

Statistics A Level

Flying Start Summer Booklet

Name: _____

Welcome to Varndean College! This booklet has been designed to help you feel confident in starting your first year, by bridging the gap between GCSE Mathematics and A Level Statistics. Be sure to complete it all and bring it to your first lesson.

Things to do before enrolment

1. You must complete **all** of this booklet and bring it to your **first lesson**. Your teacher will expect this to be **100% complete and correct** when you arrive. Write all your working in the booklet.
2. Check all of your answers to the questions against those on the answer pages and tick them off as you go.
3. Get help when you are stuck! Statistics can be tough and getting stuck is normal. What makes a successful Varndean student is one who proactively seeks help to solve problems.

How to get help: Watch the videos on any concept you need help with. You could also **attend the support sessions on September 4th, September 5th, and September 6th** in hut 43-45 after enrolment.

4. Make sure you are confident with all of the concepts in this booklet. There will be a **test** in your **second Statistics lesson** on the topics in this booklet to assess your skills.
5. The use of technology underpins statistics and the A Level Statistics course will develop your technological skills. You will need the **Casio FX-991EX Classwiz** calculator for this course (£20-£25). *(Please contact our Welfare Co-ordinator if you think you might be eligible for financial assistance)*

Measures of Central Tendency

Learning Objectives:

- Calculate the mean from an unsorted list of data or a frequency table, or the estimated mean from a grouped frequency table, using the formula and a calculator.
- Calculate the mode, median and range from an unsorted list of data or a frequency table.

Links to Videos:

Khan Academy: *Online*

- Mean, median and mode from a list of data:
<https://www.khanacademy.org/math/ap-statistics/summarizing-quantitative-data-ap/measuring-center-quantitative/v/statistics-intro-mean-median-and-mode> (*In depth discussion of the measures.*)
<https://www.khanacademy.org/math/ap-statistics/summarizing-quantitative-data-ap/measuring-center-quantitative/v/mean-median-and-mode> (*Demonstration on an example.*)

Corbett Maths: *Demonstration of techniques from GCSE Mathematics.*

- Averages and range from a list of data:
 - Mean: <https://www.youtube.com/watch?v=x8oPXlrLMc0>
 - Median: https://www.youtube.com/watch?time_continue=3&v=HjYhb078cbE
 - Mode: <https://www.youtube.com/watch?v=7WubQNkpmMQ>
 - Range: <https://www.youtube.com/watch?v=MkifricztdA>
- Averages from a frequency table:
 - Mean: https://www.youtube.com/watch?v=zGbCFis_Xpl
 - Median: https://www.youtube.com/watch?v=2_sdgFJxb_U
- Mean from grouped data:
 - Mean: <https://www.youtube.com/watch?v=KwpcKCX51ro>

Maths Genie: *Demonstration of techniques from GCSE Mathematics.*

- Mean, median, mode and range from a list of data:
<https://www.youtube.com/watch?v=J3-DjMBso24&feature=youtu.be>
- Mean, median, mode and range from a frequency table:
<https://www.youtube.com/watch?v=rb8HHk1IAx0&feature=youtu.be>
- Mean from grouped data:
<https://www.youtube.com/watch?v=Vf4lyXC5KXk&feature=youtu.be>

Questions

1. Here are the ages of 9 children at a birthday party:

10 12 13 10 11 14 15 10 12

Find the:

a. Mode

Answer: _____

b. Median

Answer: _____

c. Range

Answer: _____

d. Mean

Answer: _____

2. A football team played six games. Here are the number of goals they scored in each game:

4 1 3 2 2 5

a. Work out the median number of goals scored

Answer: _____

b. Work out the mean number of goals scored

Answer: _____

The football team play one more game. The mean number of goals scored increases to 3.

c. Work out the number of goals scored in the seventh game.

Answer: _____

3. 16 students run a 100m race, 8 from class A and 8 from class B.

The times taken, to the nearest second, for each student from **class B** are:

15 20 24 18 19 21 26 29

The mean of the times of students in **class A** is 25 seconds and the range is 14 seconds.

Thomas says that the “students in class A are faster than the students in class B”.

Is he correct?

4. A set of six numbers have a median of 5.

All of the numbers are even.

The range of the numbers is 6.

The mode of the numbers is 4.

Write down a possible set of six numbers.

Answer: _____

5. The table shows the number of sweets in 20 bags.

Number of Sweets	Frequency
23	1
24	4
25	9
26	3
27	3

Calculate the mean.

Answer: _____

6. An internet company collected data about the number of internet devices in each of 50 households. The table shows the results:

Number of Devices	Number of Households
0	10
1	15
2	28
3	47
4	92
5	137
6	101
7	74
8	33

Find:

- a. The mode number of devices in a household.

Answer: _____

- b. The median number of devices in a household.

Answer: _____

c. The range of the number of devices in a household

Answer: _____

d. The mean number of devices in a household.

Answer: _____

7. Alex works for the council. She records the number of people in cars travelling down a street over one hour. Here are her results:

Number of people in each car	Number of cars
1	41
2	54
3	32
4	20
5	3

Work out the mean number of people travelling in each car.

Answer: _____

8. Sarah asked 30 people how long it takes them to get to college.

The table shows some information about her results.

Time (t minutes)	Frequency	Midpoint	
$0 < t \leq 10$	2		
$10 < t \leq 20$	8		
$20 < t \leq 30$	12		
$30 < t \leq 40$	7		
$40 < t \leq 50$	1		

Work out an estimate for the mean time taken.

Answer: _____

9. The table below shows the length of 100 fish from a local river.

Length (L cm)	Frequency	Midpoint	
$0 < L \leq 5$	21		
$5 < L \leq 10$	11		
$10 < L \leq 30$	31		
$30 < L \leq 40$	12		
$40 < L \leq 50$	25		

Calculate and estimate of the mean length of the fish.

Answer: _____

10. The table shows the heights of 50 students.

Height (h cm)	Frequency		
$100 < h \leq 120$	3		
$120 < h \leq 130$	8		
$130 < h \leq 140$	23		
$140 < h \leq 150$	9		
$150 < h \leq 180$	7		

a. Calculate an estimate of the mean height of the students.

Answer: _____

b. Why is this only an estimate?

Answers

1. (a) 10 (b) 12 (c) 5 (d) 11.9
2. (a) 2.5 (b) 2.83 (c) 4
3. The mean time of students in class B is 21.5 seconds and the range is 14 seconds.
The ranges are the same for both of the classes and the mean time is lower for class B. So, on average, students in class B are faster. Thomas is incorrect.
4. One example is 4, 4, 4, 6, 8, 10.
5. 25.2
6. (a) 5 cm (b) 5 cm (c) 8 cm (d) 4.94 cm
7. 2.27 cm
8. 24 minutes
9. 23 cm
10. (a) 137.2 cm (b) It is only an estimate as we do not know the true values of the heights of the students and so we are using the midpoint of the class as an approximation.

Mathematical Techniques

Learning Objectives:

- Substitute numbers into the formulae.
- Solve linear simultaneous equations where the coefficients of one variable are equal and of the same sign.

Links to Videos:

Corbett Maths:

- Substitution: <https://www.youtube.com/watch?v=ZkC2FX5TOJ8>
- Simultaneous equations: https://www.youtube.com/watch?time_continue=6&v=phlus4x0UqM

Maths Genie:

- Substitution: <https://www.youtube.com/watch?v=HUbBrFwltBg&feature=youtu.be>
- Simultaneous equations: <https://www.youtube.com/watch?v=FcYeDDlgNMs&feature=youtu.be>

Hegarty Maths:

- Substitution into complex formulae: <https://www.youtube.com/watch?v=YxYUfSMkjbE>

Questions

1. Let $y = 5x + 2$. Find the value of y when $x = 6$.

Answer: _____

2. Let $y = 112 + 15x$. Find the value of y when $x = 8$.

Answer: _____

3. Let $y = 48.2 - 3.4x$. Find the value of y when $x = 3$.

Answer: _____

4. Let $P = 2x + 5y$. Find P when $x = 2.3$ and $y = 5.6$.

Answer: _____

5. Find the value of $(x - y)^2$ when:

a. $x = 5$ and $y = 3$

Answer: _____

b. $x = 5$ and $y = 8$

Answer: _____

6. Let $x = 110$ and $y = 160$. Find

a. $y + 1.5(y - x)$

Answer: _____

b. $x - 1.5(y - x)$

Answer: _____

7. Find

$$\frac{(x - y)^2}{y}$$

when

a. $x = 11$ and $y = 10$

Answer: _____

b. $x = 2$ and $y = 5$

Answer: _____

8. Let

$$\frac{a}{\sqrt{x}} = b$$

Find x when $a = 2$ and $b = 3$.

Answer: _____

9. One way of measuring how much a sample of three is spread out is given by the formula:

$$s = \frac{1}{2}((x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + (x_3 - \bar{x})^2)$$

where \bar{x} is the mean of the sample. A sample of three values is recorded: $x_1 = 4$, $x_2 = 6$ and $x_3 = 9$. Find s .

Hint: For a sample of three $\bar{x} = (x_1 + x_2 + x_3) \div 3$.

Answer: _____

10. Solve the simultaneous equations:

a. $5x + 3y = 41$

$$2x + 3y = 20$$

Answer: _____

b. $5x + y = 11$

$3x - y = 9$

Answer: _____

c. $16 - x = 4y$

$13 - x = 3y$

Answer: _____

d. $20 - x = 5y$

$14 - x = 2y$

Answer: _____

e. $170 - x = 9y$

$110 - x = 3y$

Answer: _____

Answers

1. $y=32$

2. $y=232$

3. $y=38$

4. $P=32.6$

5. (a) 4 (b) 9

6. (a) 235 (b) 35

7. (a) 0.1 (b) 1.8

8. $4/9$ or 0.444

9. $19/3$ or 6.33

10. (a) $x=7, y=2$ (b) $x=2.5, y=-1.5$ (c) $x=4, y=3$ (d) $x=10, y=2$ (e) $x=80, y=10$.

Introduction to Probability

Learning Objectives:

- Understand the concept and scale of probability.
- Illustrate probability using probability trees, Venn diagrams and two-way tables, and use them to determine probabilities of basic events.
- Understand and use set theory notation.

Links to Videos:

Corbett Maths:

- Probability: https://www.youtube.com/watch?v=ur_hHjLrBNo
- Probability of not happening: https://www.youtube.com/watch?time_continue=14&v=y9T5ol65mSU
- Sample space diagrams: https://www.youtube.com/watch?time_continue=1&v=Xqno7W00UtE
- Independent events: https://www.youtube.com/watch?time_continue=1&v=mUDqgCe-PAo
- Tree diagrams: <https://www.youtube.com/watch?v=kNOrDWm15bY>
- Conditional probability: <https://www.youtube.com/watch?v=xhFDImQUAZo>
- Venn diagrams: <https://www.youtube.com/watch?v=xwK--rNDI9E>
- Two-way tables: https://www.youtube.com/watch?time_continue=1&v=U785Y-QI-K8

Questions

1. Liam rolls an ordinary fair six-sided die.

Write down the probability that he gets:

- a. the number 4

Answer: _____

- b. a number less than 5

Answer: _____

2. The probability that James wins a competition is 0.3.

What is the probability that James does not win the competition?

Answer: _____

3. A fair coin is flipped twice.

- a. Find the probability that the coin lands on heads twice.

Answer: _____

- b. Find the probability the coin lands on tails exactly once.

Answer: _____

4. Two fair six sided dice are rolled.

The numbers on the two dice are multiplied together to give a score.

a. Complete the table to show all possible scores.

		Dice 1					
	x	1	2	3	4	5	6
Dice 2	1	1	2				
	2	2					
	3						
	4						
	5						
	6						

b. Find the probability of a score of 12

Answer: _____

c. Find the probability of a score of 10 or more.

Answer: _____

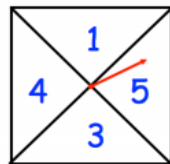
d. Find the probability of an even number.

Answer: _____

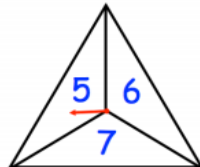
5. Two fair spinners are spun.

Spinner 1 has four equal sections labelled 1, 3, 4 and 5.

Spinner 2 has three equal sections labelled 5, 6 and 7.



Spinner 1



Spinner 2

Each spinner is spun once.

The numbers are added together to get a score.

a. Complete the table to show all possible scores.

		Spinner 1				
		+	1	3	4	5
Spinner 2	5	6				
	6					
	7					

b. Find the probability of scoring an 8

Answer: _____

c. Find the probability of scoring an odd number

Answer: _____

6. Two fair six-sided dice are rolled.

The score is the difference between the numbers on each dice.

a. Complete the table to show all possible scores.

		Dice 1					
	-	1	2	3	4	5	6
Dice 2	1	0	1				
	2	1					
	3	2					
	4						
	5						
	6						

b. Find the probability of scoring a 2

Answer: _____

c. Find the probability of scoring a number less than 3.

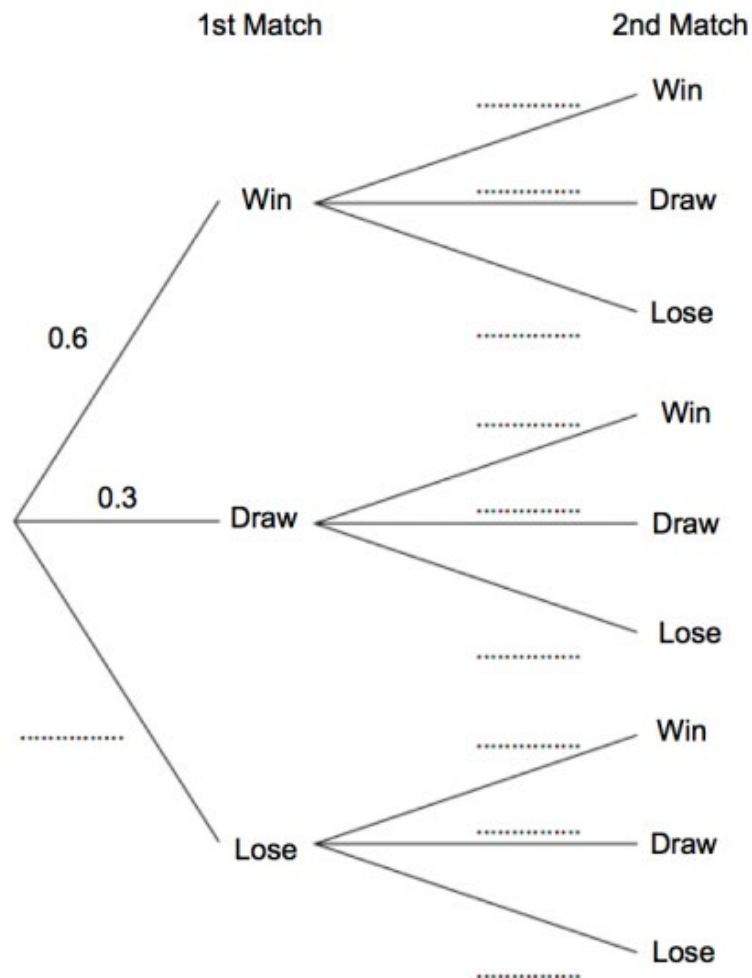
Answer: _____

7. A football team has two matches to play.

The probability that the team wins is 0.6.

The probability that the team draws is 0.3.

a. Complete the tree diagram.



b. Work out the probability that the team will win both matches.

Answer: _____

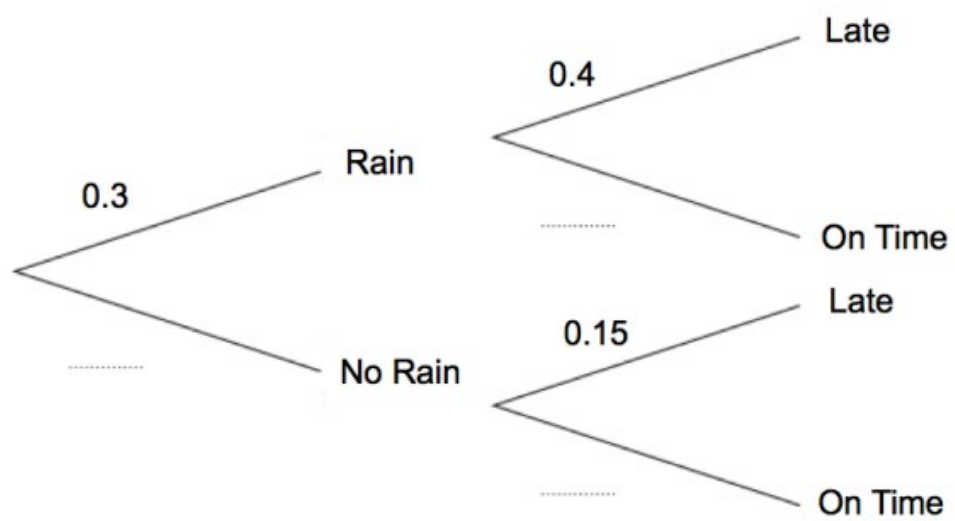
9. In a small village, one bus arrives a day.

The probability of rain in the village is 0.3.

If it rains, the probability of a bus being late is 0.4.

If it does not rain, the probability of a bus being late is 0.15.

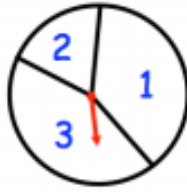
a. Complete the tree diagram.



b. Work out the probability of the bus being late.

Answer: _____

10. Shown is a spinner.



The probability of getting a 1 is $2x$.

The probability of getting a 2 is x .

The probability of getting a 3 is $2x$.

- a. Calculate the value of x .

Answer: _____

The spinner is spun twice and the scores added together.

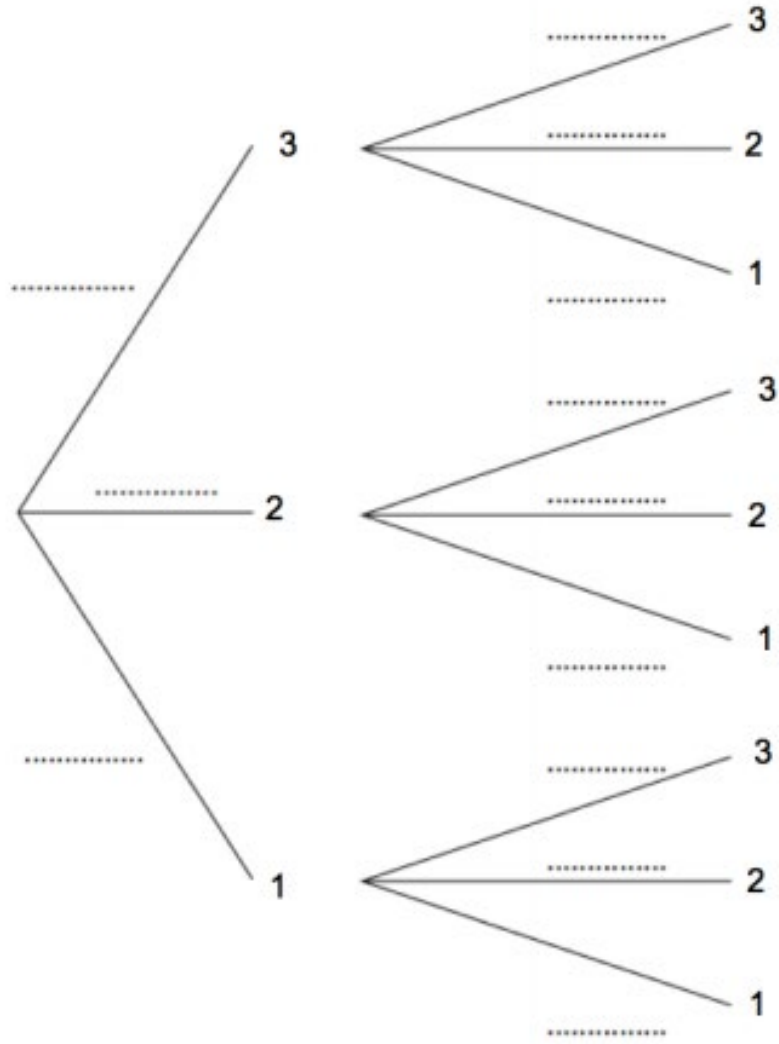
- b. Work out the probability of the final score being 4.

You may use the tree diagram on the following page to help you.

Answer: _____

1st spin

2nd spin



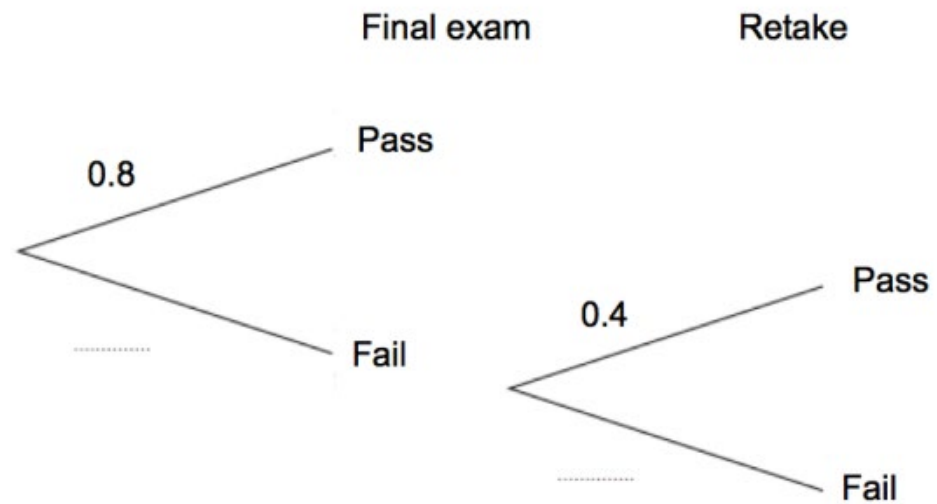
11. A college course consists of 12 weeks of teaching with a final exam at the end of the course.

If a student fails the final exam, they have one opportunity to retake the exam.

The probability of a student passing the final exam is 0.8.

The probability of a student passing the retake is 0.4.

a. Complete the probability tree diagram.



If a student passes the final exam or the retake, they receive a certificate.

b. Work out the probability of a student receiving a certificate.

Answer: _____

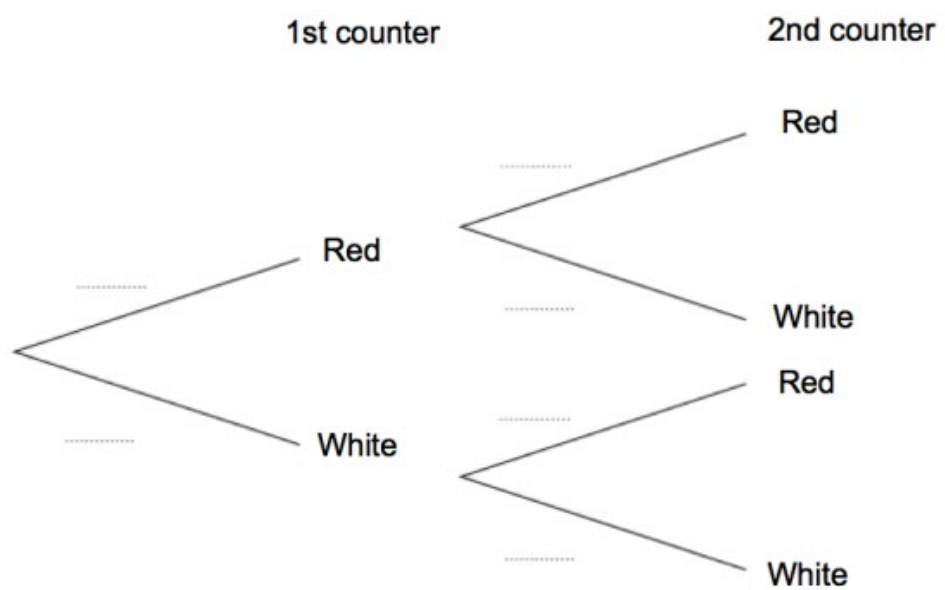
12. George has a bag of red marbles.

There are 6 red and 4 white marbles.

George takes out a marble at random and records its colour.

Without replacement, George takes out another marble, at random.

a. Complete the probability tree diagram.



b. Find the probability that the two marbles are the same colour.

Answer: _____

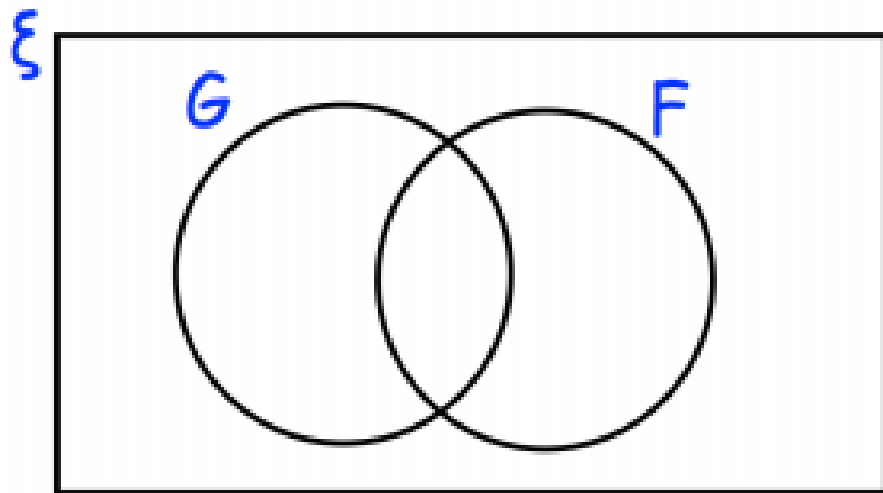
13. There are 80 students in year 11.

9 students study French and German.

35 students study only French.

2 students do not study French or German.

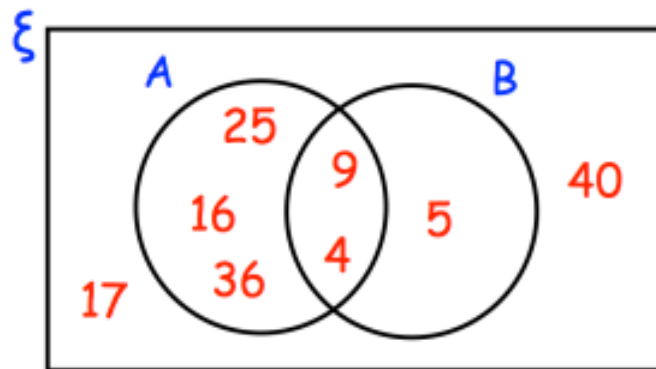
a. Complete the Venn diagram.



b. Work out how many students study only German.

Answer: _____

14. Here is a Venn diagram.



Write down the numbers that are in set:

a. $A \cap B$

Answer: _____

b. $A \cup B$

Answer: _____

c. A'

Answer: _____

15. A gym class runs two fitness classes: spinning and circuits.

On Saturday 100 people visited the gym.

18 people attended the spinning class.

10 people attended both classes

56 people did not attend either class.

a. Represent this information on a Venn diagram.

A person who attended the gym is selected at random.

Find the probability that this person:

b. attended only circuits

Answer: _____

c. attended exactly one class

Answer: _____

d. attended spinning, given that they attended circuits.

Answer: _____

16. In a company there are 110 workers.

90 workers like tea.

41 workers like coffee.

25 workers like both tea and coffee.

Work out how many workers like neither tea or coffee. You may use a Venn diagram to help you.

Answer: _____

17. 80 students visited the library over three days.

The two-way table shows some information about these students.

a. Complete the two-way table.

	Monday	Tuesday	Wednesday	Total
Year 12			13	38
Year 13	14			
Total		33	26	80

One of these students is picked at random to win a prize.

b. Write down the probability that the student is in year 13.

Answer: _____

c. Write down the probability that the student visited the library on Tuesday.

Answer: _____

18. 100 students study one language at a college, either French, Spanish or German.

54 of the students are in year 12.

20 of the 29 students who study Spanish are in year 13.

31 students study German.

15 students study French.

Using a two way table, work out the number of students who are in year 12 who study German.

	French	Spanish	German	<i>Total</i>
Year 12				
Year 13				
<i>Total</i>				

Answer: _____

19. On a particular day, 98 adults visit a leisure centre where they can:

- use the gym
- play tennis
- play badminton
- go swimming

Visitors can be either members of the leisure centre or pay on the day.

51 of the people are members of the leisure centre.

21 out of the 40 using the gym are members.

19 members and 7 non-members are going swimming.

7 out of 20 people playing badminton are members.

Twice as many non-members play tennis than members.

How many non-members play tennis? Use a two way table to help you.

	Gym	Tennis	Badminton	Swimming	Total
Members					
Non-members					
Total					

Answer: _____

20. The two way table shows the age range and voting record in the EU referendum from the results of a YouGov poll.

	Age			
	18-24	25-49	50-64	65+
Voted Remain	71	54	40	36
Voted Leave	29	46	60	64

(Source: YouGov 2016, accessed from <https://yougov.co.uk/topics/politics/articles-reports/2016/06/27/how-britain-voted>)

A random member of the sample is chosen.

Find the probability that:

- a. They are aged 25-49.

Answer: _____

- b. They voted to remain.

Answer: _____

- c. They voted to leave and are over 65.

Answer: _____

- d. They voted to remain given that they are aged 18-24.

Answer: _____

Answers

1. (a) $\frac{1}{6}$ (b) $\frac{2}{3}$
2. 0.7
3. (a) $\frac{1}{4}$ (b) $\frac{1}{2}$
4. (a) See below. (b) $\frac{4}{36}$ or $\frac{1}{9}$ (c) $\frac{19}{36}$ (d) $\frac{27}{36}$ or $\frac{3}{4}$

		Dice 1						
		x	1	2	3	4	5	6
Dice 2	1	1	2	3	4	5	6	
	2	2	4	6	8	10	12	
	3	3	6	9	12	15	18	
	4	4	8	12	16	20	24	
	5	5	10	15	20	25	30	
	6	6	12	18	24	30	36	

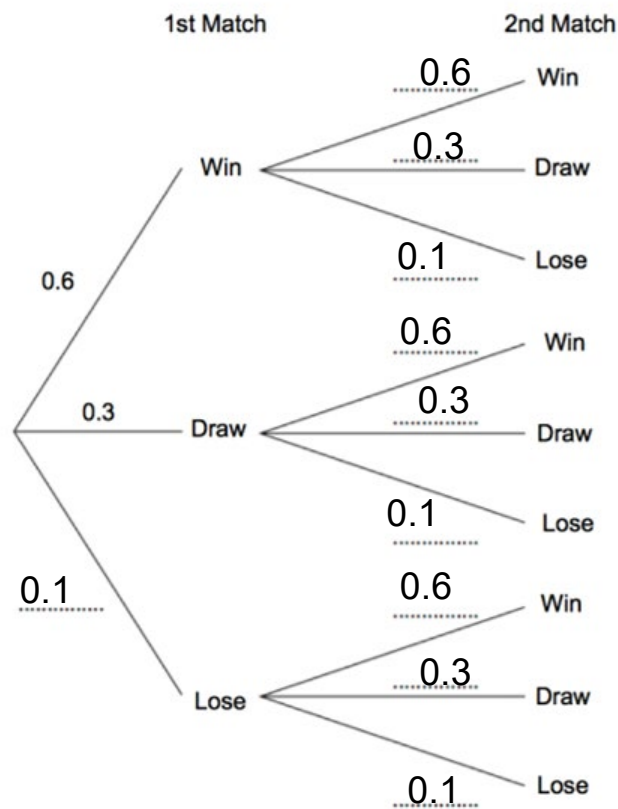
5. (a) See table below. (b) $\frac{2}{12}$ or $\frac{1}{6}$ (c) $\frac{5}{12}$

		Spinner 1				
		+	1	3	4	5
Spinner 2	5	6	8	9	10	
	6	7	9	10	11	
	7	8	10	11	12	

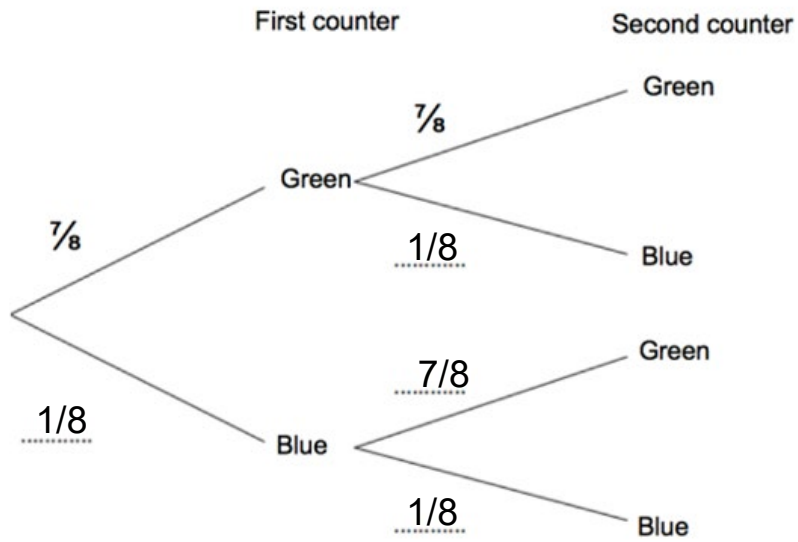
6. (a) See table below. (b) $8/36$ or $2/9$ (c) $24/36$ or $2/3$

		Dice 1						
		-	1	2	3	4	5	6
Dice 2	1	0	1	2	3	4	5	
	2	1	0	1	2	3	4	
	3	2	1	0	1	2	3	
	4	3	2	1	0	1	2	
	5	4	3	2	1	0	1	
	6	5	4	3	2	1	0	

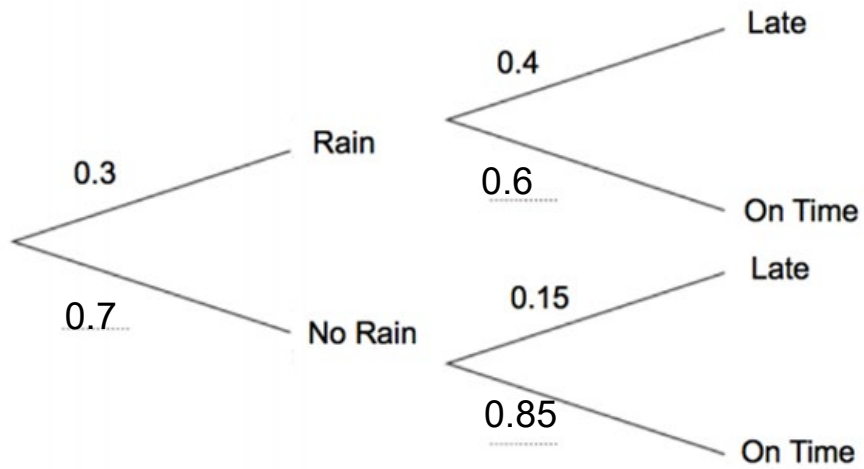
7. (a) See diagram below (b) 0.36



8. (a) See diagram below. (b) $7/32$

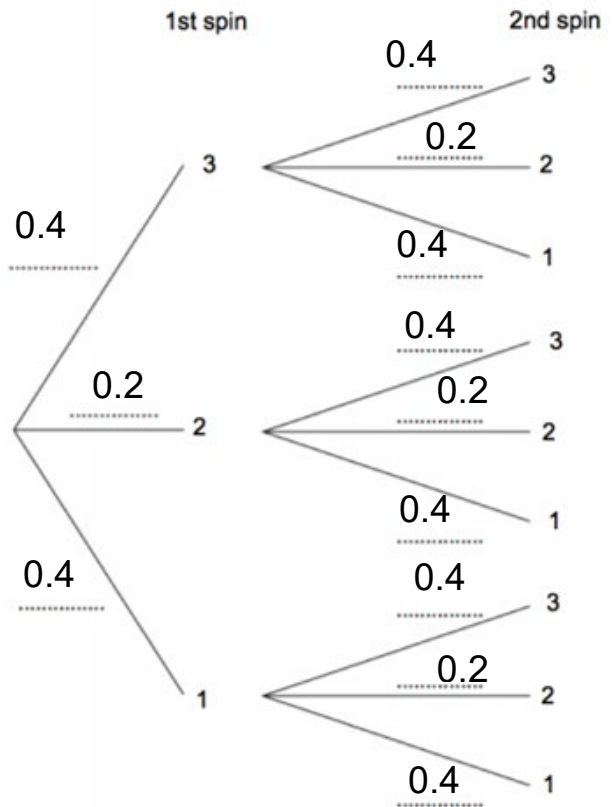


9. (a) See diagram below. (b) $9/40$



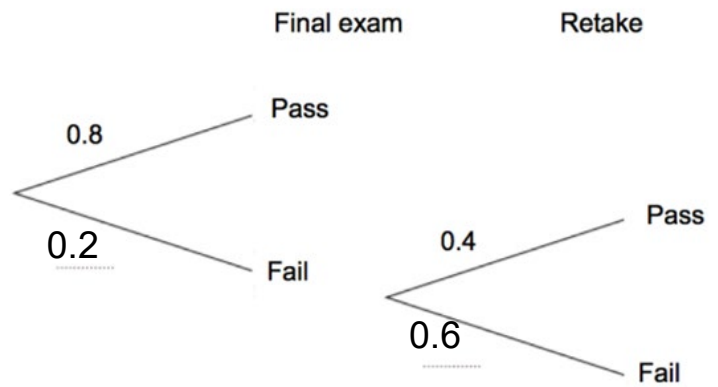
10. (a) 0.2

(b) See diagram. 9/25



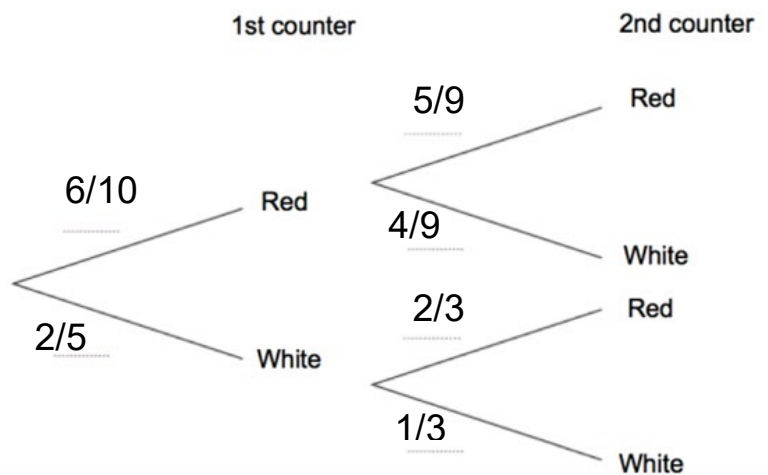
11. (a) See diagram.

(b) 22/25.

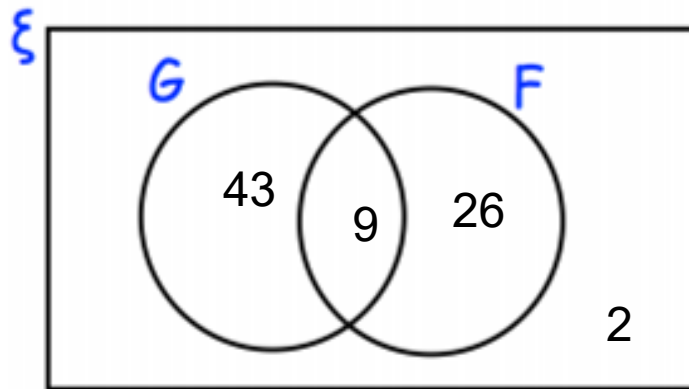


12. (a) See diagram.

(b) 7/15

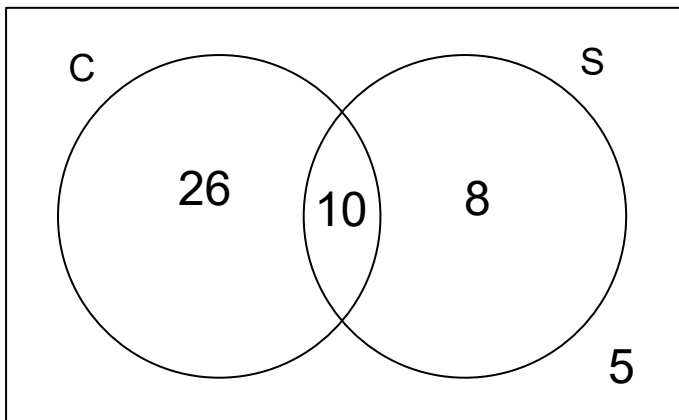


13. (a) See diagram below. (b) 43.

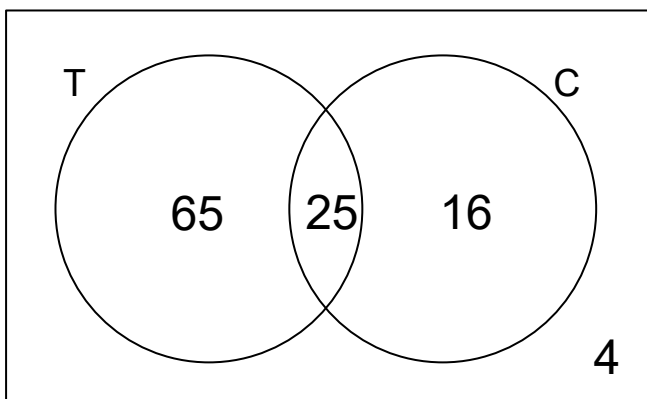


14. (a) 9, 4 (b) 25, 16, 36, 9, 4, 5 (c) 5, 17, 40

15. (a) See diagram below. (b) 0.26 (c) 0.34 (d) $5/13$ or 0.385



16. 4 (See diagram below.)



17. (a) See diagram below. (b) 21/40 (c) 33/80

	Monday	Tuesday	Wednesday	Total
Year 12	7	18	13	38
Year 13	14	15	13	42
Total	21	33	26	80

18. 20 (See diagram below.)

	French	Spanish	German	Total
Year 12	25	9	20	54
Year 13	15	20	11	46
Total	40	29	31	100

19. 8 (See diagram below.)

	Gym	Tennis	Badminton	Swimming	Total
Members	21	4	7	19	51
Non-members	19	8	13	7	47
Total	40	12	20	26	98

20. (a) $\frac{1}{4}$ (b) 201/400 (c) 64/400 or 4/25 (d) 71/100