Year 1

~ Statistics ~

SET THEORY
& PROBABILITY
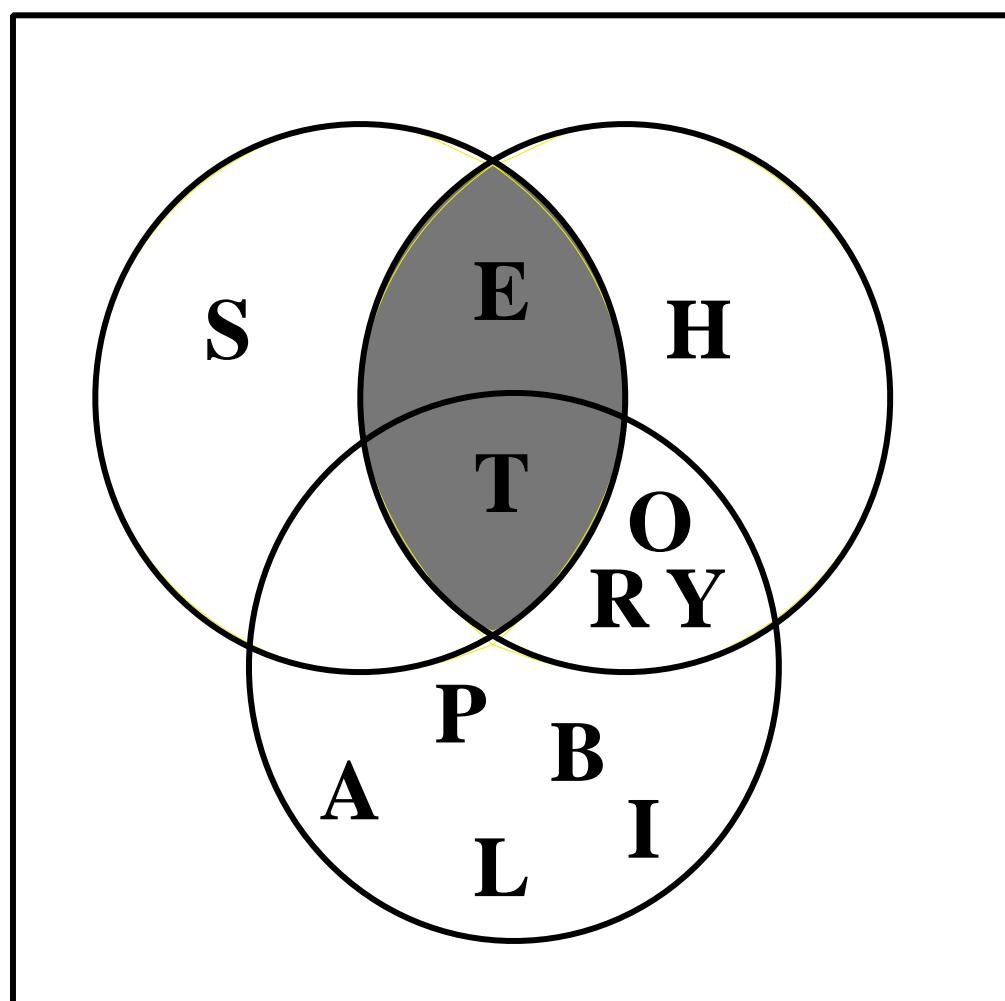
# Set Theory & Probability

**Lesson 1**

1.1 An Introductory Venn Diagram Question

Consider the following four statements about the sixth form students at a school;
100 study Maths.
58 study Biology.
68 study neither Maths nor Biology.
142 don't study Biology.

Use the four statements to complete the following Venn Diagram;
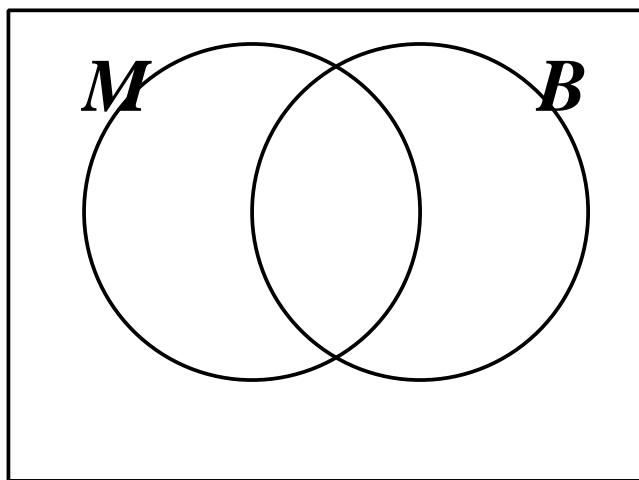
How many sixth form students are there at the school ?

Redraw the Venn Diagram showing probabilities rather than number of students.
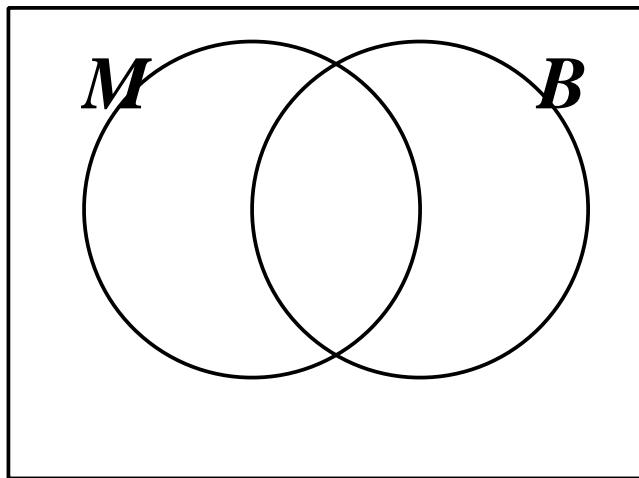
If a sixth form student from the school were to be selected at random what would be;

(i)   P (M)   **(ii)**   P (B)

(iii)   P ($M \cap B$)   **(iv)**   P ($M \cup B$)

(v)   P ($B\,'$)   **(vi)**   P ($M \,|\, B$)

(vii)   P ($B \,|\, M$)   **(viii)**   P ($M\,' \,|\, B$)

1.2 Notation

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P	probability. For now, other capital letters tend to be sets or events.
$\cap$	intersection, the bit in both.
$\cup$	union or merge of two or more sets.
'	not. $A\,'$ reads as not A.
|	given that. P ($A \,|\, B$) reads as the probability of event A happening given that event B has already happened.

1.3 Exercise

Question 1
A school has 140 students in its upper sixth.
85 take English.
24 take English and Chemistry.
82 don't take Chemistry.

Draw a Venn Diagram showing the number of students taking/not taking
English/Chemistry.
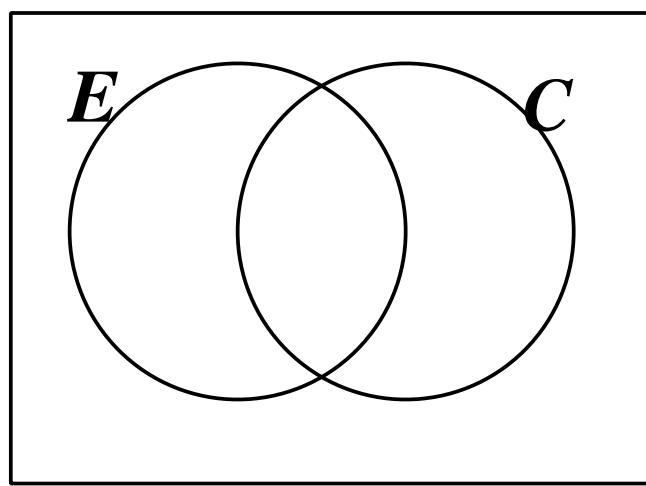
If an upper sixth student from the school were to be selected at random what would be;

(**i**)   P (C)   (**ii**)   P ($E\,'$)

(**iii**)   P ($E \cap C\,'$)   (**iv**)   P ($E \cup C$)

(**v**)   P ($E\,' \cap C\,'$)   (**vi**)   P ($E \mid C$)

(**vii**)   P ($C \mid E$)   (**viii**)   P ($E\,' \mid C$)

Question 2

In a certain class of 30 primary school children there are 16 girls.
There are 7 girls and 6 boys with fair hair.
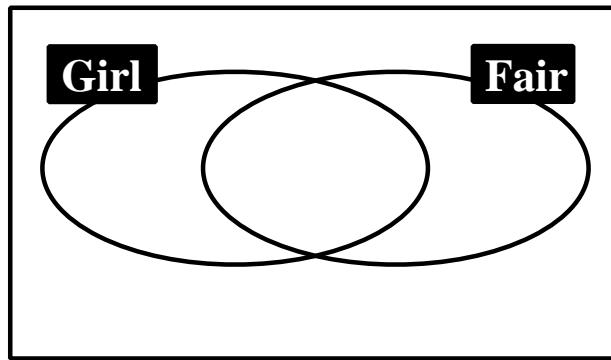
Complete the Venn diagram for the situation described above.

A pupil is selected at random to be the class captain.
Find the probability that the class captain;

(**i**)　　　is a girl

(**ii**)　　　is a boy with fair hair

(**iii**)　　　has not got fair hair

(**iv**)　　　is a girl and has not got fair hair.

Question 3

An archer has two attempts to hit a target.
The probability that his first arrow hits is 0.4.
The probability that the second arrow hits is 0.5.
Given that the probability that he hits the target with both arrows is 0.2,
find the probability that he misses the target with both arrows.

Question 4

A vet surveys 400 of her clients.

She finds that;

100 own dogs   60 own dogs and cats

212 own cats   44 own dogs and tropical fish

40 own cats and tropical fish   28 own dogs, cats and tropical fish

160 own tropical fish

(i)   Draw a three hoop Venn Diagram to represent the information given.

A client is chosen at random.

Find the probability that the client

(ii)   owns dogs only

(iii)   does not own tropical fish

(iv)   does not own dogs, cats or tropical fish