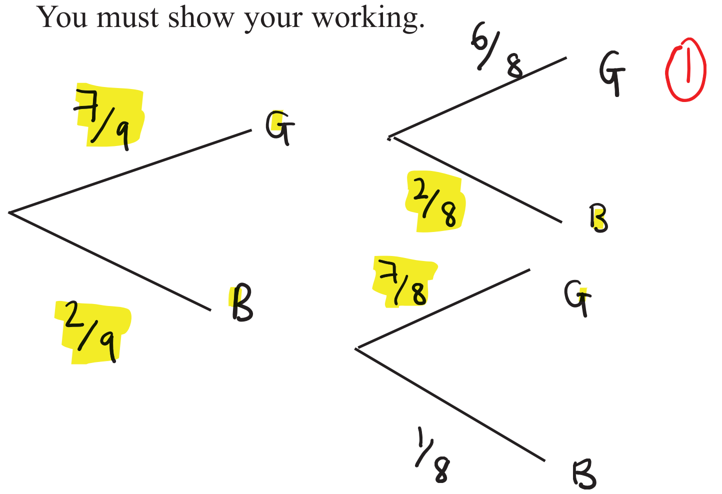
1. There are 9 counters in a bag.

7 of the counters are green.
2 of the counters are blue.

Ria takes at random two counters from the bag.

Work out the probability that Ria takes one counter of each colour.
You must show your working.



multiply

P (Green and blue)

OR → add.

P (Blue and green)

$$P(G \text{ and } B) = \frac{7}{9} \times \frac{2}{8} = \frac{14}{72}. \quad (1)$$

$$P(B \text{ and } G) = \frac{2}{9} \times \frac{7}{8} = \frac{14}{72}.$$

$$\frac{14}{72} + \frac{14}{72} = \frac{28}{72} \quad (1)$$

$\boxed{\text{Answer} = 28/72}$ (1)

....

(Total for Question is 4 marks)

2. The table shows the probabilities that a biased dice will land on 2, on 3, on 4, on 5 and on 6

Number on dice	**1**	**2**	**3**	**4**	**5**	**6**
Probability	0.31	0.17	0.18	0.09	0.15	0.1

Neymar rolls the biased dice 200 times.

Work out an estimate for the total number of times the dice will land on 1 or on 3

The sum of the probabilities of all outcomes = 1

$P(1) = 1 - (0.17 + 0.18 + 0.09 + 0.15 + 0.1) = 0.31$ (1)

$P(1 \text{ or } 3) = 0.31 + 0.18 = 0.49$

(1)

$0.49 \times 200 = \underline{\underline{98}}$.

98 (1)

(Total for Question is 3 marks)

3. There are only blue cubes, yellow cubes and green cubes in a bag.

There are

twice as many blue cubes as yellow cubes
and four times as many green cubes as blue cubes.

Hannah takes at random a cube from the bag.

Work out the probability that Hannah takes a yellow cube.

B : Y
2 : 1

G : B : Y
8 : 2 : 1

G : B
4 : 1
(×2) (×2)
8 : 2

Green = 8
Blue = 2
Yellow = 1
Total = 11

$\frac{1}{11}$

(Total for Question is 3 marks)

4. There are 12 counters in a bag.
There is an equal number of red counters, blue counters and yellow counters in the bag.
There are no other counters in the bag.

3 counters are taken at random from the bag.

(a) Work out the probability of taking 3 red counters.

4 red counters

$$\frac{4}{12} \times \frac{3}{11} \times \frac{2}{10}$$

$$= \frac{1}{55}$$

$\frac{1}{55}$

(2)

The 3 counters are put back into the bag.

Some more counters are now put into the bag.
There is still an equal number of red counters, blue counters and yellow counters in the bag.
There are no counters of any other colour in the bag.

3 counters are taken at random from the bag.

(b) Is it now less likely or equally likely or more likely that the 3 counters will be red?
You must show how you get your answer.

Probability from part a)

$= \frac{1}{55} = 0.018$

$4 \times 2 = 8$ red counters
$12 \times 2 = 24$ counters in total

$$\frac{8}{24} \times \frac{7}{23} \times \frac{6}{22}$$

$$= \frac{7}{253}$$

$$= 0.028$$

It is now more likely that 3 counters will be red because
$0.018 < 0.028$

(2)

(Total for Question is 4 marks)

5. When a drawing pin is dropped it can land point down or point up.

Lucy, Mel and Tom each dropped the drawing pin a number of times.

The table shows the number of times the drawing pin landed point down and the number of times the drawing pin landed point up for each person.

	Lucy	**Mel**	**Tom**
point down	31	53	16
point up	14	27	9
N° of throws	45	80	25

Rachael is going to drop the drawing pin once.

(a) Whose results will give the best estimate for the probability that the drawing pin will land point up?
Give a reason for your answer.

Mel, because she threw the pin the most times

(1)

Stuart is going to drop the drawing pin twice.

(b) Use all the results in the table to work out an estimate for the probability that the drawing pin will land point up the first time and point down the second time.

$P(\text{Up}) = \frac{(14+27+9)}{(45+80+25)}$

$= \frac{50}{150}$

Probability $= \frac{\text{n° of throws point up}}{\text{total n° of throws}}$

$\frac{50}{150} \times \frac{100}{150} = \frac{2}{9}$

$P(\text{Down}) = \frac{(31+53+16)}{150}$

$= \frac{100}{150}$

$\frac{2}{9}$

(2)

(Total for Question is 3 marks)

6. There are only blue counters, yellow counters, green counters and red counters in a bag.
A counter is taken at random from the bag.

The table shows the probabilities of getting a blue counter or a yellow counter or a green counter.

Colour	blue	yellow	green	red
Probability	0.2	0.35	0.4	

4 7 8 1 = 20

(a) Work out the probability of getting a red counter.

$0.2 + 0.35 + 0.4 + P(Red) = 1$

$0.95 + P(Red) = 1$

$(-0.95) \quad (-0.95)$

$P(Red) = 0.05$

0.05

(1)

(b) What is the least possible number of counters in the bag?
You must give a reason for your answer.

HCF = 0.05

20 ; because the number of counters for each colour must be a whole number

(2)

(Total for Question is 3 marks)

7. There are only red counters, blue counters and purple counters in a bag.
The ratio of the number of red counters to the number of blue counters is 3 : 17

Sam takes at random a counter from the bag.
The probability that the counter is purple is 0.2

Work out the probability that Sam takes a red counter.

$$P(\text{red or blue}) = 1 - P(\text{purple})$$
$$= 1 - 0.2$$
$$= 0.8$$

red : blue
3 : 17

red in ratio

$$P(\text{red}) = \frac{3}{3+17} = \frac{3}{20} \quad (1)$$

sum of ratio

P(red) when it could either be red or blue

$$P(\text{red overall}) = \frac{3}{20} \times 0.8 = 0.12 \quad (1)$$

P(it is red or blue)

P(red) when either red or blue

0.12 (1)

(Total for Question is 3 marks)

8. There are some counters in a bag.
The counters are red or white or blue or yellow.

Bob is going to take at random a counter from the bag.

The table shows each of the probabilities that the counter will be blue or will be yellow.

Colour	red	white	blue	yellow
Probability	$2x$	x	0.45	0.25

There are 18 blue counters in the bag.

The probability that the counter Bob takes will be red is twice the probability that the counter will be white.

(a) Work out the number of red counters in the bag.

Probabilities sum to 1 :

$$2x + x + 0.45 + 0.25 = 1$$
$$3x = 0.3 \quad (1)$$
$$x = 0.1$$

$$2x = P(\text{Red}) = 0.2 \quad (1)$$

$P(\text{Blue}) = 0.45$

total counters

$0.45t = 18$ ← number of blue counters

$t = \frac{18}{0.45} = 40$ counters (1)

Number of red counters :

$40 \times 0.2 = 8$

8 (1)

(4)

A marble is going to be taken at random from a box of marbles.
The probability that the marble will be silver is 0.5

$\frac{1}{2}t$ must be a whole number

There must be an even number of marbles in the box.

(b) Explain why.

0.5 multiplied by an odd number will never be a whole number and we can not have half a marble. For half of a number to be an integer, the number must be even.

(1)

(Total for Question is 5 marks)

9. There are only blue cubes, red cubes and yellow cubes in a box.

The table shows the probability of taking at random a blue cube from the box.

Colour	blue	red	yellow
Probability	0.2		

$= 1$

$= 0.8$

The number of red cubes in the box is the same as the number of yellow cubes in the box.

(a) Complete the table.

This means that the probability of taking a red cube is equal to the probability of taking a yellow cube.

$P(R) = P(Y)$. (1)

$1 - 0.2 = 0.8$. $\Rightarrow$ This is the total probability of taking R or Y.

$\frac{0.8}{2} = 0.4 \Rightarrow$ Since $P(R) = P(Y)$, they each have a probability of $\frac{0.8}{2} = 0.4$.

$$\boxed{\begin{aligned} \therefore P(R) &= 0.4 \\ P(Y) &= 0.4 \end{aligned}}$$ (1)

(2)

There are 12 blue cubes in the box.

(b) Work out the total number of cubes in the box.

total = 100%.

$0.2 = 12$

$\times 5$ $20\% = 12$. $\times 5$

$100\% = 60$

(1)

$\therefore$ total number of cubes $= \underline{\underline{60}}$

(1)

60

(2)

(Total for Question is 4 marks)

10. Hannah is planning a day trip for 195 students.

She asks a sample of 30 students where they want to go.
Each student chooses one place.

The table shows information about her results.

Place	**Number of students**
Theme Park	10
Theatre	5
Sports Centre	8
Seaside	7

(i) Work out how many of the 195 students you think will want to go to the Theme Park.

1

$$\frac{10}{30} \xrightarrow{\times 6.5} \frac{65}{195}$$

$\times 6.5$ $\times 6.5$

1

65

(2)

(ii) State any assumption you made **and** explain how this may affect your answer.

Assumed that the sample is representative - otherwise, our answer would be wrong. 1

(1)

(Total for Question is 3 marks)

11. There are p counters in a bag.
12 of the counters are yellow.

Shafiq takes at random 30 counters from the bag.
5 of these 30 counters are yellow.

Work out an estimate for the value of p.

$\boxed{\frac{12}{p} \text{ are yellow}}$

$\boxed{\text{On one random trial } \frac{5}{30} \text{ were yellow}}$

$$\frac{5}{30} \xrightarrow{\times \frac{12}{5}} \frac{12}{72}$$

Since $\frac{12}{p}$ are yellow we can estimate $p = 72$

(1)

$$\frac{30}{1} \times \frac{12}{5} = \frac{30 \times 12}{5} = \frac{\cancel{5} \times 6 \times 12}{\cancel{5}} = 6 \times 12 = 72$$

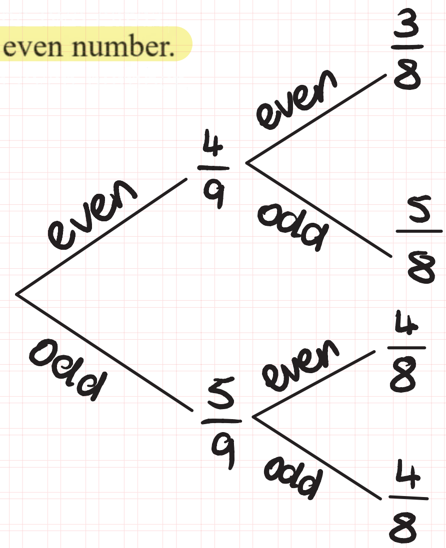
72 (1)

12. Marek has 9 cards.
There is a number on each card.

1	2	3	4	5	6	7	8	9

Marek takes at random two of the cards.
He works out the product of the numbers on the two cards.

Work out the probability that the product is an even number.



odd x odd = odd
odd x even = even
even x even = even

For 'And' use x
For 'Or' use +

even and even

$$\frac{4}{9} \times \frac{3}{8} = \frac{1}{6}$$

odd and even

$$\frac{5}{9} \times \frac{4}{8} = \frac{5}{18} \quad (1)$$

even and odd

$$\frac{4}{9} \times \frac{5}{8} = \frac{5}{18}$$

$$\frac{1}{6} + \frac{5}{18} + \frac{5}{18} = \frac{13}{18}$$

(1)

'OR' the possibilities

$\frac{13}{18}$ (1)

13. When a biased coin is thrown 4 times, the probability of getting 4 heads is $\frac{16}{81}$

Work out the probability of getting 4 tails when the coin is thrown 4 times.

Probability of getting 1 head when the coin is thrown 1 time

let x be probability of getting heads

so probability of getting 4 heads is $x \times x \times x \times x = \frac{16}{81}$

$x^4 = \frac{16}{81}$

$x = \sqrt[4]{\frac{16}{81}}$

$x = \frac{2}{3}$ (1) probability of heads

Probability of tails is

1 − probability of heads

$= 1 - \frac{2}{3} = \frac{1}{3}$ Probability of tails

Probability of 4 tails when coin thrown 4 times

$\frac{1}{3} \times \frac{1}{3} \times \frac{1}{3} \times \frac{1}{3} = \frac{1}{81}$

$\frac{1}{81}$ (1)

14. Sally plays two games against Martin.
In each game, Sally could win, draw or lose.

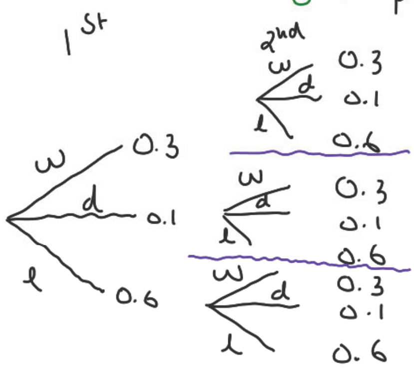
In each game they play,
the probability that Sally will win against Martin is 0.3 $\quad P(l) = 0.6$
the probability that Sally will draw against Martin is 0.1

Work out the probability that Sally will win **exactly** one of the two games against Martin.

$P(w) + P(d) + P(l) = 1$

$0.3 + 0.1 + p(l) = 1 \rightarrow p(l) + 0.4 = 1$

$p(l) = 0.6 \quad -0.4$



0.03
0.18
0.03
0.18
0.42
2

$P(\text{exactly } 1) = 0.3 \times 0.1 + 0.3 \times 0.6 + 0.1 \times 0.3 + 0.6 \times 0.3$

$= 0.03 + 0.18 + 0.03 + 0.18$

$= 0.42$

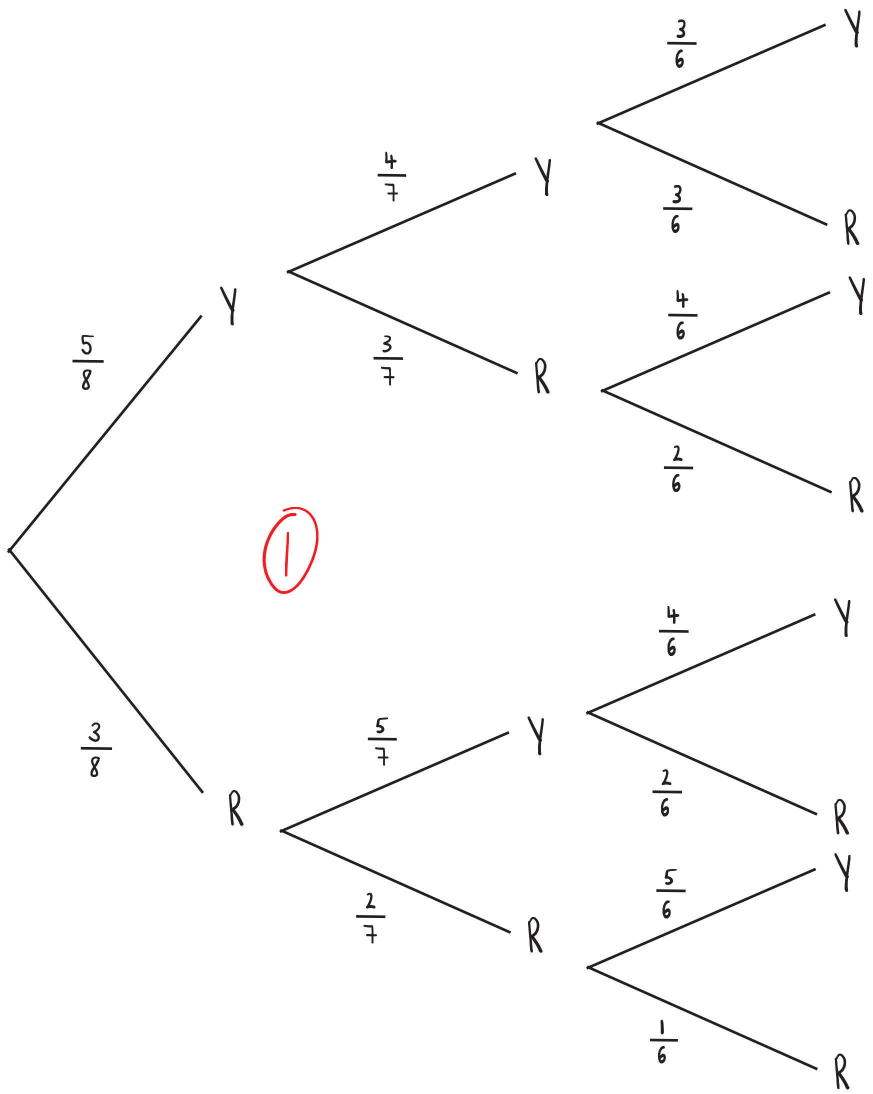
.......0.42.......

(Total for Question is 3 marks)

15. There are only 3 red counters and 5 yellow counters in a bag.

Jude takes at random 3 counters from the bag.

Work out the probability that he takes exactly one red counter.



P(exactly one Red) = P(RYY) OR P(YRY) OR P(YYR)

$= \left(\frac{3}{8} \times \frac{5}{7} \times \frac{4}{6}\right) + \left(\frac{5}{8} \times \frac{3}{7} \times \frac{4}{6}\right) + \left(\frac{5}{8} \times \frac{4}{7} \times \frac{3}{6}\right)$ 1

$= \frac{60}{336} + \frac{60}{336} + \frac{60}{336} = \boxed{\frac{180}{336}}$

1 1

$\frac{180}{336}$

(Total for Question is 4 marks)

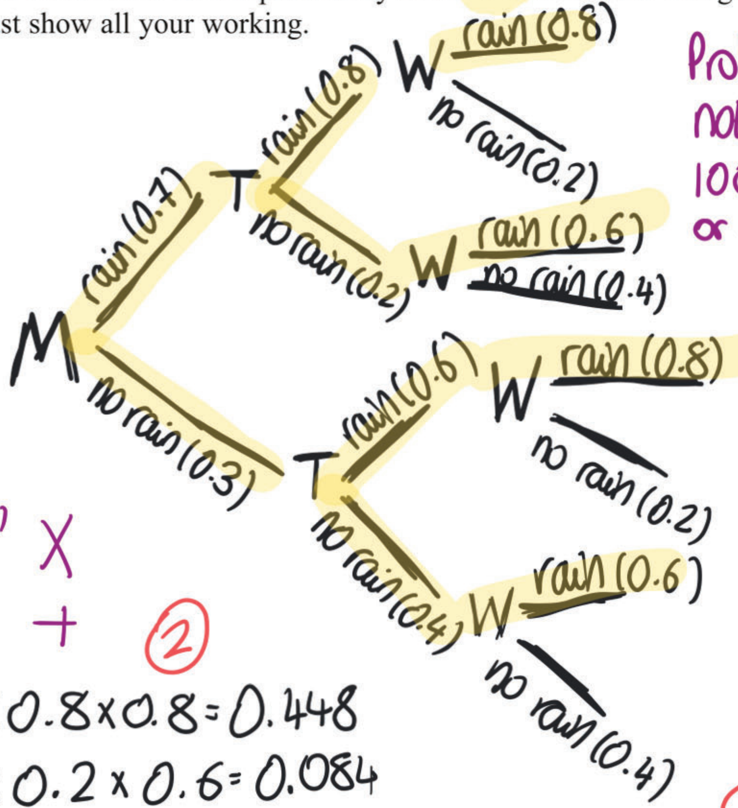
16. In a village,

> if it rains on one day, the probability that it will rain on the next day is 0.8
> if it does **not** rain on one day, the probability that it will rain on the next day is 0.6

A weather forecaster says,

"There is a 70% chance that it will rain in the village on Monday."

Work out an estimate for the probability that it will rain in the village on Wednesday.
You must show all your working.



Probability of raining or not raining is 1 (because 100% chance of either raining or not raining)

This allows you to work out missing probabilities

'And' ×
'Or' +

(2)

$0.7 \times 0.8 \times 0.8 = 0.448$
$0.7 \times 0.2 \times 0.6 = 0.084$
$0.3 \times 0.6 \times 0.8 = 0.144$
$0.3 \times 0.4 \times 0.6 = 0.072$

(1)

Probability will rain Wednesday
$0.448 + 0.084 + 0.144 + 0.072$
$= 0.748$

(1)

0.748

17. In a bag there are only red counters, blue counters, green counters and pink counters.
A counter is going to be taken at random from the bag.

The table shows the probabilities of taking a red counter or a blue counter.

Colour	red	blue	green	pink
Probability	0.05	0.15	0.5 (1)	0.3 (1)

The probability of taking a green counter is 0.2 more than the probability of taking a pink counter.

(a) Complete the table. All of the probabilities add up to 1.

$P(G) + P(P) = 1 - (0.05 + 0.15) = 1 - 0.2 = 0.8.$

If $P(P) = x$, then $P(G) = x + 0.2.$

$\therefore x + 0.2 + x = 0.8. \rightarrow 2x + 0.2 = 0.8 \rightarrow x = 0.3.$

$\therefore P(P) = 0.3$ and $P(G) = 0.5.$

(2)

There are 18 blue counters in the bag.

(b) Work out the total number of counters in the bag.

$15\% = 18. \rightarrow$ we want to find 100%

$15\% = 18$ (1)

$\div 15$

$1\% = 1.2$

$\times 100$

$100\% = 120$

(1) 120

(2)

(Total for Question is 4 marks)

18. Pat throws a fair coin n times.

Find an expression, in terms of n, for the probability that Pat gets at least 1 head and at least 1 tail.

It is almost certain that Pat will get at least one head and one tail.

The ONLY time this is not possible is if there are all heads or all tails.

$P(\text{all heads}) = \left(\frac{1}{2}\right)^n$. $P(\text{all tails}) = \left(\frac{1}{2}\right)^n$

$P(\text{all heads OR all tails}) = \left(\frac{1}{2}\right)^n + \left(\frac{1}{2}\right)^n$. (1)

$P(\text{at least one head and one tail})$

$= 1 - (\text{all heads or all tails})$

$= 1 - \left(\left(\frac{1}{2}\right)^n + \left(\frac{1}{2}\right)^n\right)$

$= 1 - \left(\frac{1}{2}\right)^n - \left(\frac{1}{2}\right)^n$ (1)

(Total for Question is 2 marks)