Sets and Prob.

Set has some elements (ϵ) in common.

$\#$ = cardinal = number of elements.

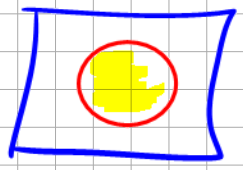
$\mathcal{U}$ = Universal = all possible elements

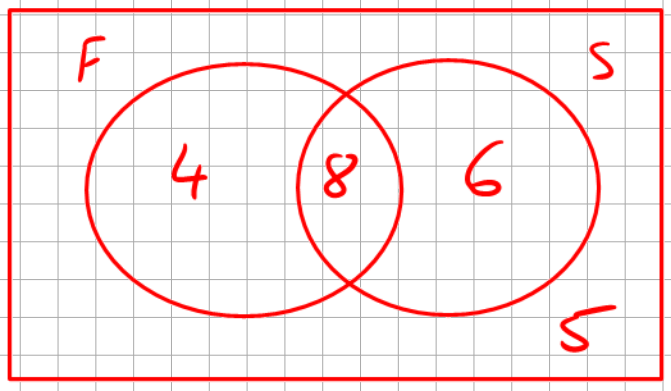
$\cap$ = intersection = both (and)

$\cup$ = union = together (or)

ϕ = null set = no elements

A' = complement = outside





Find

(i) $P(S) = \frac{14}{23}$

(ii) $P(S \cup F) = 1 - \text{outside}$

$= 1 - \frac{5}{23} = \frac{18}{23}$

$4 + 8 + 6 = 18$ Ans. $\frac{18}{23}$

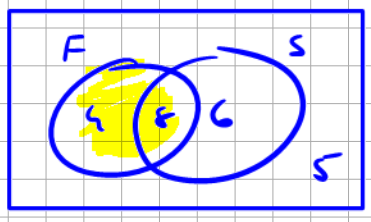
$= \frac{12}{23} + \frac{14}{23} - \frac{8}{23}$

(iii) $P(S \cap F) = \frac{8}{23}$

(iv) $P(S') = \frac{9}{23}$

(v) $P(S \cap F')$

$\frac{6}{23}$



(vi) $P(S|F) = \frac{8}{12} = \frac{2}{3}$

S|F means do Spanish given that you are already in French.

$P(S) = \frac{14}{23} = \frac{42}{69}$ $\quad P(S|F) = \frac{2}{3} = \frac{46}{69}$

These are events are not independent.

Learn

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

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

Independent = $P(A \cap B) = P(A).P(B)$

= $P(A|B) = P(A)$

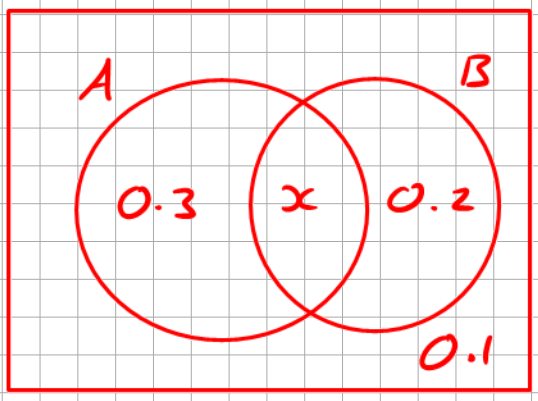
Mutually exclusive = nothing in common

= $P(A \cap B) = 0$

Exhaustive events = $P(A \cup B) = 1$

nothing outside.

$\mathcal{U}$



Find

(i) x

(ii) $P(A)$

(iii) $P(A \cup B)$

(iv) $P(A')$

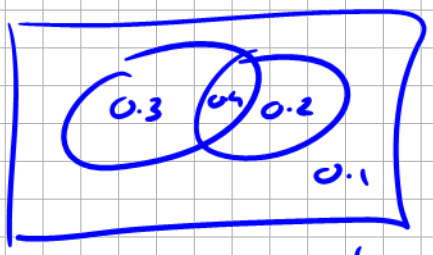
(v) $P(A|B)$

Are they independent.

(i) $x + 0.3 + 0.2 + 0.1 = 1 \Rightarrow x = 0.4$

(ii) $P(A) = 0.3 + 0.4 = 0.7$

(iii) $P(A \cup B) = 0.9 = P(A) + P(B) - P(A \cap B)$



(iv) $P(A') = 0.3$

(v) $P(A|B) = \dfrac{P(A \cap B)}{P(B)} = \dfrac{4}{6} = \dfrac{2}{3}$

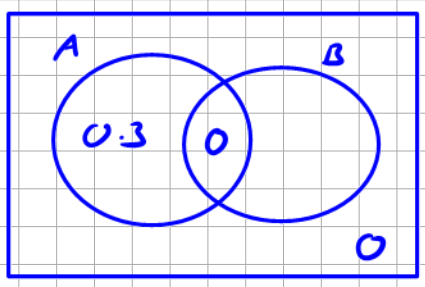
Not independent $\quad P(A) \neq P(A|B)$

$0.7 \neq 0.6$

$P(A \cap B) \neq P(A)\,P(B)$

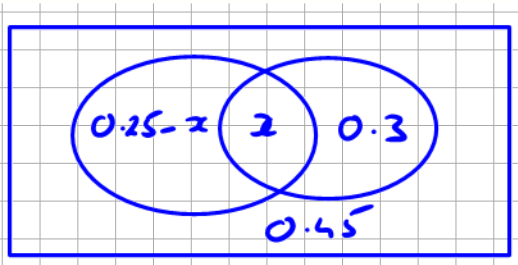
$0.4 \neq 0.7(0.6)$

A and B are 2 events that are both mutually exclusive and exhaustive. Given $P(A) = 0.3$ find $P(B)$.



$P(B) = 0.7$

• A and B are independent events such that $P(A) = 0{\cdot}25$ and $P(A \cup B) = 0{\cdot}55$.
Find $P(B)$.



Stuck ?

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

$\Rightarrow P(A \cap B) = P(A)P(B)$

Let $P(B) = x$

$0.25 + x - 0.25x = 0.55$

$0.75x = 0.3$

$x = \frac{0.3}{0.75} =$

• A bag contains the following cardboard shapes:
10 red squares, 15 green squares, 8 red triangles and 12 green triangles.
One of the shapes is drawn at random from the bag.
E is the event that a square is drawn.
F is the event that a green shape is drawn.

(i) Find $P(E \cap F)$.

(ii) Find $P(E \cup F)$.

(iii) State whether E and F are independent events, giving a reason for your answer.

(iv) State whether E and F are mutually exclusive events, giving a reason for your answer.

10 RS 15 GS 8 RT 12 GT

Sq = E = 10 + 15 = 25

Green = F = 15 + 12 = 27

Total 10 + 15 + 8 + 12 = 45

$P(E \cap F) = \frac{GS}{Total} = \frac{15}{45} = \frac{1}{3}$

(iii) $E \cup F$ = green or square

$15 + 12 + 10 = \frac{37}{45}$

$P(E) = \frac{25}{45}$ $\quad P(F) = \frac{27}{45}$

$P(E) \times P(F) = \frac{15}{45}$

$\frac{25}{45} \cdot \frac{27}{45} = \frac{15}{45}$ true $\Rightarrow$ independent

(iv) Mutually exclusive $\Rightarrow$ no

since $P(E \cap F) \neq 0$.

Two events E_1 and E_2 are independent. $P(E_1) = \frac{1}{5}$ and $P(E_2) = \frac{1}{7}$. Find

(i) $P(E_1 \cap E_2)$

(ii) $P(E_1 \cup E_2)$.

(i) $P(E_1 \cap E_2) = P(E_1) \times P(E_2)$

$= \frac{1}{5} \times \frac{1}{7} = \frac{1}{35}$

(ii) $P(E_1 \cup E_2) = P(E_1) + P(E_2) - P(E_1 \cap E_2)$

$= \frac{7}{35} + \frac{5}{35} - \frac{1}{35} = \frac{11}{35}$