2.4 – Adding Probabilities

Probability of Mutually Exclusive Events → $\boxed{\text{OR} = \text{ADD}}$

If two events, A and B, are mutually exclusive (two events cannot occur at the same time), then the probability of one event or another event is $P(A \text{ or } B) = P(A) + P(B)$

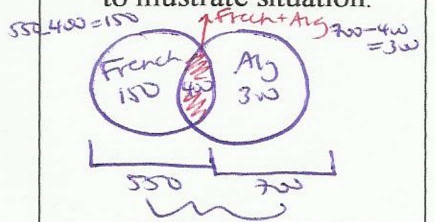
Example 1: Complete each problem about finding the probability of mutually exclusive events.

a.) Keisha has a stack of 8 baseball cards, 5 basketball cards, and 6 soccer cards. If she selects a card at random from the stack, find the probability of the situations below. 19 cards total		b.) A card is drawn from a standard deck of cards. Determine the probability. 52 cards total	
i.) P (baseball or soccer) $P(\text{base}) + P(\text{soccer})$ $= \frac{8}{19} + \frac{6}{19}$ $= \frac{14}{19} = \boxed{73.7\%}$	ii.) P (football or basketball) $P(\text{foot}) + P(\text{basket})$ $= \frac{0}{19} + \frac{5}{19}$ $= \frac{5}{19} = \boxed{26.3\%}$	i.) P (6 or king) $P(6) + P(K)$ $= \frac{4}{52} + \frac{4}{52}$ $= \frac{8}{52} = \boxed{15.4\%}$	ii.) P (red or black) $P(\text{red}) + P(\text{black})$ $= \frac{26}{52} + \frac{26}{52}$ $= \frac{52}{52} = \boxed{100\%}$

Probability of Inclusive Events →

If two events, A and B, are inclusive (two events can occur at the same time), then the probability one event or another event is $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

Example 2: Complete each problem about finding the probability of inclusive events.

a.) The enrollment at South High School is 1400. total Suppose 550 students take French, 700 take Algebra, and 400 take both French and Algebra.		b.) A card is drawn from a standard deck of cards. Determine the probability. 52 cards total	
i.) Draw a Venn Diagram to illustrate situation.  =1250 b/c not everyone takes French+Alg.	ii.) P (French or Algebra) $P(F) + P(A) - P(F+A)$ $= \frac{550}{1400} + \frac{700}{1400} - \frac{400}{1400}$ $= \frac{850}{1400} = \boxed{60.7\%}$	i.) P (queen or diamond) $P(Q) + P(D) - P(QD)$ $= \frac{4}{52} + \frac{13}{52} - \frac{1}{52}$ $= \frac{16}{52} = \boxed{30.8\%}$	ii.) P (black or ace) $P(B) + P(A) - P(BA)$ $= \frac{26}{52} + \frac{4}{52} - \frac{2}{52}$ $= \frac{28}{52} = \boxed{53.8\%}$

Example 3: Two cards are drawn from a standard deck of cards. Find each probability.
use nCr (combinations)

a.) P (2 kings or 2 black)	b.) P (both 8 or both jacks)	c.) P (both 3's or both < 5)	d.) P (2 face or 2 red)
$P(2K) + P(2B) - P(2BK)$ $= \frac{4C2}{52C2} + \frac{26C2}{52C2} - \frac{2C2}{52C2}$ $= \frac{6+325-1}{1326} = \boxed{24.9\%}$	$P(2\ 8\text{'s}) + P(2J\text{'s})$ $= \frac{4C2}{52C2} + \frac{4C2}{52C2}$ $= \frac{6+6}{1326} = \boxed{.9\%}$	$P(2\ 3\text{'s}) + P(2<5\text{'s}) - P(3\text{'s}+<5\text{'s})$ $= \frac{4C2}{52C2} + \frac{12C2}{52C2} - \frac{4C2}{52C2}$ $= \frac{6+66-6}{1326} = \boxed{5\%}$	$P(2\text{face}) + P(2\text{red}) - P(2\text{ red face})$ $= \frac{12C2}{52C2} + \frac{26C2}{52C2} - \frac{6C2}{52C2}$ $= \frac{66+325-15}{1326} = \boxed{28.4\%}$

Example 4: Determine whether the events are exclusive or inclusive. Then find the probability.

a.) There are 3 literature books, 4 algebra books, and 2 biology books on a shelf. 9 books total
If a book is randomly selected, what is the probability of selecting a literature book or an algebra book?

E (no both) → $P(L) + P(A) = \frac{3}{9} + \frac{4}{9} = \frac{7}{9} = \boxed{77.8\%}$

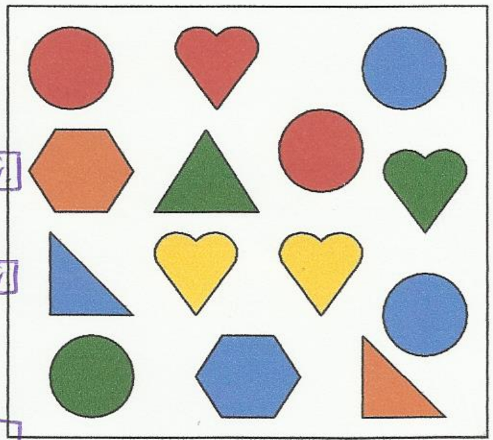
b.) A die is rolled. What is the probability of rolling a 5 or a number greater than 3? 6 total #'s

I (both) → $P(5) + P(>3) - P(5+>3) = \frac{1}{6} + \frac{3}{6} - \frac{1}{6} = \frac{3}{6} = \boxed{50\%}$

c.) In the Math Club, 7 of the 20 girls are seniors, and 4 of the 14 boys are seniors. What is the probability of randomly selecting a boy or a senior to represent the club at a statewide math contest? 34 ppl total, 11 seniors total

I → $P(B) + P(S) - P(BS) = \frac{14}{34} + \frac{11}{34} - \frac{4}{34} = \frac{21}{34} = \boxed{61.8\%}$

d.) Jamie reaches into a dish and selects a token at random. Find the probability of each situation. 14 tokens total



i.) What is the probability of Jamie picking a circle or heart token?

E → $P(\bigcirc) + P(\heartsuit) = \frac{5}{14} + \frac{4}{14} = \frac{9}{14} = \boxed{64.3\%}$

ii.) What is the probability of Jamie picking a triangle or blue token?

I → $P(\triangle) + P(\text{Blue}) - P(\text{blue } \triangle) = \frac{3}{14} + \frac{4}{14} - \frac{1}{14} = \frac{6}{14} = \boxed{42.9\%}$

iii.) What is the probability of Jamie picking an orange or hexagon token?

I → $P(\text{orange}) + P(\text{hexagon}) - P(\text{orange hexagon}) = \frac{2}{14} + \frac{2}{14} - \frac{1}{14} = \frac{3}{14} = \boxed{21.4\%}$

iv.) What is the probability of Jamie picking a blue heart or green triangle?

E → $P(\text{blue } \heartsuit) + P(\text{green } \triangle) = \frac{0}{14} + \frac{1}{14} = \frac{1}{14} = \boxed{7.1\%}$

v.) What is the probability of Jamie picking a red or yellow token?

E → $P(\text{red}) + P(\text{yellow}) = \frac{3}{14} + \frac{2}{14} = \frac{5}{14} = \boxed{35.7\%}$

e.) One tile with each letter of the alphabet is placed in a bag, and one is drawn at random. 26 total letters
What is the probability of selecting a vowel or a letter from the word EQUATION? 8 letters in word, 5 vowels

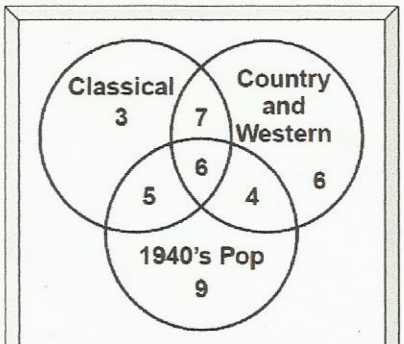
I → $P(\text{vowel}) + P(\text{letter from word}) - P(\text{vowels in word}) = \frac{5}{26} + \frac{8}{26} - \frac{5}{26} = \frac{8}{26} = \boxed{30.8\%}$

f.) There are 7 girls and 6 boys on the junior class homecoming committee.
A subcommittee of 4 people is being chosen at random to decide the theme for the class float. 13 ppl total
What is the probability that the subcommittee will be 3 girls or 2 boys? use nCr. 4 will be selected

P(3 girls (and 1 boy)) or P(2 boys (and 2 girls))

E → $= \frac{{}_7C_3 \cdot {}_6C_1}{{}_{13}C_4} + \frac{{}_6C_2 \cdot {}_7C_2}{{}_{13}C_4} = \frac{35 \cdot 6}{715} + \frac{21 \cdot 15}{715} = \frac{525}{715} = \boxed{73.4\%}$

g.) The Venn Diagram below represents senior citizens and their music preferences.
The number of senior citizens surveyed was 60. Determine the probability of each situation. total



a.) P (only Western or only Classical)

E → $P(\text{only W}) + P(\text{only C}) = \frac{6}{60} + \frac{3}{60} = \frac{9}{60} = \boxed{15\%}$

b.) P (Classical or 1940's Pop)

I → $P(C) + P(P) - P(C+P)$
$= \frac{3+7+6+5}{60} + \frac{5+6+4+9}{60} + \frac{5+6}{60} = \frac{21+24-11}{60} = \boxed{56.7\%}$

c.) P (Classical and Western and 1940's Pop)

E → $P(C \cdot W \cdot P) = \frac{6}{60} = \boxed{10\%}$