



## 1.2 Probability and Odds

### probability

- the mathematical likelihood of something happening
  - a ratio that compares the number of possible successful outcomes to the total number of possible outcomes
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- Will the Ice Caps or the Pirates be more likely to win the game?
  - What is the chance of drawing a king from a deck of cards?
  - What is the possibility of rain today?
  - What are the chances of getting tails in one toss of a coin?

Every time a coin is flipped, there is a 50/50 chance of landing on heads or tails. So, if a coin is flipped 50 times, the result should be 25 heads and 25 tails.

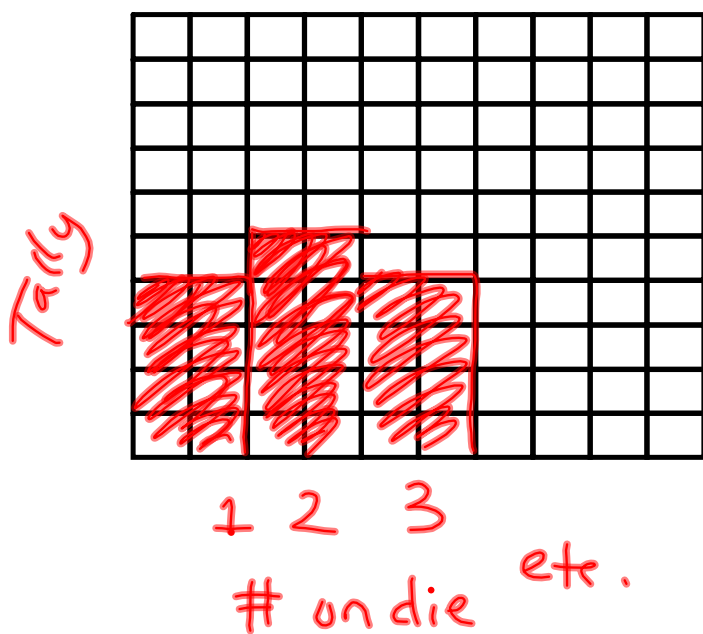
<http://www.random.org/coins/>

<http://www.btwaters.com/probab/dice/dicemain3D.html>

### Explore Probability

1. Suppose you roll one die.
  - a) What are all of the possible rolls you can get?
  - b) Suppose you roll a die 50 times. Predict the number of times you will roll a 3.
  
2. a) Copy the table shown in your notebook. In the first column, record all of the possible rolls. Refer to your answer in step 1 a).

Number on Die	Tally	Number of Times Rolled
1		
2		
3		
4		
5		
6		



example!

## On the Job 1

### Calculate Probability

A fisheries officer needs to measure the length of three different kinds of fish: pike, trout, and whitefish. The lake has been stocked with 250 fish.

- 25 fish are pike.
- 75 fish are trout.
- 100 fish are whitefish.

The officer catches the first fish to be measured. What is the probability that the fish is

- a) a pike?
- b) a trout?
- c) a whitefish?
- d) any one of these three kinds of fish?



Express each answer in four ways: fraction, decimal, percent, and words.

### Solution

- a) There are 25 pike in a total of 250 fish. The first fish caught could be any one of the 25 pike.

Fraction:  $\frac{25}{250} = \frac{1}{10}$

Decimal:  $1 \div 10 = 0.1$

Percent: C 1 ÷ 10 2nd % = 10

The probability is 10%.

Words: The probability of the fish being a pike is 1 in 10.

Write the fraction in lowest terms.

Experiment with your calculator to find out what keystrokes give you the answer.

- b)** There are 75 trout in a total of 250 fish.

Fraction:  $\frac{75}{250} = \frac{3}{10}$

Decimal:  $3 \div 10 = 0.3$

Percent:  $\boxed{C} \boxed{3} \boxed{\div} \boxed{10} \boxed{2nd} \boxed{\%} \boxed{=} \boxed{30}$

The probability is 30%.

Words: The probability of the fish being a trout is 3 in 10.

- c)** There are 100 whitefish in a total of 250 fish.

Fraction:  $\frac{100}{250} = \frac{2}{5}$

Decimal:  $2 \div 5 = 0.4$

Percent:  $\boxed{C} \boxed{2} \boxed{\div} \boxed{5} \boxed{2nd} \boxed{\%} \boxed{=} \boxed{40}$

The probability is 40%.

Words: The probability of the fish being a whitefish is 2 in 5.

- d)** The total number of pike, trout, and whitefish is

$$25 + 75 + 100 = 200.$$

Fraction:  $\frac{200}{250} = \frac{4}{5}$

Decimal:  $4 \div 5 = 0.8$

Percent:  $\boxed{C} \boxed{4} \boxed{\div} \boxed{5} \boxed{2nd} \boxed{\%} \boxed{=} \boxed{80}$

The probability is 80%.

Words: The probability that the fish is any one of these three kinds is 4 in 5.

6. A new medication for migraines has come on the market.
- The medication causes serious side effects in 2 of 100 patients. Express this probability as a fraction, a decimal, and a percent.
  - The medication is 90% effective. Express this probability in words, as a fraction, and as a decimal.
  - Melanie has a migraine once a year. Should she take the medication? Explain why or why not.
  - Ian has a migraine twice a month. Should he take the medication? Explain why or why not.



6. a)  $\frac{1}{50}$ , 0.02, 2%
- b) The medication is effective 9 times in 10,  $\frac{9}{10}$ , or 0.9.
- c) Example: No. She does not get headaches often.
- d) Example: Yes. He gets headaches regularly, so he would benefit from the medication.

7. Manufacturers need to determine the probability of their products failing. The chart shows a standard way of ranking probabilities of failure.

Probability of Failure	Ranking
more than 1 in 2	Very high: failure almost inevitable
1 in 3	
1 in 8	High: repeated failures
1 in 20	
1 in 80	Moderate: occasional failures
1 in 400	
1 in 2000	
1 in 15 000	Low: relatively few failures
1 in 150 000	
fewer than 1 in 1 500 000	Remote: failure is unlikely

**a)** A car part has a failure probability of 1 in 2000. What is the failure ranking? What is this probability as a decimal and a fraction?

**b)** An electronic part in a television has a failure probability of 12.5%. What is the failure ranking? What is this probability in words?

**c)** What do you think should be the highest acceptable failure ranking for a car? for a television? Explain.

7. **a)** moderate; 0.0005,  $\frac{1}{2000}$

**b)** high; The probability that an electronic part in a television fails is 1 in 8.

**c)** Example: car: low; reliability, safety/injury concerns; television: moderate; built-in usage period for electronics