MBF 3C1                                         Name: _____

# Comparing Theoretical and Experimental Probability

|  | THEORETICAL PROBABILITY | EXPERIMENTAL PROBABILITY |
|---|---|---|
| **Calculation Method?** | mathematical theory | perform many trials of the experiment |
| **Time Frame?** | quick | time consuming |
| **When Used?** | when theory exists | when theory is too complicated |
| **Product?** | gives exact probability | gives an estimate only |

As the number of trials in an experiment increases, experimental probability often approaches theoretical probability.

### Example 1

You roll a die 20 times and observe an even result 13 times.

a. What is the experimental probability of rolling an even number?

$$\frac{13}{20} = 65\%$$

b. What is the theoretical probability of rolling an even number?

even: 2,4,6

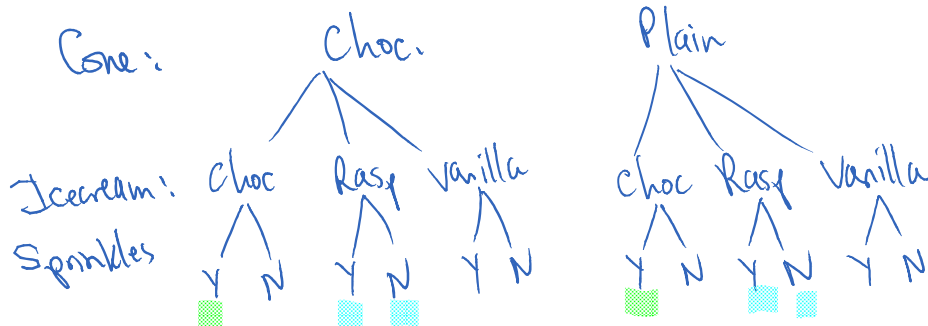possible outcomes: 1,2,3,4,5,6

$$\frac{3}{6} = 50\%$$

c. What could be done to make the experimental value more accurate and closer to the theoretical value?

do more trials than 20.

**Example 2**

An ice cream shop offers multiple options.  The ice cream can be served on a chocolate dipped cone or a plain cone, with chocolate, raspberry or vanilla ice cream.  A customer can also request sprinkles or no sprinkles.  All ice cream cone options have an equal chance of being chosen.

   a.  Create a tree diagram to list all possible ice cream cones.

Cone:                           Choc.              Plain

Icecream:   Choc    Rasp   vanilla      Choc   Rasp   Vanilla

Sprinkles      Y   N   Y   N   Y   N      Y   N   Y   N   Y   N

   b.  How many ice cream cone combinations can be made?

$$12$$

   c.  What is the probability that a customer orders a raspberry ice cream cone?

$$\frac{4}{12} = \frac{1}{3} = 33\%$$

   d.  What is the probability that a customer orders a chocolate ice cream cone with sprinkles?

$$\frac{2}{12} = \frac{1}{6} = 17\%$$