PROBABILITY

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

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

$$\text{odds} \geq 0$$

$$\text{Prob (storm)} = \frac{5}{7} \quad \frac{\text{suc-storm}}{\text{total}}$$

$$\text{Odds (storm)} = \frac{\text{suc}}{\text{fail}} = \frac{5}{2}$$

Horse 1 = odds = $\frac{2}{3}$
Horse 2 = odds = $\frac{20}{1}$

$$\text{Prob (gentleman)} = \frac{7}{11}$$

$$0 \leq p \leq 1$$

$$\text{Prob}\binom{\text{not wearing}}{\text{black shoes}} = \frac{8}{11}$$

$$\text{Odds}\binom{\text{not wearing}}{\text{black shoes}} = \frac{8}{3}$$

$$\text{Odds (no tornado)} = \frac{5 \text{ no tor.}}{3 \text{ tor.}}$$

$$\text{Prob (tornado)} = \frac{\text{tornado}}{\text{total}}$$

$$= \frac{3}{8}$$

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

1000's

Sample Space--all possible outcomes from an event

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

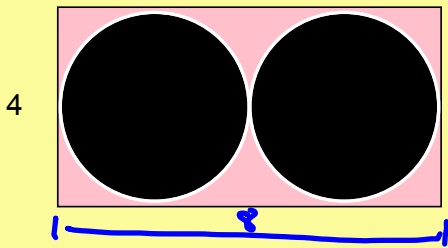Select 1 coin and 2 marbles. List the sample space.

N P P   Q P P
N P B   Q P B
N B P   Q B P

$P(\text{at least one } P) = \frac{6}{6} = 1$

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

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

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

4

$$\text{Prob (lands on pink)}$$

$$\frac{\text{Area (pink)}}{\text{Area (whole)}} = \frac{32-8\pi}{32} \approx 0.215$$

$\text{Rect} = 4 \cdot 8 = 32$

$\text{Circle} = \pi r^2 = \pi (2)^2 = 4\pi$

$\text{Pink} = 32 - 2(4\pi) = 32 - 8\pi$

$\text{Rect} = \ell \cdot w$

$\text{Triangle} = \frac{1}{2} bh$

$\text{Circle} = \pi r^2$

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.

Always find probability first!

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

$$P \; P \; P \qquad PMP$$
$$P \; P \; M \qquad PMM$$
$$P \; P \; C \qquad PMC$$

$$\frac{suc}{total} = \frac{{}_6C_3}{{}_{12}C_3} = \frac{1}{11} \approx 0.0909$$

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

$$Odds = \frac{suc}{fail} = \frac{{}_6C_3}{}$$

$$Prob = \frac{1}{11} \; \frac{suc}{total}$$

$$Odds = \frac{1}{10}$$

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

$$\frac{{}_4C_2 \cdot {}_2C_1}{{}_{12}C_3} = \frac{3}{55}$$

$$AND = multiply$$

$$odds = \frac{3}{52}$$

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

$$Prob\left(\begin{array}{c}3 \; caramel \; and \\ 2 \; other\end{array}\right) = \frac{{}_4C_3 \cdot {}_8C_2}{{}_{12}C_5}$$

$$8 \left\langle \begin{array}{l} \text{6 peanut butter} \\ \text{4 caramel} \\ \text{2 chocolate} \end{array}\right.$$

$$= \frac{14}{99} \approx 0.141$$