1. Use the answers in your book to check your HW

If you had QUESTIONS ON Homework

2. Be sure to pull out your IB FORMULA sheet.

Start the warm up.

The table below shows the number of left and right handed tennis players in a sample of 50 males and females.

	Left handed	Right handed	Total
Male	3	29	32
Female	2	16	18
Total	5	45	50

If a tennis player was selected at random from the group, find the probability that the player is

(a) male and left handed;

(b) right handed;

(c) right handed, given that the player selected is female.

1. The table below shows the number of left and right handed tennis players in a sample of 50 males and females.

	Left handed	Right handed	Total
Male	3	29	32
Female	2	16	18
Total	5	45	50

original Sample Space = 50

If a tennis player was selected at random from the group, find the probability that the player is

(a) male and left handed; 3/50

(b) right handed; 45/50

(c) right handed, given that the player selected is female. /18

16/18 ← reduced sample space

(a) Represent the above information on a Venn Diagram.

(b) How many children drank none of the above?

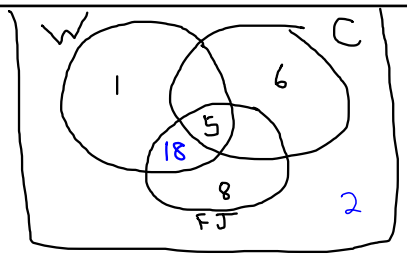
(c) A child is chosen at random. Find the probability that the child drank

(i) coffee;

(ii) water or fruit juice but not coffee;

(iii) no fruit juice, given that the child did drink water.

(d) Two children are chosen at random. Find the probability that both children drank all three choices.



Represent the above information on a Venn Diagram.

How many children drank none of the above? 2

A child is chosen at random. Find the probability that the child drank

(i) coffee;

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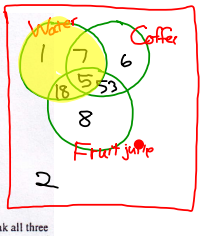


Represent the above information on a Venn Diagram.

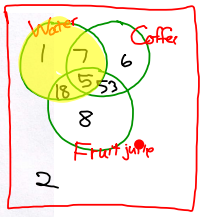
How many children drank none of the above? 2

A child is chosen at random. Find the probability that the child drank

(i) coffee; $\frac{71}{100}$

(ii) water or fruit juice but not coffee; $\frac{27}{100}$

(iii) no fruit juice, given that the child did drink water. $\frac{8}{31}$



Two children are chosen at random. Find the probability that both children drank all three choices.

$\frac{5}{100} \cdot \frac{4}{99} = \frac{20}{9900} = \frac{2}{990} = \frac{1}{495}$

.002

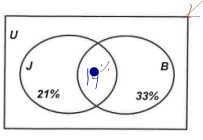
or 0.2%

3

A survey of a large number of students at an international school concerning exercise habits shows the following:

35% of the students jog (*J*)
47% of the students ride a bike (*B*)
14% of the students jog and ride a bike

(i) Copy and complete the Venn diagram below given the information provided.



(ii) Determine the probability of

(a) students who do not jog or ride a bike.

(b) students who do not jog.

(iii) If the school has a total of 1800 students, then What is the expected number of students who ride a bike?

3

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It's percent so it must add to 1 or 100%

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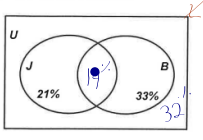

(ii) Determine the probability of

(a) students who do not jog or ride a bike. 32%

(b) students who do not jog. 33+32 = 65%

(iii) If the school has a total of 1800 students, then What is the expected number of students who ride a bike? 47% of 1800 = 846 students

---

4

At a second international school a survey was taken of grade 10, 11 and 12 students concerning their attitude about the use of nuclear energy. The results are shown in the table below:

Nuclear Energy Preference

		For (F)	Against (A)	No Opinion (N)	Total
Grade	10	6	16	12	34
	11	2	24	10	36
	12	5	11	14	30
	Total	13	51	36	100

If a student from this school survey is selected at random, Then what is the probability that the student

(i) is in grade 10 and is against the use of nuclear energy (A)?

(ii) is in grade 11 or is for the use of nuclear energy (F)?

(iii) is in grade 11 or grade 12 and has no opinion (N)?

4

At a second international school a survey was taken of grade 10, 11 and 12 students concerning their attitude about the use of nuclear energy. The results are shown in the table below:

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		For (F)	Against (A)	No Opinion (N)	Total
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	12	5	11	14	30
	Total	13	51	36	100

If a student from this school survey is selected at random, Then what is the probability that the student

(i) is in grade 10 and is against the use of nuclear energy (A)? 16/100

(ii) is in grade 11 or is for the use of nuclear energy (F)?

(iii) is in grade 11 or grade 12 and has no opinion (N)?

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(iii) is in grade 11 or grade 12 and has no opinion (N)?

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	12	5	11	14	30
	Total	13	51	36	100

If a student from this school survey is selected at random, Then what is the probability that the student

(i) is in grade 10 and is against the use of nuclear energy (A)? 16/100

(ii) is in grade 11 or is for the use of nuclear energy (F)? 47/100

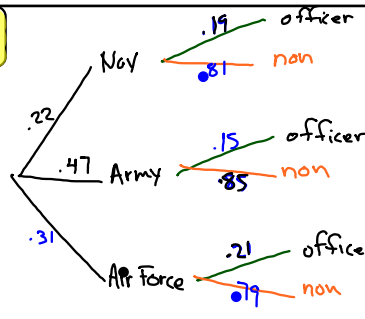
(iii) is in grade 11 or grade 12 and has no opinion (N)? 24/100

P. 482 #4

In a class of 40 students, 19 play tennis, 20 play netball and 8 play neither of these sports. A student is randomly chosen from the class. Determine the probability that the student:

a plays tennis
b does not play netball
c plays at least one of the sports
d plays one and only one of the sports
e plays netball, but not tennis
f plays tennis knowing he/she plays netball.

P. 474 #5

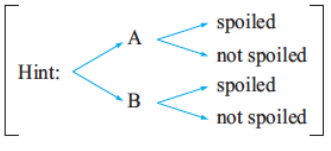


i) P(not officer)

iii) (not an army or air force)

P. 474 # 7

Machine A makes 40% of the bottles produced at a factory. Machine B makes the rest. Machine A spoils 5% of its product, while Machine B spoils only 2%. Determine the probability that the next bottle inspected at this factory is spoiled.



P478 #2

5 tickets (1,2,3,4,5)

a) P(both odd)

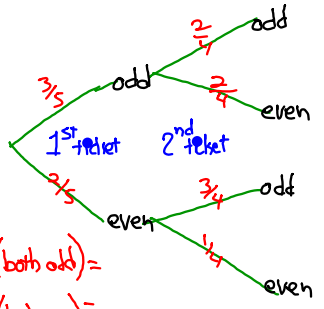
b) P(both even)

c) P(one of each)

= P(odd/even or even/odd)

=

5 tickets (1,2,3,4,5)



a) P(both odd) =

b) P(both even) =

c) P(one of each) =

P478 #

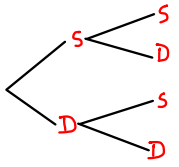
A cook selects an egg at random from a carton containing 6 ordinary eggs and 3 double-yolk eggs. She cracks the egg into a bowl and sees whether it has two yolks or not. She then selects another egg at random from the carton and checks it.

Let S represent "a single yolk egg" and D represent "a double yolk egg".

a Draw a tree diagram to illustrate this sampling process.

b What is the probability that both eggs had two yolks?

c What is the probability that both eggs had only one yolk?



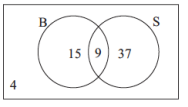
P482 – 3

3 In a survey at an alpine resort, people were asked whether they liked skiing (S) or snowboarding (B). Use the Venn diagram to determine the number of people:

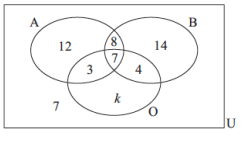
a in the survey b who liked both activities

c who liked neither activity

d who liked exactly one of the activities.



P482 #8



In the Venn diagram, U is the set of all members of a gymnastic club.

The members indicate their liking for apples (A), bananas (B) and oranges (O). There are 60 members in the club.

a Find the value of k.

b If a randomly chosen member is asked about their preferences for this fruit, what is the probability that the member likes:

i only bananas

ii bananas and oranges

iii none of these fruit

iv at least one of these fruits

v all of the fruits

vi apples and bananas, but not oranges

vii oranges or bananas

vii exactly one of the three varieties of fruit

Aim

Understand and use the Probability Laws

Pull out your IB Formula Sheet

Laws of Probability

The Laws

Write down the laws of probability as they are recorded in your formula booklet.

Combined Events	
Mutually Exclusive Events	
Independent Events	
Conditional Probability	

3.6	Probability of an event A	$P(A) = \frac{\text{number of outcomes in } A}{\text{total number of outcomes}}$
	Complementary events	$P(A') = 1 - P(A)$
3.7	Combined events	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$
	Mutually exclusive events	$P(A \cap B) = 0$
	Independent events	$P(A \cap B) = P(A)\,P(B)$
	Conditional probability	$P(A \mid B) = \frac{P(A \cap B)}{P(B)}$

or

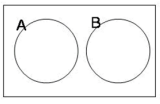
and

given that

For example:

A: The child has blue eyes

B: The child has brown eyes.



In this case, the Combined Events Law simplifies to:

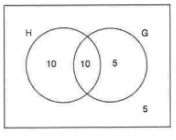
$$P(A \cup B) = P(A) + P(B)$$

School 1

together

Consider the following Venn Diagrams/information that show/describe the sets of students that study History (H) and Geography (G) in different schools. Answer the questions that go with each one by using the laws of probability.

School 1



a) Work out $P(G)$ $15/30 = 1/2$

b) Work out $P(H)$ $20/30$

c) Work out $P(G|H)$

d) What can we conclude from the difference between the answers to a) and c)?

e) Using the rule for independent events, verify if studying history and studying geography are independent events in this school.

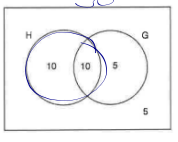
f) Verify that $P(G \cup H) = P(G) + P(H) - P(G \cap H)$

g) Why are these events not mutually exclusive?

Consider the following Venn Diagrams/information that show/describe the sets of students that study History (H) and Geography (G) in different schools. Answer the questions that go with each one by using the laws of probability.

School 1

30



a) Work out $P(G)$

b) Work out $P(H)$

c) Work out $P(G|H)$

d) What can we conclude from the difference between the answers to a) and c)?

e) Using the rule for independent events, verify if studying history and studying geography are independent events in this school.

$P(G \cap H) = P(G) \cdot P(H)$ $\frac{10}{30} = \frac{15}{30} \cdot \frac{20}{30}$ =

f) Verify that $P(G \cup H) = P(G) + P(H) - P(G \cap H)$

$\frac{25}{30} = \frac{15}{30} + \frac{20}{30} - \frac{10}{30}$

g) Why are these events not mutually exclusive?

$P(G \cap H) \neq 0$

Events are not Mutually exclusive

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

$P(G/H) = \frac{P(G \cap H)}{P(H)}$

$= \frac{\frac{10}{30}}{\frac{20}{30}}$

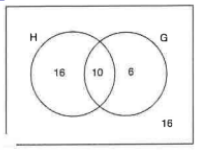
$= \frac{10}{30} \cdot \frac{30}{20}$

$= 1/2$

School 2

then stop

School 2



a) Work out $P(G)$

b) Work out $P(H)$

c) Work out $P(G|H)$

d) What can we conclude from the difference between the answers to a) and c)?

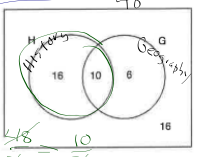
e) Using the rule for independent events, verify if studying history and studying geography are independent events in this school.

f) Verify that $P(G \cup H) = P(G) + P(H) - P(G \cap H)$

g) Why are these events not mutually exclusive?

School 2

48



a) Work out $P(G)$ $16/48$ or $1/3$

b) Work out $P(H)$ $26/48$

c) Work out $P(G|H) = \frac{P(G \cap H)}{P(H)} = \frac{\frac{10}{48}}{\frac{26}{48}} = \frac{10}{26}$

d) What can we conclude from the difference between the answers to a) and c)?

$\frac{10}{48} \cdot \frac{48}{26} = \frac{10}{26}$

same, so G and H are independ events

e) Using the rule for independent events, verify if studying history and studying geography are independent events in this school.

$P(G \cap H) = P(G) \cdot P(H)$

$\frac{10}{48} = \frac{16}{48} \cdot \frac{26}{48}$

f) Verify that $P(G \cup H) = P(G) + P(H) - P(G \cap H)$ $\frac{32}{48} = \frac{16}{48} + \frac{26}{48} - \frac{10}{48}$

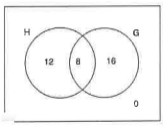
g) Why are these events not mutually exclusive? $\frac{32}{48} = \frac{32}{48}$

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

Schools 3 and 4

then a BB

School 3



a) Work out $P(G)$

b) Work out $P(H)$

c) Work out $P(G|H)$

d) What can we conclude from the difference between the answers to a) and c)?

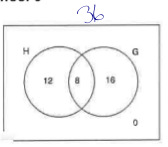
e) Using the rule for independent events, verify if studying history and studying geography are independent events in this school.

f) Verify that $P(G \cup H) = P(G) + P(H) - P(G \cap H)$

g) Why are these events not mutually exclusive?

School 3

36



a) Work out $P(G)$ $24/36 = 4/6 = 2/3$

b) Work out $P(H)$ $20/36$

c) Work out $P(G|H)$ $\frac{P(G \cap H)}{P(H)} = \frac{8/36}{20/36} = 2/5$

d) What can we conclude from the difference between the answers to a) and c)?

Since they are not same G and H are not independent

e) Using the rule for independent events, verify if studying history and studying geography are independent events in this school.

$P(G \cap H) \overset{?}{=} P(G) \cdot P(H)$ $\frac{8}{36} \overset{?}{=} \frac{24}{36} \cdot \frac{20}{36}$

f) Verify that $P(G \cup H) = P(G) + P(H) - P(G \cap H)$ $\frac{2}{9} \neq \frac{10}{27}$

agreement

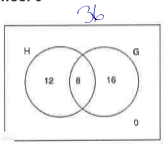
g) Why are these events not mutually exclusive?

Is an overlap so not M.E.

ME: OO

School 3

36



a) Work out $P(G)$ $24/36 = 4/6 = 2/3$

b) Work out $P(H)$ $20/36$

c) Work out $P(G|H)$ $\frac{P(G \cap H)}{P(H)} = \frac{8/36}{20/36} = 2/5$

d) What can we conclude from the difference between the answers to a) and c)?

Since they are not same G and H are not independent

e) Using the rule for independent events, verify if studying history and studying geography are independent events in this school.

$P(G \cap H) \overset{?}{=} P(G) \cdot P(H)$ $\frac{8}{36} \overset{?}{=} \frac{24}{36} \cdot \frac{20}{36}$

f) Verify that $P(G \cup H) = P(G) + P(H) - P(G \cap H)$ $\frac{2}{9} \neq \frac{10}{27}$

$\frac{36}{36} = \frac{24}{36} + \frac{20}{36} - \frac{8}{36}$ yes!

agreement

g) Why are these events not mutually exclusive?

because $P(G \cap H) \neq 0$

School 4

In this school you are given that $P(G) = 0.4$, and $P(H) = 0.6$ $P(G \cup H) = 0.8$

don't know if indep. so must start by using law of Combined Events

a) Work out $P(G \cap H)$

b) Show if the events are independent or not

c) Show if the events are mutually exclusive or not

School 4

In this school you are given that $P(G) = 0.4$, and $P(H) = 0.6$ $P(G \cup H) = 0.8$

don't know if indep. so must start by using law of Combined Events

a) Work out $P(G \cap H)$ $P(G \cup H) = P(G) + P(H) - P(G \cap H)$

$0.8 = 0.4 + .6 - x$

b) Show if the events are independent or not

$x = .2 \rightarrow$ so $P(G \cap H) = 0.2$

Use Law of independent Events $P(G \cap H) \overset{?}{=} P(G) \cdot P(H)$

$0.2 \neq (0.4)(.6)$ so not indep.

c) Show if the events are mutually exclusive or not

Since $P(G \cap H) \neq 0$

Events are not ME.

B B

LCQ

US States Renamed For Countries With Similar GDPs

School 5 and 6

School 5

In this school you are given that $P(G) = 0.3$, and $P(H) = 0.4$ $P(G \cup H) = 0.7$

a) Work out $P(G \cap H)$

b) Show if the events are mutually exclusive or not

School 5

Law of Combined Events

In this school you are given that $P(G) = 0.3$, and $P(H) = 0.4$ $P(G \cup H) = 0.7$

a) Work out $P(G \cap H)$ $0.7 = .3 + .4 - x$

$x = 0 \rightarrow P(G \cap H) = 0$

b) Show if the events are mutually exclusive or not

Since there is no overlap

the events are Mutually Exclusive

School 6

In this school you are given that $P(G) = 0.6$, $P(G \cap H) = 0.1$ and $P(G \cup H) = 0.8$

a) Work out $P(H)$

b) Work out $P(G|H)$

c) Show if these events are independent or not

School 6

In this school you are given that $P(G) = 0.6$, $P(G \cap H) = 0.1$ and $P(G \cup H) = 0.8$

a) Work out $P(H)$ $P(G \cup H) = P(G) + P(H) - P(G \cap H)$

$0.8 = .6 + P(H) - .1$

$P(H) = 0.3$

b) Work out $P(G|H)$ $P(G|H) = \frac{P(G \cap H)}{P(H)} = \frac{0.1}{0.3} = \frac{1}{3}$

c) Show if these events are independent or not

$P(G \cap H) \stackrel{?}{=} P(G) \cdot P(H)$

$.1 = (.6)(.3)$

$.1 \neq .18$

Not indep

School 6

In this school you are given that $P(G) = 0.6$, $P(G \cap H) = 0.1$ and $P(G \cup H) = 0.8$

a) Work out $P(H)$ $P(G \cup H) = P(G) + P(H) - P(G \cap H)$

$0.8 = .6 + P(H) - .1$

$P(H) = 0.3$

b) Work out $P(G|H)$ $= \frac{P(G \cap H)}{P(H)} = \frac{.1}{.3} = \frac{1}{3}$

c) Show if these events are independent or not

$P(G \cap H) \stackrel{?}{=} P(G) \cdot P(H)$

$.1 = (.6)(.3)$

$.1 \neq .18$

So G and H are not indep.

Assignment 7

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