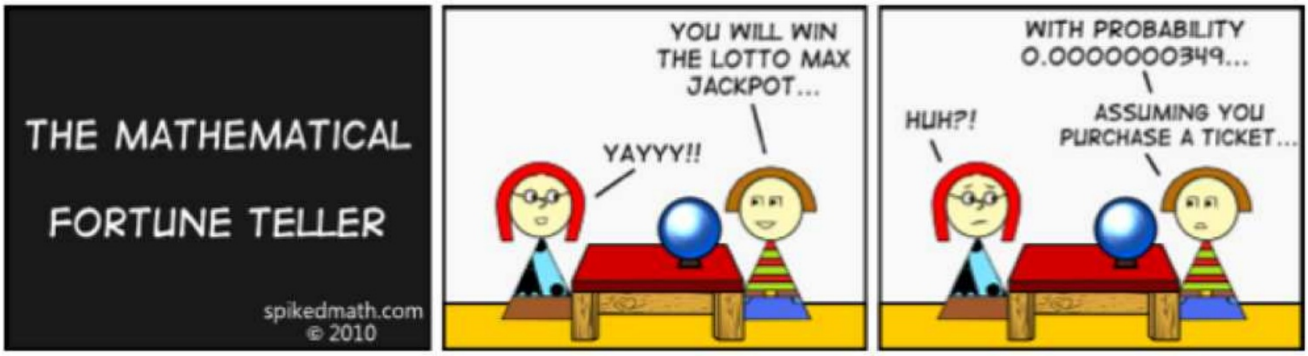
Addition Rule & Conditional Probability



The HW is on my website

Addition Rule Vocabulary

- mutually exclusive - two events are mutually exclusive or disjoint if they cannot both be true (occur) at the same time

  ex: the set of outcomes of a single coin toss, which can result in either heads or tails, but not both

- inclusive - two events are inclusive if they CAN happen simultaneously

  ex: When picking one student in a class you pick a student who is both a junior and 16 years old.

Addition Rule

- Mutually Exclusive Events

$$\boxed{P(A \cup B) = P(A) + P(B)}$$

or

- Inclusive Events

$$\boxed{P(A \cup B) = P(A) + P(B) - P(A \cap B)}$$

or and

ex 1: Are these events mutually exclusive or inclusive?

a)

Event A: randomly selecting a junior
Event B: randomly selecting a senior

Mutually exclusive. These are seperate categories

b)

Event A: randomly selecting a doctor
Event B: randomly selecting a female

Inclusive. A doctor can be female.

ex 2: Each teacher cast one vote for the teacher of the year. Of the teachers 25% voted for Novick, 20% for Goodwin, and 55% for Cousineau. If a voting teacher is selected at random, what is the probability that they voted for Novick or Cousineau?

$$0.25 + 0.55 = 0.80$$

ex 3: A drink company applies one label to each bottle cap: "free drink," "free meal," or try again." A bottle cap has a 1/10 probability of being labeled "free drink" and a 1/25 probability of being labeled "free meal." What is the probability that a bottle cap is labeled "free drink" or "free meal?"

ex 4: Find each probability on a number cube.

a) Rolling a 5 or an odd number.

$P(5 \text{ or odd}) = P(5) + P(\text{odd}) - P(5 \text{ and odd})$

$\frac{1}{6} + \frac{3}{6} - \frac{1}{6} = \frac{3}{6}$

b) ~~Rolling at least one 4 when rolling 2 number cubes~~.

Rolling a multiple of 2 or a multiple of 3.

$P(\text{mult. } 2 \text{ or mult. } 3) = P(\text{m. of } 2) + P(\text{m. of } 3) - P(\text{m of } 2 \text{ and m. of } 3)$

$\frac{3}{6} + \frac{2}{6} - \frac{1}{6} = \frac{4}{6}$

ex 5: A group of juniors and seniors were polled to find out how many were planning to major in a scientific study in college. 210 Juniors and 200 Seniors voted no. Find each of the probabilities if a student is selected at random.

	Yes	No	Total
Junior	150	210	360
Senior	112	200	312
Total	262	410	672

a) P(Junior) $\frac{360}{672}$

b) P(Yes) $\frac{262}{672}$

ex 5: A group of juniors and seniors were polled to find out how many were planning to major in a scientific study in college. 210 Juniors and 200 Seniors voted no. Find each of the probabilities if a student is selected at random.

	Yes	No	Total
Junior	150	210	360
Senior	112	200	312
Total	262	410	672

c) P(Senior or Yes) $= \frac{312}{672} + \frac{262}{672} - \frac{112}{672} = \frac{462}{672}$

d) P(Junior or No) $\frac{560}{672}$

ex 6: Of 3510 drivers surveyed, 1950 were male and 103 were color-blind. Only 6 of the color-blind drivers were female. What is the probability that a driver was male or was color-blind.

	Y	N	
Male	97	1853	
female	6	1554	
			3510

$$\frac{1950}{3510} + \frac{103}{3510} - \frac{97}{3510} = \frac{1956}{3510}$$

Conditional Probability

- Conditional Probability - conditional probability is the measure of the probability of an event given that another event has already occurred.

and

$$\boxed{P(B|A) = \frac{P(A \cap B)}{P(A)}}$$

In words $P(B|A)$ is read "the probability of B given A."

ex 7:

A survey of middle school students asked: What is your favorite winter sport? The results are summarized below:

Favorite Winter Sport

Grade	Snowboarding	Skiing	Ice Skating	TOTAL
6th	68	41	46	155
7th	84	56	70	210
8th	59	74	47	180
TOTAL	211	171	163	545

Find the indicated probabilities.

$$P(B|A) = \frac{P(A \cap B)}{P(A)}$$

a) P(7th grader, given ice skating)

$$\frac{\frac{70}{545}}{\frac{163}{545}} = \frac{70}{163}$$

ex 7:

A survey of middle school students asked: What is your favorite winter sport? The results are summarized below:

Favorite Winter Sport

Grade	Snowboarding	Skiing	Ice Skating	TOTAL
6th	68	41	46	155
7th	84	56	70	210
8th	59	74	47	180
TOTAL	211	171	163	545

Find the indicated probabilities.

b) P(ice skating, given a 7th grader)

$$\frac{70}{210}$$

ex 7:

A survey of middle school students asked: What is your favorite winter sport? The results are summarized below:

Favorite Winter Sport

Grade	Snowboarding	Skiing	Ice Skating	TOTAL
6th	68	41	46	155
7th	84	56	70	210
8th	59	74	47	180
TOTAL	211	171	163	545

Find the indicated probabilities.

c) P(snowboarding, given an 8th grader)

$$\frac{59}{180}$$

ex 7:

A survey of middle school students asked: What is your favorite winter sport? The results are summarized below:

Favorite Winter Sport

Grade	Snowboarding	Skiing	Ice Skating	TOTAL
6th	68	41	46	155
7th	84	56	70	210
8th	59	74	47	180
TOTAL	211	171	163	545

Find the indicated probabilities.

d) P(skiing, given a 6th grader)

$$\frac{41}{155}$$