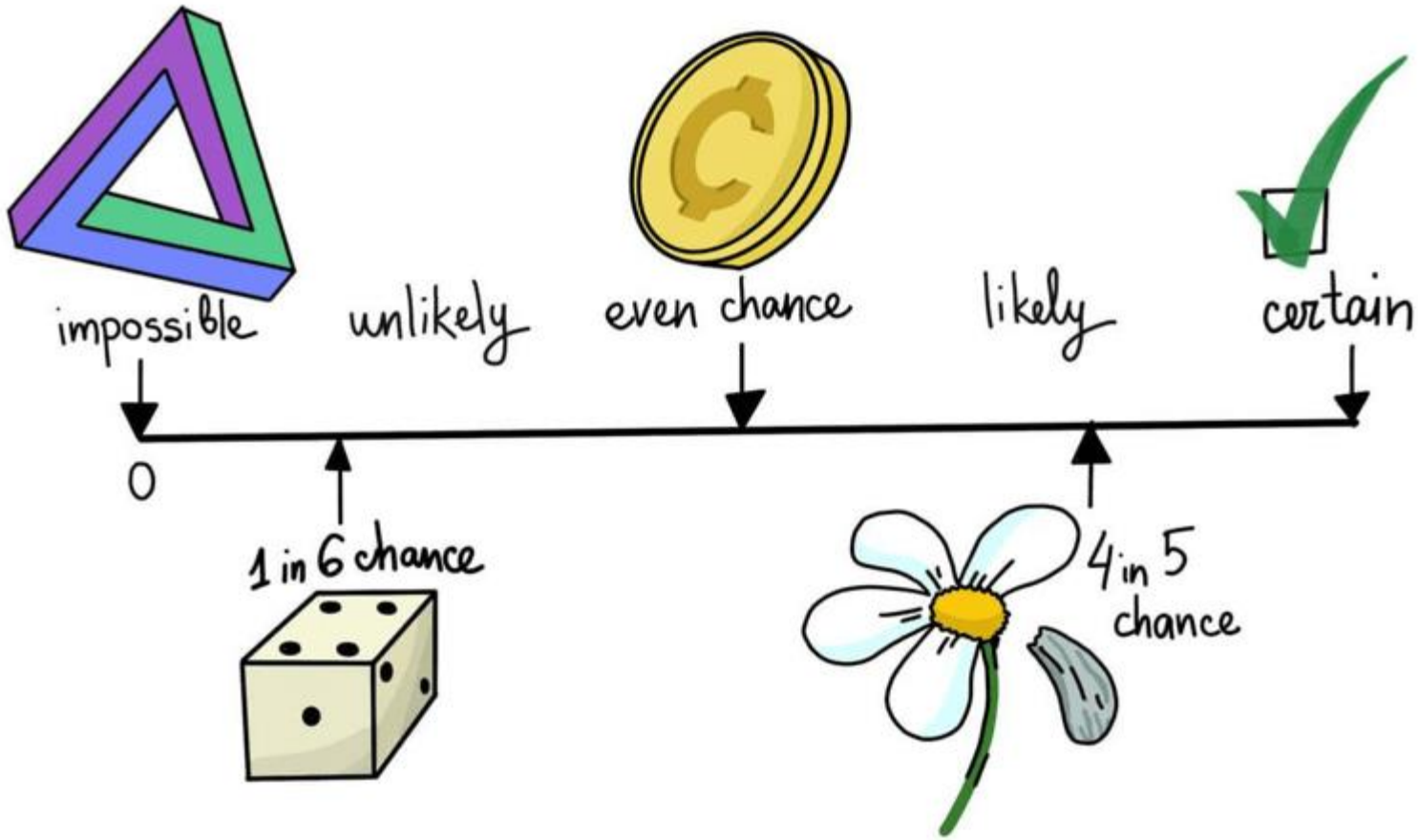
Probability Formulas



Probability Formulas

1.3

Name: _____

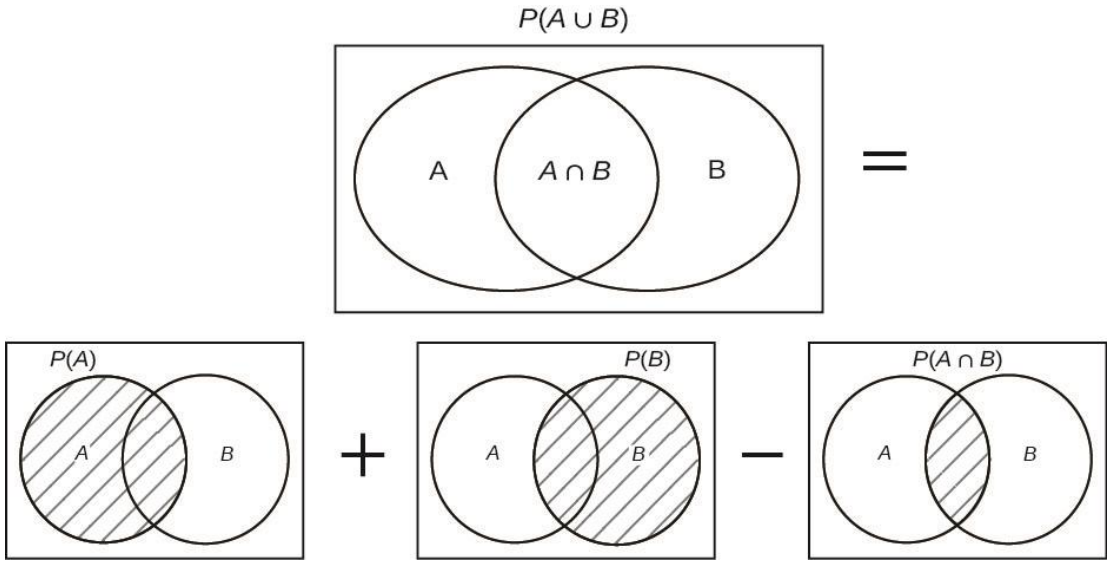
Title	Formula	With Raw Data	Word Problem
a) Theoretical Probability	$P(A) = \frac{n(A)}{n(s)}$	n(a) = 7, n(S) = 12. What is P(A)? $P(A) = \frac{n(A)}{n(s)}$ $= \frac{7}{12}$	There are 18 marbles in a bag. 9 of them are red. What is the probability of drawing a red marble? $P(R) = \frac{n(R)}{n(s)}$ $= \frac{9}{18}$ $= \frac{1}{12}$

b) Compliment	$P(A') = 1 - \mathrm{P(A)}$	P(A) = 0.4, What is P(A')? $P(A') = 1 - \mathrm{P(A)}$ $= 1 - 0.4$ $= 0.6$ P(B) = 60%, What is P(B')? $P(B') = 1 - \mathrm{P(B)}$ $= 100 - 60$ $= 40\%$	There are 14 marbles in a bag. 3 of them are red. What is the probability of drawing a marble that isn't red? $P(R') = 1 - \mathrm{P(R)}$ $= 1 - \frac{3}{14}$ $= \frac{14}{14} - \frac{3}{14}$ $= \frac{11}{14}$

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

c) Additive Principle		$P(A) = 0.3$, $P(B) = 0.4$, $P(A \cap B) = 0.2$. What is $P(A \cup B)$?	The probability of sun is 0.5 and of wind is 0.4. The probability of both is 0.2. What is the probability of sun or wind?

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$
$$= 0.3 + 0.4 - 0.2$$
$$= 0.5$$



$$P(S \cup W) = P(S) + P(W) - P(S \cap W)$$
$$= 0.5 + 0.4 - 0.2$$
$$= 0.7$$

Mutually Exclusive

['myü-chə-wəl-lē ik-'sklü-siv]

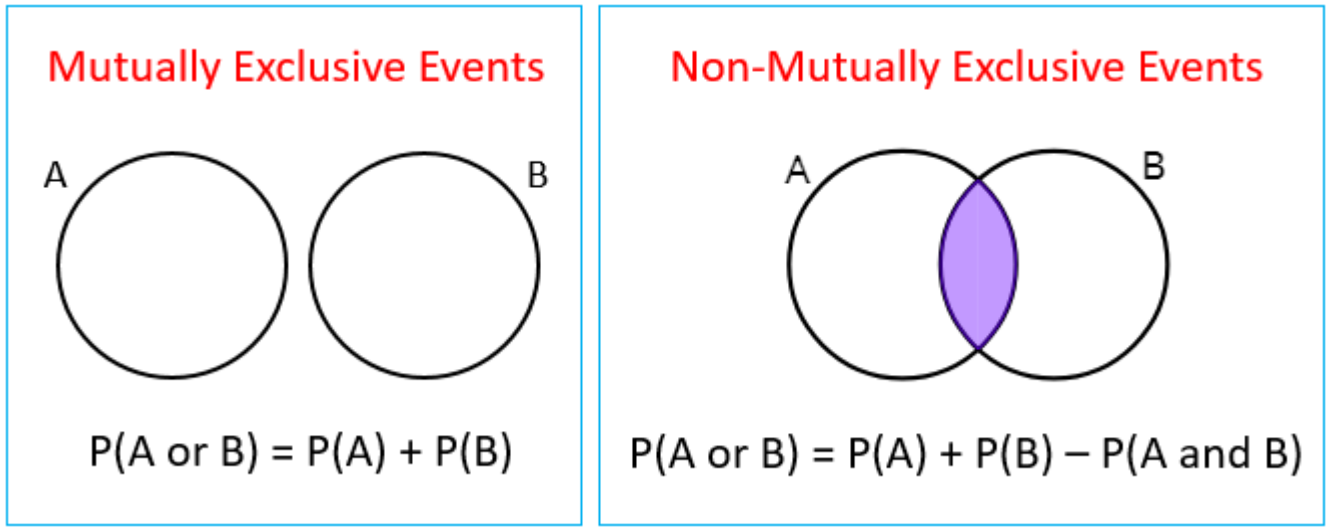
A statistical term describing two or more events that cannot happen simultaneously.

Classify as ME - Mutually Exclusive, N- Not Mutually Exclusive.

Event 1	Event 2	Classification (ME, N)
1. Dice rolls a 2	Same Dice rolls a 5	
2. Holiday is in October	Holiday starts with “H”	
3. Animal is a Spider	Animal is a Bird	
4. Ice Cream Flavour is Cookie Flavoured	Ice Cream Flavour contains Chocolate	
5. The card is a Heart	The card is a King	
6. The dessert is cold	The dessert is warm	
7. It is a horror film	It is a comedy	
8. The name is one syllable	The name starts with an A	
9. The vegetable is round	The vegetable is huge	
10. The city is in England	The city is in China	
11. The dog is small	The dog is large	

d) Mututally Exclusive – And	$P(A \cap B)=0$	P(A) = 0.2, P(B) = 0.3. What is $P(A \cap B)$? $P(A \cap B)=0$	The probability of extreme heat is 0.4 and of snow is 0.3. What is the probability of snow and extreme heat? $P(S \cap EH)=0$

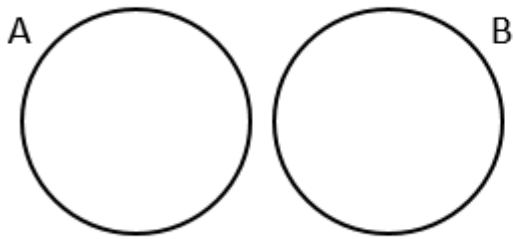
Mutually Exclusive Events cannot occur at the same time. There is no AND.



e) Mutually Exclusive – Additive Principle	$P(A \cup B) = P(A) + P(B)$	$P(A) = 0.2, P(B) = 0.3.$ What is $P(A \cup B)$? $P(A \cup B) = P(A) + P(B)$ $= 0.2 + 0.3$ $= 0.5$	The probability of extreme heat is 0.4 and of snow is 0.3. What is the probability of snow or extreme heat? $P(EH \cup S) = P(EH) + P(S)$ $= 0.4 + 0.3$ $= 0.7$

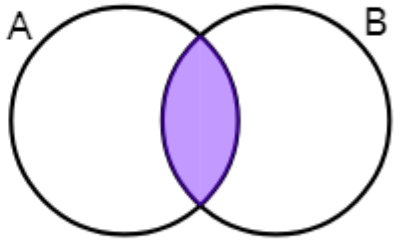
Because there is no AND, the additive principle can be reduced.

Mutually Exclusive Events



P(A or B) = P(A) + P(B)

Non-Mutually Exclusive Events



P(A or B) = P(A) + P(B) – P(A and B)

Independent Events

Two or more events that occur in a sequence. If the outcome of any event **does not** affect the possible outcomes of the other event(s), then the events are independent.

Dependent Events

Two or more events that occur in a sequence. If the outcome of any event **changes** the possible outcomes of the other event(s), then the events are dependent.

Classify as I - Independent, D - Dependent.

Event 1	Event 2	Classification (I, D)
1. Dice One rolls a 2	Dice Two rolls a 5	
2. You are tall	Your name starts with “F”	
3. It is rainy	It is cold	
4. You pull out one marble from a bag.	You pull out a second marble from the bag, without replacing the first.	
5. The first card is a Heart	The second card is a King (you replace the first)	
6. It is Tuesday	It is sunny	
7. It is April, in Ontario	It is rainy	
8. You live in Canada	You have gone ice-skating	

f) Idenpendent And	$P(A \cap B) = P(A) \times P(B)$	P(A) = 0.2, P(B) = 0.4. They are independent. What is is P(A∩B)? $P(A \cap B) = P(A) \times P(B)$ $= 0.2 \times 0.4$ $= 0.08$	The probability of rain is 0.4. The probability of pizza in the cafeteria for lunch is 0.3. What the probability of both occurring on the same day? $P(R \cap P) = P(R) \times P(P)$ $= 0.4 \times 0.3$ $= 0.12$

The probability of one event does not influence the other.

One coin doesn't influence the next coin being flipped.

g) Conditional	$P(B\|A) = \frac{P(A \cap B)}{P(A)}$	$P(A \cap B) = 0.2$, $P(A) = 0.5$. What is $P(B\|A)$?	The probability of sun is 0.6. The probability of sun and wind is 0.3. What is the probability of wind, given that it is sunny?

The probability of B, given that A occurs.

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

$$= \frac{0.2}{0.5}$$

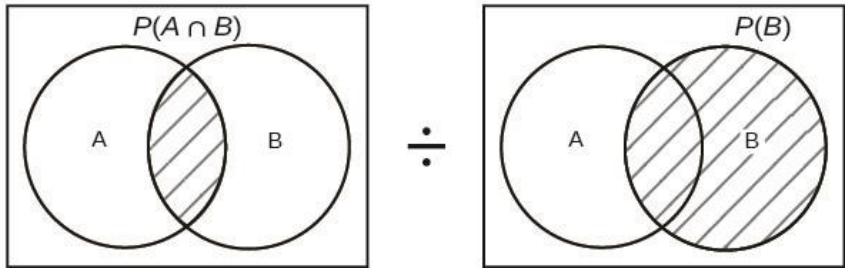
$$= 0.4$$

$$P(W|S) = \frac{P(S \cap W)}{P(S)}$$

$$= \frac{0.3}{0.6}$$

$$= 0.5$$

$$P(A|B) =$$



$\div$

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

The probability of A, given that B occurs.