is greater than 3? Is at least 3? Is less than 3?

$\dfrac{3}{36} = \boxed{\dfrac{1}{12}}$ $\dfrac{33}{36} = \boxed{\dfrac{11}{12}}$ $\boxed{\dfrac{35}{36}}$ $\boxed{\dfrac{1}{36}}$

*****NOTICE THE DIFFERENCE BETWEEN at least AND less than*****
                                        3   3

*****NOTICE WHEN ASKED " opposite " QUESTIONS THE sum

OF THE OUTCOMES IS ALWAYS ___1___

(100%)

PROBABILITY DISTRIBUTION **Description of all possible numerical outcomes of a random situation along with the probability that each occurs**

4.) Use the information from the Dice chart
  a. Complete a copy of this probability distribution by filling in the probabilities.
  b. What is the sum of all the probabilities? $\frac{36}{36} = 1$ or 100%
  c. How could you use your probability distribution table to find each of the probabilities in problem 3? **look @ table & add up the prob.**

5.) Other probability distributions can be made from the sample space from problem 1 for the roll of two dice. Suppose that you roll two dice and record the larger of the two numbers (If the numbers are the same, record that number)
  a. Use your sample space from Problem 1 to help you complete a probability distribution table for this situation.
  b. What is the probability that the larger of the two numbers is 3? Is 2 or 3? Is 3 or less? Is more than 3?

Sum	Probability
2	$\frac{1}{36}$
3	$\frac{2}{36} = \frac{1}{18}$
4	$\frac{3}{36} = \frac{1}{12}$
5	$\frac{4}{36} = \frac{1}{9}$
6	$\frac{5}{36}$
7	$\frac{6}{36} = \frac{1}{6}$
8	$\frac{5}{36}$
9	$\frac{4}{36} = \frac{1}{9}$
10	$\frac{3}{36} = \frac{1}{12}$
11	$\frac{2}{36} = \frac{1}{18}$
12	$\frac{1}{36}$

| Larger	Probability
1	$\frac{1}{36}$
2	$\frac{3}{36} = \frac{1}{12}$
3	$\frac{5}{36}$
4	$\frac{7}{36}$
5	$\frac{9}{36} = \frac{1}{4}$
6	$\frac{11}{36}$

6.) Suppose you flip a coin twice.

a. Complete a chart that shows the sample space of all possible outcomes. It should look like the chart for rolling twice dice except that only heads and tails are possible for each coin rather than the six numbers that are possible for each die.

b. Make a probability distribution table that gives the probability of getting 0, 1, and 2 heads

c. What is the probability that you get exactly one head if you flip a coin twice? What is the probability that you get at least one head?

$\frac{1}{2}$

$3/4$

1st coin

	H	T
H	HH	HT
T	TH	TT

2nd coin

HH
HT
TH
TT

1st flip   2nd flip   3rd

T < T < H,T
    H < H,T

H < T < H,T
    H < H,T
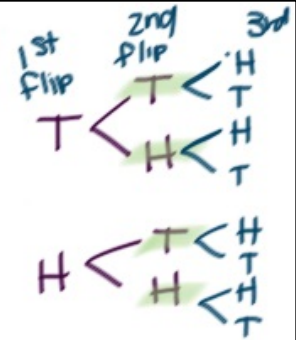
heads	Prob.
0	$\frac{1}{4}$
1	$\frac{2}{4}$ or $\frac{1}{2}$
2	$\frac{1}{4}$

$\frac{2}{4}$

$\frac{2}{4} > \frac{3}{4}$