

# PROBABILITY

$$\text{Probability} = \frac{\# \text{ of ways to succeed}}{\text{total possible outcomes}}$$

$$\text{Odds} = \frac{\# \text{ of ways to succeed}}{\# \text{ of ways to fail}}$$

$$\text{Prob (female)} = \frac{6}{13}$$

$$\text{Prob (not shorts)} = \frac{7}{13}$$

$$\text{Odds (not shorts)} = \frac{7}{6}$$

$$\text{Odds (hood)} = \frac{8}{5}$$

$$\text{Prob (hood)} = \frac{8}{13}$$

$$\text{Prob (rain)} = \frac{5}{7} \quad \begin{array}{l} \text{suc} = \text{rain} \\ \text{total} \end{array}$$

$$\text{Odds (no rain)} = \frac{2}{5}$$

Theoretical probability--the probability that should occur based on rules or formulas

Experimental probability--Estimating the probability of an event by performing the activity many times and using the results to estimate the probability

Sample Space--all possible outcomes from an event

Given: 2 coins (Nickel & Quarter) and 3 marbles (2 purple, 1 blue)

Select 1 coin and 2 marbles. List the sample space.

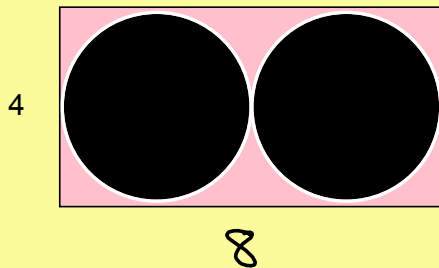
$N P_1 P_2$      $Q P_1 P_2$   
 $N P_1 B$      $Q P_1 B$   
 $N P_2 B$      $Q P_2 B$

What is the probability of selecting a nickel and at least one purple marble?

$$\frac{3}{6} = \frac{1}{2}$$

$$P(\text{blue}) = \frac{4}{6} = \frac{2}{3}$$

Geometric Probability--Estimating the probability using the area of a figure



$$\text{Area of whole} = 4 \cdot 8 = 32$$

$$\text{Area of circle} = \pi r^2 = \pi (2)^2 = 4\pi$$

$$\begin{aligned} \text{Fly} &= \text{Prob}(\text{pink}) \\ &= \frac{\text{Area of pink}}{\text{Area of whole}} = \frac{32 - 8\pi}{32} \\ &\approx 0.215 \end{aligned}$$

$$\begin{aligned} \text{pink} &= 32 - 2(4\pi) \\ &= 32 - 8\pi \end{aligned}$$

The Easter bunny brings you an Easter basket filled with 6 peanut butter eggs, 4 caramel eggs, and 2 solid chocolate eggs. Your mother will only allow you to have 3 eggs at a time.

$P_1, P_2, P_3$     $P_1, P_2, P_5$   
 $P_1, P_7, P_4$     $P_1, P_2, P_6$

What is the probability that you select 3 peanut butter eggs?

$$\text{Prob}(3 \text{ peanut butter}) = \frac{{}^6C_3}{{}^{12}C_3} = \frac{1}{11} \stackrel{\text{succ}}{\underset{\text{total}}{\approx}} 0.0909$$

What are the odds that you select 3 peanut butter eggs?

~~Odds (3 p.b) =  $\frac{\text{succ}}{\text{fail}} = \frac{{}^6C_3}{10}$~~

Always find probability first!

6 peanut butter
4 caramel
2 chocolate

What is the probability that you select 2 caramel eggs and 1 chocolate egg?

$$\text{Prob}(2 \text{ caramel} + 1 \text{ choc}) = \frac{{}^4C_2 \cdot {}^2C_1}{{}^{12}C_3} = \frac{3}{55}$$

AND = Multiply

If 5 eggs are selected, what is the probability of selecting 3 caramel eggs?

$$\text{Prob}(3 \text{ caramel} + 2 \text{ other}) = \frac{{}^4C_3 \cdot {}^8C_2}{{}^{12}C_5} = \frac{14}{99} \approx 0.141$$