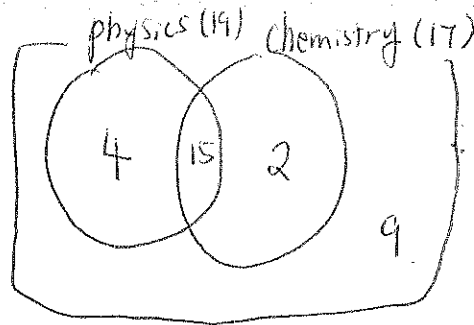


Practice) Problem Solving using Venn diagram

1)

In a class of 30 students, 19 study Physics, 17 study Chemistry, and 15 study both of these subjects. Display this information on a Venn diagram and hence determine the probability that a randomly selected class member studies:

- i) both subjects
- ii) Physics but not Chemistry
- iii) neither subject
- iv) at least one of the subjects
- v) exactly one of the subjects



- (i) Both subject 15
- (ii) 4
- (iii) 9
- (iv) $30 - 9 = 21$
- (v) $4 + 2 = 6$

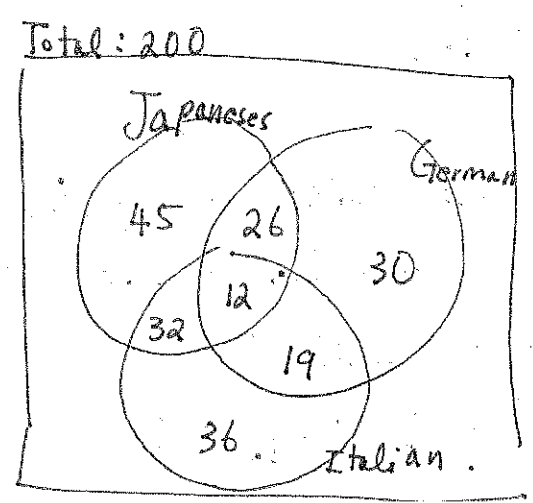
30
- 2
- 15
- 4
9

2)

A group of 200 language students, all of whom speak at least one language have the following languages:

Italian 99, Japanese 115, German 87, Italian and Japanese 44, German and Japanese 38 while Italian and German number 31.

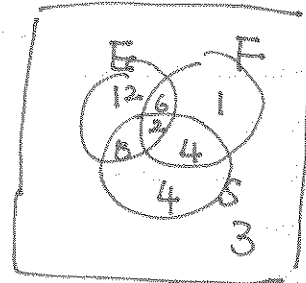
- i. Draw a Venn diagram to show this information.
- ii. If a student is chosen at random, what is the probability that s/he speaks all three languages? $\frac{12}{200}$
- iii. If a student is chosen at random, what is the probability that s/he speaks exactly two languages? $\frac{26 + 32 + 19}{200}$
- iv. If a student is chosen at random, what is the probability that s/he speaks Italian given that s/he also speaks Japanese? $\frac{32}{200}$
- v. If two students are randomly chosen to represent the group on a student council, are the selections independent of each other? Give a brief reason.



Independent because choosing one kid doesn't affect the others.

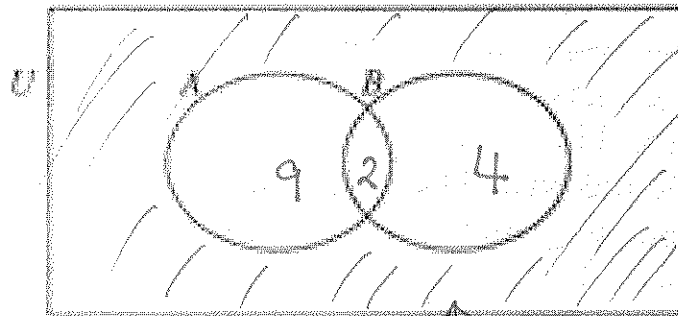
3. A group of 40 IB students were surveyed about the languages they have chosen at IB: E = English, F = French, S = Spanish.

3 students did not study any of the languages above.
 2 students study all three languages
 8 study English and French
 10 study English and Spanish
 6 study French and Spanish
 13 students study French
 28 students study English



- (a) Draw a Venn diagram to illustrate the data above. On your diagram write the number in each set.
 (b) How many students study only Spanish? 4
 (c) On your diagram shade $(E \cup F)^c$, the students who do not study English or French. 6

4. The following Venn diagram shows a sample space U and events A and B .



$n(U) = 36, n(A) = 11, n(B) = 6$ and $n(A \cap B) = 2$.

- (a) On the diagram, shade the region $(A \cup B)^c$.

- (b) Find

(i) $n(A \cap B)$: 2

(ii) $P(A \cap B)$: $\frac{2}{36} = \frac{1}{18}$.

- (c) Explain why events A and B are not mutually exclusive.

Mutually Exclusive events are $P(A) + P(B) = 1$

However this example has $P(A \cap B) = \frac{1}{18}$.

$P(A) + P(B) + P(A \cap B) = 1$

$\frac{9}{36} + \frac{4}{36} + \frac{2}{36} + \frac{21}{36} = 1$

key

Probability Questions From Past IB Exams

- A bag contains 2 red balls, 3 blue balls and 4 green balls. A ball is chosen at random from the bag and is not replaced. A second ball is chosen. Find the probability of choosing one green ball and one blue ball in any order. $\left(\frac{4}{9}\right)\left(\frac{3}{8}\right) + \left(\frac{3}{9}\right)\left(\frac{4}{8}\right)$
- In a bilingual school there is a class of 21 pupils. In this class, 15 of the pupils speak Spanish as their first language and 12 of these 15 pupils are Argentine. The other 6 pupils in the class speak English as their first language and 3 of these 6 pupils are Argentine. Find the probability that the pupil speaks Spanish as his/her first language.

A pupil is selected at random from the class and is found to be Argentine. Find the probability that the pupil speaks Spanish as his/her first language.

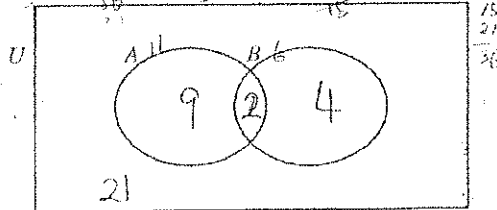
- For the events A and B , $p(A) = 0.6$, $p(B) = 0.8$ and $p(A \cup B) = 1$. Find

- $p(A \cap B) = 0.4$
- $p(\overline{A \cup B}) = 0$

- A fair coin is tossed eight times. Calculate
 - the probability of obtaining exactly 4 heads;
 - the probability of obtaining exactly 3 heads;
 - the probability of obtaining 3, 4 or 5 heads.

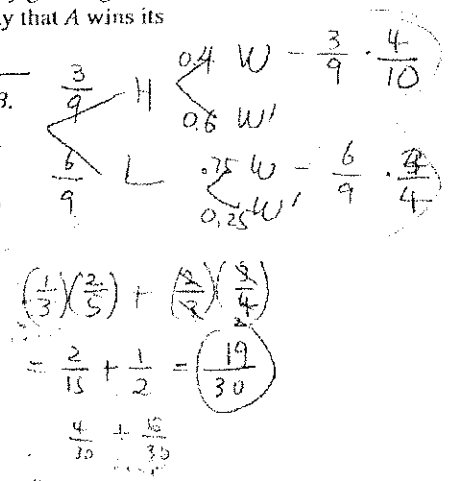
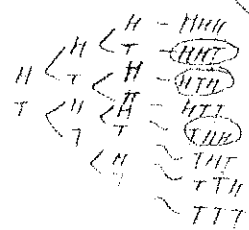
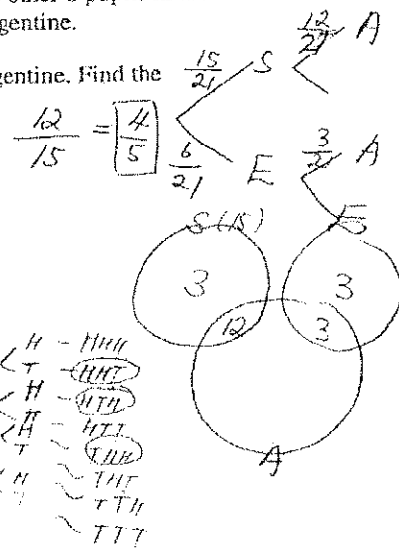
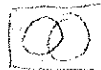
- The local Football Association consists of ten teams. Team A has a 40% chance of winning any game against a higher-ranked team, and a 75% chance of winning any game against a lower-ranked team. If A is currently in fourth position, find the probability that A wins its next game.

- The following Venn diagram shows a sample space U and events A and B .



$n(U) = 36$, $n(A) = 11$, $n(B) = 6$ and $n(A \cap B) = 2$.

- On the diagram, shade the region $(A \cup B)'$.



$$\left(\frac{1}{3}\right)\left(\frac{2}{5}\right) + \left(\frac{2}{3}\right)\left(\frac{3}{4}\right) = \frac{2}{15} + \frac{1}{2} = \frac{19}{30}$$

$$\frac{4}{10} + \frac{16}{30}$$

probability questions (From past IB Exams)

(3)

12 (a) $\frac{40}{36} \cdot \frac{7}{12} \left(\frac{21}{36}\right)$ (b) $\frac{11}{36}$ (c) $\frac{4}{20} \cdot \frac{8}{21}$

	1	2	3	4	5	6
1	(1,1) =2	(1,2) =3	(1,3) =4	(1,4) =5	(1,5) =6	(1,6) =7
2	(2,1) =3	(2,2) =4	(2,3) =5	(2,4) =6	(2,5) =7	(2,6) =8
3	(3,1) =4	(3,2) =5	(3,3) =6	(3,4) =7	(3,5) =8	(3,6) =9
4	(4,1) =5	(4,2) =6	(4,3) =7	(4,4) =8	(4,5) =9	(4,6) =10
5	(5,1) =6	(5,2) =7	(5,3) =8	(5,4) =9	(5,5) =10	(5,6) =11
6	(6,1) =7	(6,2) =8	(6,3) =9	(6,4) =10	(6,5) =11	(6,6) =12

13, Total out come $36 \times 36 = 1296$

(a) (i) $\frac{4}{9} \cdot \frac{4}{36} = \frac{1}{9}$

(ii) $\frac{4}{36} \times \frac{4}{36} = \frac{1}{81}$

(b) (i) $\left(\frac{1}{36}\right)\left(\frac{1}{36}\right) + \left(\frac{2}{36}\right)\left(\frac{2}{36}\right) + \left(\frac{3}{36}\right)\left(\frac{3}{36}\right) + \left(\frac{4}{36}\right)\left(\frac{4}{36}\right) + \dots = \frac{146}{1296}$

(ii) Not having the same score $\left(1 - \frac{146}{1296}\right)$

Alan Exceeding $\Rightarrow \frac{1}{2} \left(1 - \frac{146}{1296}\right) = \frac{575}{1296}$

Belle's score

(c)

X	1	2	3	4	5	6
$P(X=x)$	$\frac{1}{1296}$	$\frac{15}{1296}$	$\frac{65}{1296}$	$\frac{175}{1296}$	$\frac{369}{1296}$	$\frac{671}{1296}$

(d) $E(X) = (1)\left(\frac{1}{1296}\right) + (2)\left(\frac{15}{1296}\right) + (3)\left(\frac{65}{1296}\right) + (4)\left(\frac{175}{1296}\right) + (5)\left(\frac{369}{1296}\right) + (6)\left(\frac{671}{1296}\right)$