Stewards Academy

Maths Spring 2

Year 10 Higher

Blended Learning Booklet

Name:

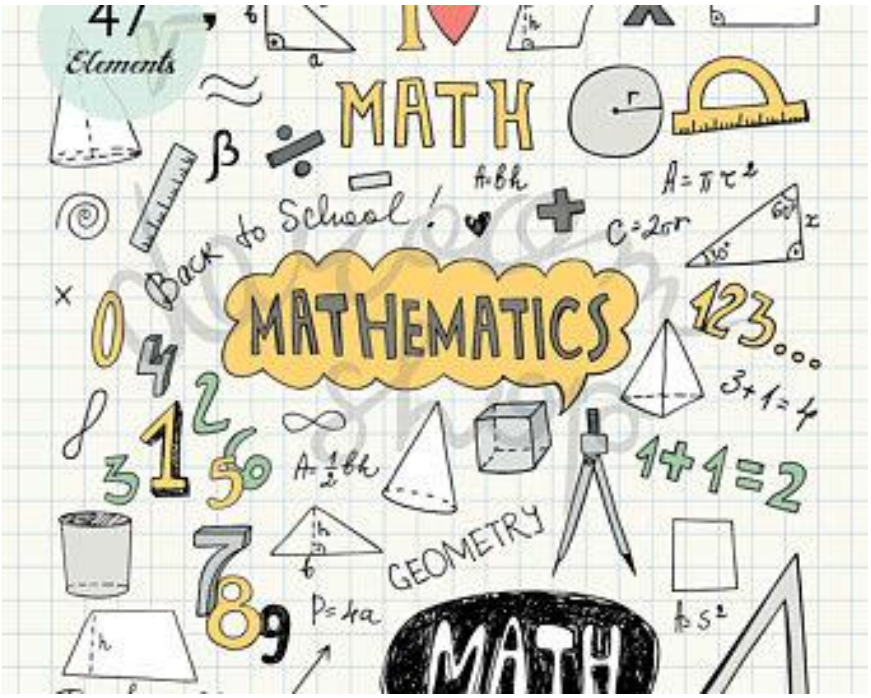
Form:

Each week covers topics you would complete in your 3 Maths lessons that week. Write out the title and LI and then complete the tasks.

All video links are online using the ClassCharts link.

The Knowledge Organiser on page 4 has further practice questions and page numbers linking to your pocket revision guides for all the key information and examples to help you with this unit.

Upload all work onto ClassCharts for feedback.



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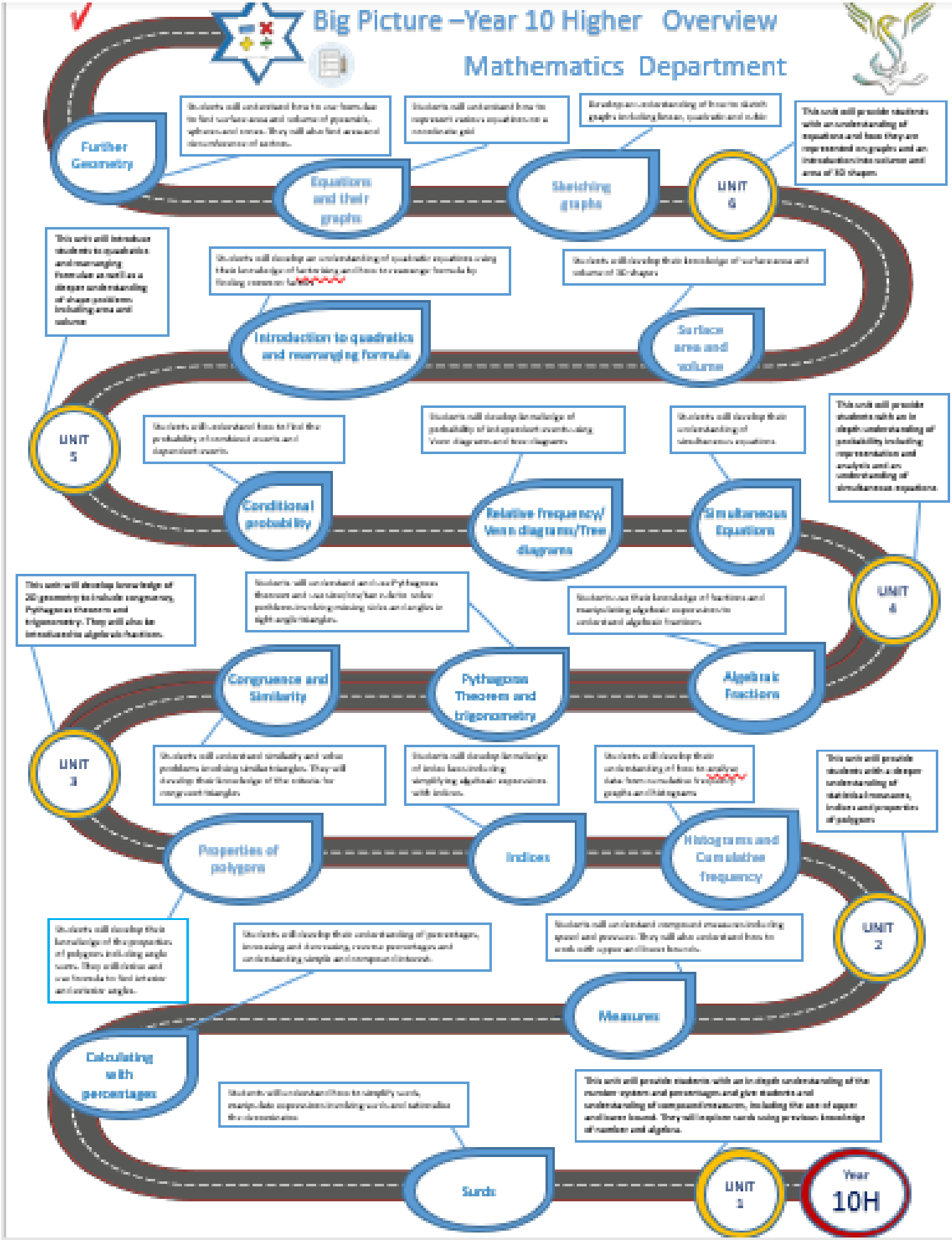

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Year 10 - Higher

Spring Two

Simultaneous Equations, Relative Frequency, Venn & Tree Diagrams, Conditional Probability

Revision Guide pages:

Simultaneous equations – 46, 47

Relative Frequency – 99

Venn & Tree diagrams – 98, 100, 101

Conditional probability – 96, 97

Task 3 – Solve each pair of simultaneous equations:

$9x - 4y = 19$ $\quad 4x + 4y = 20$

$5x + 4y = 130$ $\quad x + 6y = 130$

$5x - 3y = 18$ $\quad 2x + 4y = 54$

$x = 10 - y$ $\quad 2x + y = 17$

Task 6

The cost of buying a coffee and a tea in a café is £4.

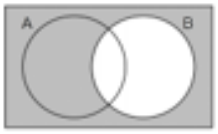
The cost of buying a coffee and three teas is £7.

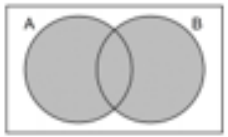
Work out the cost of buying a coffee and the cost of buying a tea.

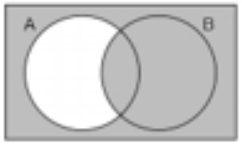
Task 1

A box contains 7 red and 3 blue pens. A pen is selected at random and removed from the box. A second pen is then selected at random. Use a tree diagram to calculate the probability that exactly one of the pens removed was red.

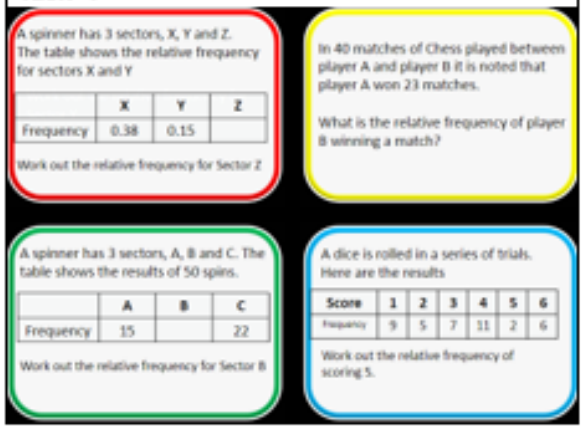
Task 2 – For each Venn diagram, express the shaded area using set notation







Task 4



Task 7

Five adult tickets and three child tickets at a cinema costs £58.

Two adult tickets and eight child tickets costs £47.

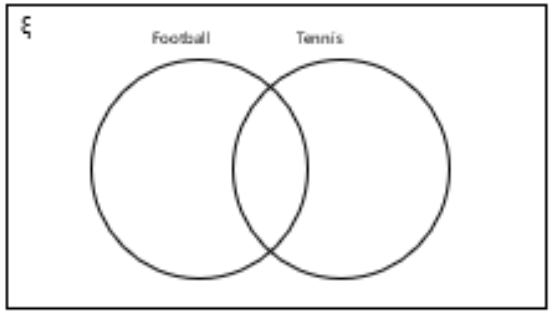
Work out the cost of each type of ticket.

Task 5

In a class there are:

- 7 students who play tennis and football
- 8 students who do not play tennis or football
- 12 students who play tennis
- 21 students who play football

Using the Venn diagram, calculate how many students are in the class.



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Week 1:

- **LI: I can solve simultaneous equations using the elimination method**

Demonstration Videos:

https://corbettmaths.com/2013/03/05/simultaneous-equations-elimination-method/

Tasks:

Question 1: Solve the following simultaneous equations by using elimination.

(a)	$6x + y = 18$ $4x + y = 14$	(b)	$4x + 2y = 10$ $x + 2y = 7$	(c)	$9x - 4y = 19$ $4x + 4y = 20$
(d)	$2x + y = 36$ $x - y = 9$	(e)	$6x - 3y = 12$ $4x - 3y = 2$	(f)	$3x - 6y = 6$ $2x - 6y = 3$
(g)	$8x + 7y = 39$ $8x + 2y = 34$	(h)	$x + 3y = 38$ $x + 6y = 53$	(i)	$6x + 3y = 48$ $6x + y = 26$
(j)	$2x - 4y = 10$ $2x + 3y = 24$	(k)	$5x - 2y = 120$ $5x + y = 165$	(l)	$x - 2y = 8$ $x - 3y = 3$
(m)	$3x + 2y = 54$ $2x - 2y = 16$	(n)	$7x - 4y = 80$ $3x - 4y = -80$	(o)	$5x - 2y = -23$ $5x - 6y = -39$
(p)	$6x + 2y = -26$ $2x + 2y = -10$	(q)	$x - 5y = 65$ $2x - 5y = 85$	(r)	$10x - 10y = -40$ $10x + 4y = 16$

☆

Solve simultaneously

1) $x + 2y = 8$, $3x + 2y = 12$

2) $3x + y = 7$, $3x + 2y = 11$

3) $x + 3y = 5$, $2x + 3y = 4$

4) $4x - y = 10$, $3x - y = 8$

5) $2x - y = 7$, $2x + 3y = 3$

6) $x + 5y = 2$, $2x + 5y = -1$

☆☆

Solve simultaneously

1) $x + 2y = 6$, $3x - 2y = 10$

2) $3x - y = 10$, $2x + y = 5$

3) $-3x + y = 9$, $3x + 4y = 6$

4) $4x - y = 11$, $x + y = -1$

5) $-x - 2y = 6$, $x - 5y = 1$

6) $2x + 3y = 6$, $x - 3y = -17$

☆☆☆

Solve simultaneously

1) $2x + y = 4$, $3x - y = 1$

2) $x + 3y = 7$, $x - 2y = -8$

3) $x + 4y = 15$, $3x - 4y = -19$

4) $3x + 5y = 9$, $3x + y = -3$

5) $2x - 3y = 4$, $x + 3y = 11$

6) $-2x + y = -7$, $x - y = 4$

Question 2: Solve the following simultaneous equations by using elimination.

(a) $3x + 2y = 23$, $2x - y = 6$

(b) $3x - 3y = 9$, $2x + y = 12$

(c) $4x + 2y = 34$, $3x + y = 21$

(d) $9x - 4y = 59$, $2x - y = 12$

(e) $2x + 8y = 43$, $x + 3y = 18$

(f) $6x + 3y = 45$, $2x - 2y = 12$

(g) $5x + 4y = 130$, $x + 6y = 130$

(h) $10x - 15y = 25$, $x - 2y = 1$

(i) $3x + 8y = 97$, $2x + 4y = 58$

(j) $3x - y = 4$, $5x + 4y = 52$

(k) $4x + 9y = 10$, $2x + 3y = 2$

(l) $5x - 3y = 33$, $3x - 9y = 63$

(m) $2x + 4y = -2$, $4x + 2y = -10$

(n) $8x + 4y = -28$, $3x - 12y = 30$

(o) $15x - 4y = 82$, $5x - 9y = 12$

(p) $12x + 3y = 9$, $2x + 11y = -9$

(q) $9x - 7y = 111$, $x - 2y = 16$

(r) $8x - y = 4$, $3x + 8y = -166$

Question 3: Solve the following simultaneous equations by using elimination.

(a) $2x + 2y = 14$, $5x - 3y = 19$

(b) $2x + 3y = 1$, $7x + 2y = -22$

(c) $5x + 3y = 22$, $2x + 4y = 20$

(d) $5x - 6y = 28$, $4x - 4y = 24$

(e) $3x + 2y = 7$, $2x + 9y = 43$

(f) $3x + 3y = -6$, $4x - 4y = -24$

(g) $3x + 8y = 31$, $5x + 3y = 31$

(h) $7x - 15y = 2.5$, $3x - 2y = 5.5$

(i) $3x + 2y = 53$, $2x + 5y = 72$

(j) $5x - 3y = 18$, $2x + 4y = 54$

(k) $2x + 9y = 11$, $9x + 3y = -63$

(l) $2x - 4y = 4$, $5x - 3y = 24$

(m) $3x + 3y = 42$, $2x + 4y = 38$

(n) $6x + 2y = -2$, $4x - 3y = 29$

(o) $4x - 4y = 8$, $5x - 3y = 18$

(p) $4x + 3y = 9$, $5x + 2y = 13$

(q) $4x - 2y = 18$, $2x - 3y = 15$

(r) $5x + 2y = 38$, $2x - 3y = 19$

Question 4: Solve the following simultaneous equations by rearranging and then using elimination.

(a) $x = 10 - y$, $2x + y = 17$

(b) $x - 4 = y$, $x + 3y = 12$

(c) $2x + 6y = 4$, $x = 12 + 2y$

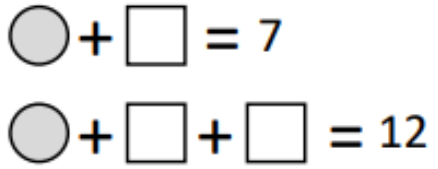
(d) $3x = 10 + 5y$, $3y = 52 - 4x$

(e) $2x + y - 18 = 0$, $3y = 7x + 80$

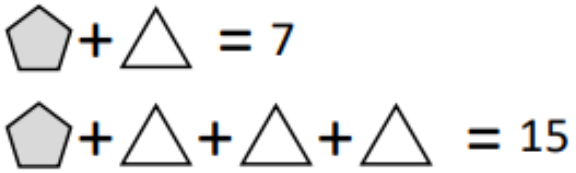
(f) $6x + 2y + 6 = 0$, $7x - 5y - 93 = 10$

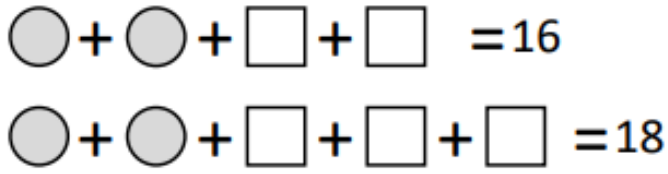
Write an equation for each calculation.

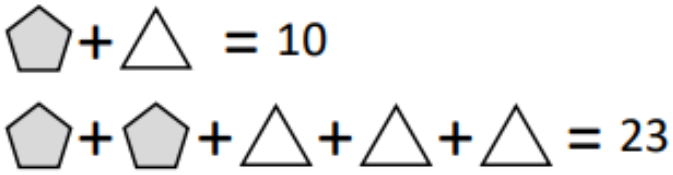
How can you manipulate them to solve the **Simultaneous Equations**?

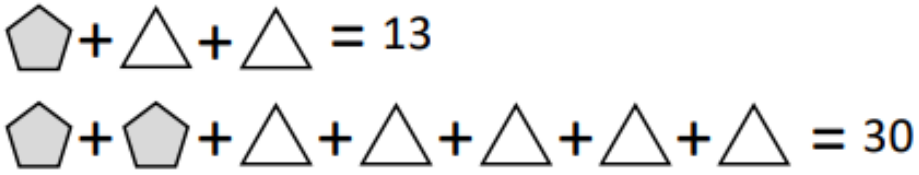
a) 

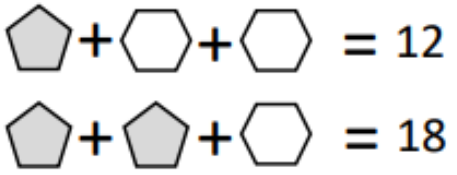
$x + y = 7$

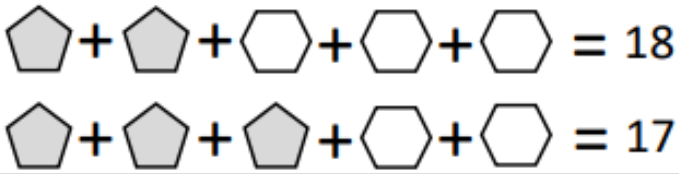
b) 

c) 

d) 

e) 

f) 

g) 

Challenges:

Q1 Four chairs and two tables cost £218.
Six chairs and seven tables cost £587.
Find the total cost of buying twenty chairs and five tables.

Q2 A plumber charges a price for each hour, £h, and a fixed charge, £c.
A 5 hour job costs £155 in total.
A 8 hour job costs £230 in total.
How much would a job that lasts 2 hours cost?

Q3 Barry buys 200 pieces of stationery for £76.
Of the 200 pieces of stationery, x of them are rulers that cost 50p each and y of them are pens that cost 20p each.
Find how many rulers Barry buys and how many pens he buys.

Q4 In a greengrocers, 4kg of bananas and 3kg of apples costs £7.50
In the same greengrocers, 3kg of bananas and 5kg of apples costs £8.10
How much would 2kg of bananas and 2kg of apples cost?

Exam Practice:

https://www.mathsgenie.co.uk/resources/5-simultaneous-equations.pdf

Solve the simultaneous equations.

$2x + y = 18$

$x - y = 6$

Answer _____

(Total 3 marks)

At a café,

2 teas and 1 coffee cost £3.40

1 tea and 4 coffees cost £7.30

Work out the cost of 1 tea and the cost of 1 coffee.

Tea _____

Coffee _____

(Total 4 marks)

The sum of two numbers is 15.
The difference of the same two numbers is 8.

Use algebra to work out the numbers.

Do **not** use trial and improvement.
You **must** show your working.

Answer _____ and _____

(Total 4 marks)

Week 2:

- **LI: I can solve simultaneous equations using the substitution method**
- **LI: I can solve simultaneous equations using a graphical method**

Demonstration Videos:

https://corbettmaths.com/2013/05/07/solving-simultaneous-equations-by-substitution/

https://corbettmaths.com/2019/03/27/solving-simultaneous-equations-graphically/

Tasks:

	LINK	Left & Right	
A	$2x + y = 7$ $y = x + 1$	$x = 2$ $y = 2$	
B	$6x - y = 1$ $3x + 2 = y$	$x =$ $y = 6$	
C	$y - 3x = -4$ $y = 8 - 3x$	$x = 3$ $y =$	
D	$3x + 2y = 14$ $x + 2 = y$	$x = 2$ $y = 3$	
E	$3y + 4x = 22$ $y = 2x + 4$	$x = 4$ $y = 3$	
F	$5x + 4y = 28$ $3x = y + 10$	$x =$ $y = 5$	
G	$2x - 3y = -6$ $y = 4x - 8$	$x = 4$ $y = 2$	
H	$5x - 2y = 14$ $y + 2x = 11$	$x = 2$ $y = 4$	

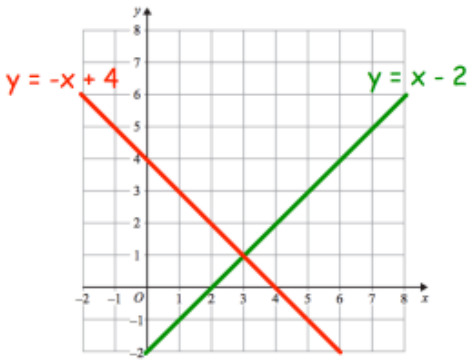
Question 1: Shown below are the graphs of $y = -x + 4$ and $y = x - 2$

(a) Write down the coordinates of the point where the graphs of $y = -x + 4$ and $y = x - 2$ intersect.

(b) Use your answer to (a) to solve the simultaneous equations.

$y = -x + 4$

$y = x - 2$



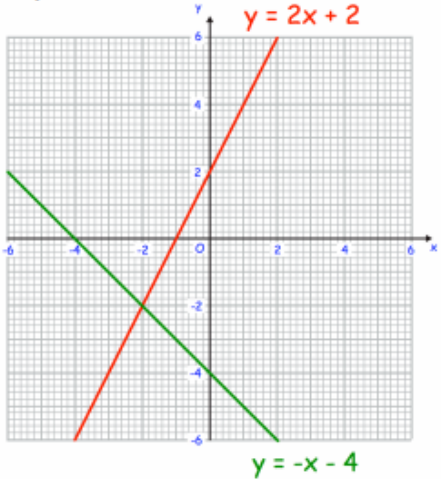
Question 2: Shown below are the graphs of $y = 2x + 2$ and $y = -x - 4$

(a) Write down the coordinates of the point where the graphs of $y = 2x + 2$ and $y = -x - 4$ intersect.

(b) Use your answer to (a) to solve the simultaneous equations.

$y = -x - 4$

$y = x - 2$



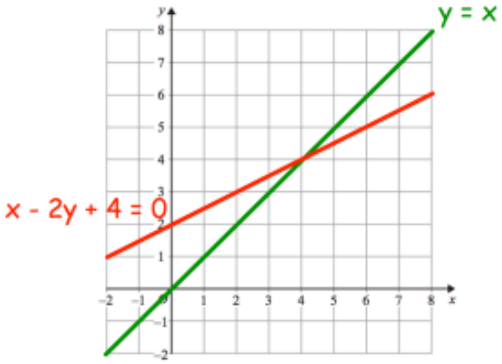
Question 3: Shown below are the graphs of $y = x$ and $x - 2y + 4 = 0$

(a) Write down the coordinates of the point where the graphs of $y = x$ and $x - 2y + 4 = 0$ intersect.

(b) Use your answer to (a) to solve the simultaneous equations.

$y = x$

$x - 2y + 4 = 0$

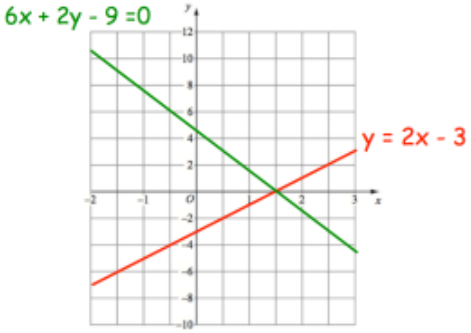


Question 4: Shown below are the graphs of $6x + 2y - 9 = 0$ and $y = 2x - 3$

Use the graphs to solve the simultaneous equations

$6x + 2y - 9 = 0$

$y = 2x - 3$.



Solving Simultaneous Equations Graphically

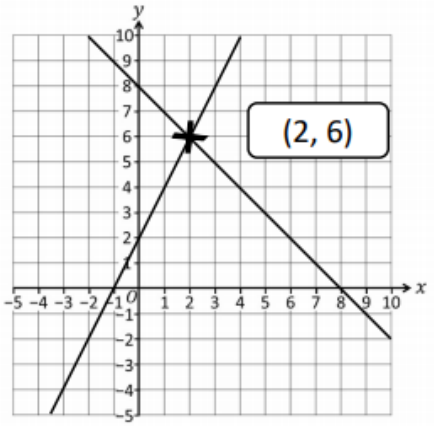
Plot each equation on the same grid.

You may want to rearrange the equations first.

The intersection shows the values (x, y) that satisfy both equations.

Check the solution by substituting values back into the equations.

$y = 2x + 2$ $\quad$ $y + x = 8$



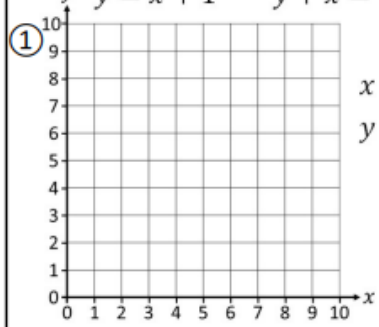
Solution: $x = 2$ $\quad$ $y = 6$

Substitute to check:

$y = 2x + 2$ $\quad$ $6 = 2(2) + 2$ ✓

$y + x = 8$ $\quad$ $6 + 2 = 8$ ✓

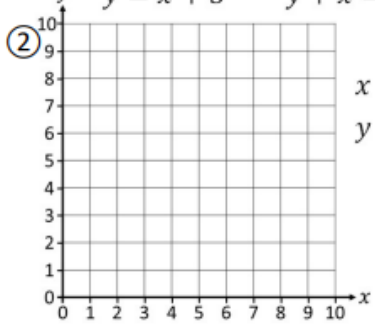
① $y = x + 1$ $\quad$ $y + x = 9$



$x =$

$y =$

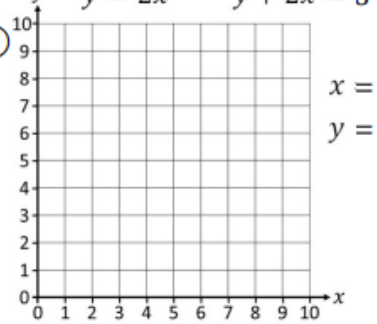
② $y = x + 3$ $\quad$ $y + x = 7$



$x =$

$y =$

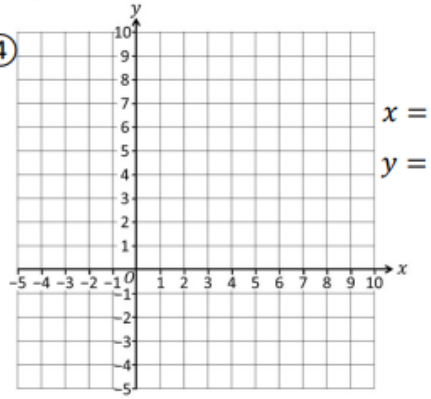
③ $y = 2x$ $\quad$ $y + 2x = 8$



$x =$

$y =$

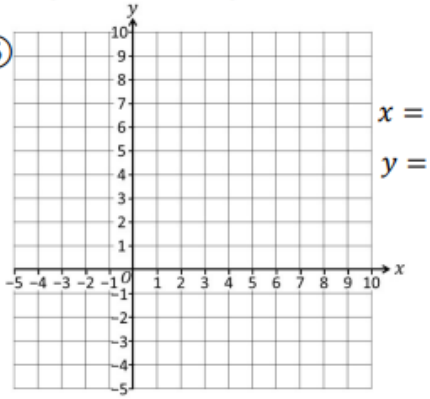
④ $y = 3x - 3$ $\quad$ $2y + 3x = 12$



$x =$

$y =$

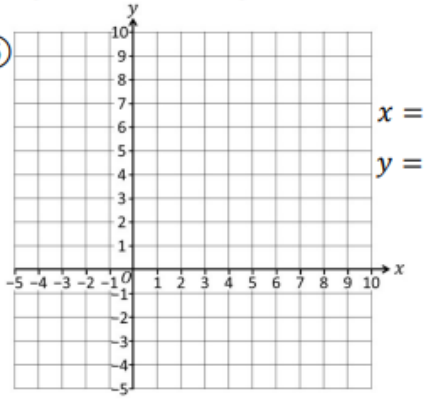
⑤ $y = 5 - 2x$ $\quad$ $y = 0.5x - 5$



$x =$

$y =$

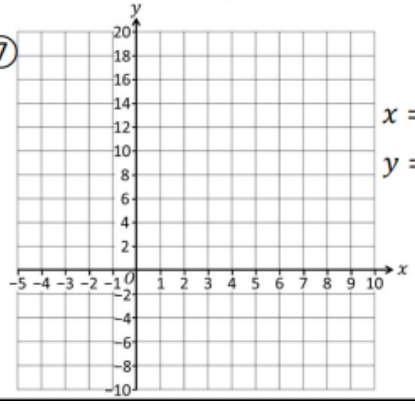
⑥ $y - x = -3$ $\quad$ $2y - 3x = -9$



$x =$

$y =$

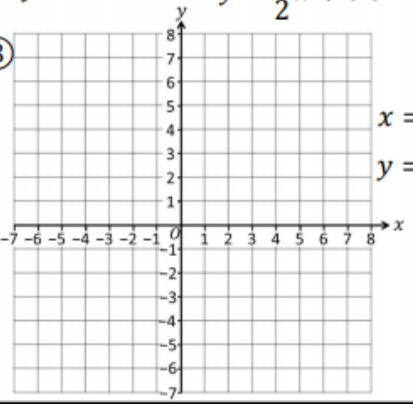
⑦ $2y + 5x = 30$ $\quad$ $y = 6x - 2$



$x =$

$y =$

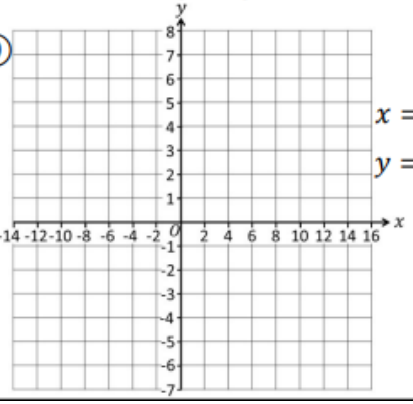
⑧ $4y + 5x = -20$ $\quad$ $y = \frac{1}{2}x + 5.5$



$x =$

$y =$

⑨ $2x = -24 - 6y$ $\quad$ $y - 10 = 2x$



$x =$

$y =$

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Challenges:

The numbers at the end of each row and column are the sum of that row or column. Work out the value of each shape in the grid.

Exam Practice:

https://corbettmaths.com/wp-content/uploads/2013/02/simultaneous-equations-pdf.pdf

https://www.mathsgenie.co.uk/resources/5-solving-simultaneous-equations-graphically.pdf

Week 3:

- **LI: I can calculate the probability of independent events**
- **LI: I can use sample space diagrams and two-way tables**
- **LI: I can calculate relative frequency and use it to predict outcomes**

Demonstration Videos:

https://corbettmaths.com/2013/06/15/probability/

https://corbettmaths.com/2013/05/15/probability-of-not-happening/

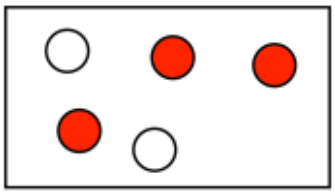
https://corbettmaths.com/2013/06/18/sample-space-diagrams/

https://corbettmaths.com/2012/08/10/two-way-tables/

https://corbettmaths.com/2013/06/20/relative-frequency/

Tasks:

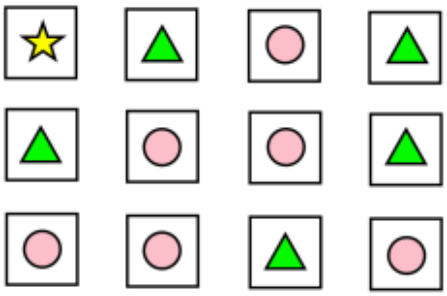
Question 1: Theo has 3 red sweets and 2 white sweets.
He picks a sweet at random.



(a) Write down the probability that Theo picks a red sweet.

(b) Write down the probability that Theo picks a white sweet.

Question 2: Leah has 12 cards, each with a shape on it.
She takes a card at random.



(a) What is the probability that Leah takes a card with a star on it?

(b) What is the probability that Leah takes a card with a triangle on it?

(c) What is the probability that Leah takes a card with a circle on it?

Question 3: Ralph has 9 cards, each with a number on it.

He picks a card at random.
Write down the probability that the chosen card is

(a) the number 8 (b) an even number (c) a number less than 7

(d) a multiple of 4 (e) a square number (f) a prime number

Question 4: There are 12 red roses, 5 yellow roses and 3 white roses in a vase.
Felix takes a rose, at random, from the vase.

(a) Write down the probability that he takes a white rose.
(b) Write down the probability that he takes a red **or** a white rose.
(c) Write down the probability that Felix takes a rose that is **not** red.

Question 5: Leon throws a biased coin.
The probability of getting tails is 0.4
Work out the probability of getting heads.

Question 6: Edith plants a daffodil bulb.
The probability that the bulb will grow is 0.8
What is the probability that the bulb will **not** grow?

Question 7: Wycombe Wanderers play a match of football.
The probability that they win the match is 0.28
The probability that they draw the match is 0.55
Work out the probability that they lose the match.

Question 8: Evelyn has 80 pens in a drawer.
15 pens are black and the other pens are blue.

Evelyn picks a pen at random from the drawer.

(a) What is the probability that Evelyn picks a black pen?
(b) What is the probability that Evelyn picks a blue pen?

Question 9: There are 20 counters in a bag.

2 of the counters are white.
1 of the counters is pink.
4 of the counters are black.
The rest of the counters are purple.

Carter takes a counter at random from the bag.
Show that the probability that the counter is white or purple is $\frac{3}{4}$

TRUE or **FALSE**?

Complete the Sample Space Diagrams and sort them into two piles: **TRUE & FALSE**

A Two coins are flipped.

	H	T
H	HH	HT
T		

P (Tails & Tails) = 0.25

B Two coins are flipped.

	H	T
H		
T		

P (At least 1 Tails) = 0.5

C A coin is flipped & a dice is thrown.

	1	2	3	4	5	6
H	H, 1					
T	T, 1					

P (Tails & Odd) = 1/4

D Two 4-sided spinners are spun & their scores added.

	1	2	3	4
1	2			
2	3			
3				
4				

P (6) = 4/16

E Two 4-sided spinners are spun & their scores multiplied.

	1	2	3	4
1	1	2	3	4
2				
3				
4				

P (More than 4) = 11/16

F A 6-sided dice and a 4-sided spinner: scores added.

	1	2	3	4	5	6
1	2	3				
2	3	4				
3						
4						

P (7 or less) = 0.75

G A 3-sided & a 8-sided spinner are spun & their scores added.

	1	2	3	4	5	6	7	8
1	2	3						
2								
3								

P (4 or 9) = 1/4

H

2 cube dice are rolled & their scores added.

P (Less than 6) = 5/12

I

A 6-sided dice & a tetrahedron dice are rolled & their scores are multiplied.

P (More than 8) = 0.5

J Two 5-sided spinners: scores added.

	1	2	3	4	5
1	2	3			
2	3	4			
3					
4					
5					

P (3 or 6) = 0.15

K Two 5-sided spinners: scores multiplied.

	1	2	3	4	5
1					5
2					10
3					15
4					20
5	5	10	15	20	25

P (Less than 3 or exactly 20) = 0.2

L

An octahedron & a cube dice are rolled & their scores are added.

P (9 or more) = 7/16

Stewards Academy

Stewards Academy

These incomplete Two-Way Tables show the results of data collection.

Sort them into two piles: **TRUE & FALSE**

A 30 adults & 30 children were asked if they preferred movies or documentaries.

	Movie	Doc.	
Adults	12	18	
Children	20	11	

B Adults & children were asked if if they played sport or went to the gym.

	Sport	Gym	Total
Adults	9		
Children		8	
Total	24		49

17 adults went to the gym.

C 20 Year 8 & 20 Year 9 students were asked about the number of siblings they had.

	0	1	2	3
Year 8	7			
Year 9		3	4	1
Total	19	10		4

6 Year 8 students had 2 or more siblings.

D 60 people were asked if they preferred watching football or athletics.

	Football	Athletics	Total
Children	17		19
Adults		18	
Total			

$\frac{1}{3}$ of the people preferred watching football.

E Year 9 & Year 10 students were asked about how they got to school.

	Walk	Bus	Cycle	Total
Year 9	6	12		26
Year 10	3		7	
Total				51

$\frac{3}{5}$ of the Year 10s took the bus to school.

F Adults & Children gamers were asked what platform they play on.

	PC	Console	Phone	Total
Adults	10	10		25
Children	5		15	45
Total				

$\frac{4}{7}$ of the console players were children.

G Year 7 & Year 8 students were asked which dish they had for lunch.

	Pasta	Pie	Total
Year 7	11	14	
Year 8	7	16	
Total			

$\frac{5}{8}$ of the students had Pie.

H Year 9 & Year 10 students were asked about what they drank with their lunch.

	Juice	Soda	Other	Total
Year 9	7	7		22
Year 10		6		28
Total	20			

34% of the students didn't have Juice or Soda.

I People were asked how they stayed healthy.

	Gym	Run	Cycle	N/A	Total
Adults	13		5		
Children		7		2	
Total	15	21	14	10	

Proportionally, more adults went to the gym than children went running.

J Hours of homework done per night:

	<1	1 to 2	2+	Total
Year 9	4	12		24
Year 10		7	6	
Year 11	2			
Total		28	23	60

$\frac{9}{10}$ of Year 11 students did more than 1 hour of homework a night

K For 3 football teams, the goals scored during the season were totalled.

	0	1	2	3+	Total
United	12	4	2	6	
City	8	7	8	1	
Rovers	16	4	0	4	
Total					

As a proportion, United scored 2+ goals in a game **more** than Rovers scored 1+ goals in a game.

L The Two-Way Table shows results in the winter exam.

	Fail	51-80%	81-100%	Total
Year 9	13	16		
Year 10		12	15	
Year 11		15	18	35
Total	22			117

More students in Year 9 passed than in both other years

Question 1: An ordinary coin is thrown 50 times.
Barry says "I am going to get heads 25 times and tails 25 times."
Explain why he could be wrong.

Question 2: A coin is thrown 30 times.
The coin lands on tails 20 times.
What is the relative frequency of the coin landing on tails?

Question 3: A dice is rolled 50 times.
It lands on six 37 times.
(a) Write down the relative frequency of the dice landing on a six.

Robyn says "the dice is biased towards landing on a six."
(b) Do you think the dice is biased? Explain your answer.

Question 4: Jessica wants to test if a coin is biased.
She throws the coin 24 times.

T T H H T H H H T H T T
T H H T T H H T H H H T

(a) Complete the relative frequency table.

	Heads	Tails
Relative frequency		

(b) Do you think the coin is biased? Explain your answer.

Question 5: A biased dice is rolled is rolled 30 times.

3 4 1 3 6 2 6 6 6 5 6 3 6 4 6
1 6 3 4 6 6 2 6 3 6 6 3 6 3 6

(a) Complete the relative frequency table

Number	1	2	3	4	5	6
Relative Frequency						

(b) Do you think the dice is biased? Explain your answer.

Question 6: Esme takes the bus to university 40 times during a term.
The relative frequency of the bus being late is 0.3.
How many times was the bus late?

Question 7: Katie rolls a dice 100 times.
The table shows the results

Number	1	2	3	4	5	6
Frequency	22	9	14	31	19	5

Work out the relative frequency of throwing:

(a) An even number (b) A square number (c) A prime number
(d) A cube number (e) A multiple of 3 (f) A factor of 18

Question 8: A spinner lands of white, black, red or orange.
The relative frequencies after 300 spins are shown in the table below.

Colour	White	Black	Red	Orange
Relative Frequency	0.25	0.4	0.2	0.15

(a) How many times did the spinner land on white?
(b) How many times did the spinner land on red?
(c) How many more times did the spinner land on black than orange?

Question 7: Martin and Laura want to estimate how many green jelly beans are in a tub of 600 jelly beans.
A trial consists of taking a jelly bean at random, noting the colour and replacing the jelly bean into the tub.

	Number of trials	Number of green jelly beans chosen
Martin	30	4
Laura	150	12

(a) Write down the relative frequency of Martin taking a green jelly bean.
(b) Write down the relative frequency of Laura taking a green jelly bean.
(c) Whose experiment gives the more reliable estimate of the number of green jelly beans in the tub? Give a reason for your answer.
(d) How many green jelly beans do you expect to be in tub altogether?

Exam Practice:

https://www.mathsgenie.co.uk/resources/2-writing-probability-and-the-probability-scale.pdf

https://www.mathsgenie.co.uk/resources/3-two-way-tables.pdf

https://www.mathsgenie.co.uk/resources/4-probability-and-relative-frequency.pdf

Stewards Academy

Week 4:

- **LI: I can use the product rule for counting**
- **LI: I can use a Tree diagram to calculate probabilities of dependent and independent events**

Demonstration Videos:

https://corbettmaths.com/2016/09/18/17416/

https://corbettmaths.com/2013/05/07/tree-diagrams/

Tasks:

TRUE or **FALSE**?

A 6 marbles can be arranged in 720 ways.	**B** The 10 outfield players (not goalkeeper) on a football team can be arranged into 36288 different formations.
C A 4-digit (zero to nine) phone PIN has 1,000 combinations.	**D** 20 people meet. If they all bow to each other once, there are a total of 190 bows.
E "My 4-digit phone PIN is either an odd number below 3000... or it is any number equal or greater than 3000." The possibility of guessing this PIN in one try is 1/4000.	**F** The digits to unlock a 5-wheel combination lock are all different and all greater than 2. The combination lock has 2520 possible codes.
G At a restaurant there are 3 starters, 6 main courses & 5 types of dessert. If you pick one of each, there are 90 combinations of meals available.	**H** A sandwich shop offers 8 types of filling for a sandwich. If you pick 3 fillings there are 336 different types of sandwich you could order.
I A robot factory gives a unique code to each robot. It is either letter-letter-digit OR letter-letter-letter-digit. The factory can produce 182,520 robots before it needs to introduce a new code.	**J** 15 students audition for the school play. There are 5 different roles available in the play. The roles could be filled in 360,360 different ways.
K There are 12 different toppings available at a pizza restaurant. If you pick 4 for your pizza, there are 990 different combinations of pizza available.	**L** A headteacher wants to choose 2 students from Year 10 to represent the school. There are 120 students in Year 10, so there are 14,280 possible pairs of students to choose from.

1 Hayley makes a sandwich using
bread (B) or a roll (R) and
ham (H) or cheese (C) and
salad (S) or pickle (P)

1 (a) List **all** the possible types of sandwich Hayley could make.
One has been done for you. **[2 marks]**

BHS

1 (a) What **fraction** of the possible types of sandwich have cheese **and** pickle?

[1 marks]

Product Rule for Counting

1	8

How many 2-digit numbers can you make with these 2 cards?

1	8	7

How does this change if we add a third card?

1	8	7	3

A) How many 4-digit numbers can you make using these cards?

* How many choices do you have for the 1st card?
* After you choose a 1st card,
  how many choices do you have for the 2nd card, 3rd card & 4th card?

4	8	3	6	2

B) How many odd 5-digit numbers can you make with these cards?

* One number must be last, how does this affect our choices?

7	9	1	5	3

C) How many numbers greater than 40,000 can you make?

* How many choices are there for the 1st card?

5	6	8	3	4	2

D) How many odd 6-digit numbers can you make?

* How many choices are there for the last card?

7	1	6	5	2	9

E) How many numbers greater than 300,000 can you make?

1	6	5	2	7

F) How many 5-digit numbers that are a multiple of 2 can you make?

7	2	4	3	8

G) How many odd numbers greater than 50,000 can you make?

* Sum the choices for each starting card.

6	1	9	7	3	2

H) How many odd numbers greater than 500,000 can you make?

8	2	5	1	7	4

H) How many even numbers smaller than 600,000 can you make?

9	6	7	1

I) How many 2-digit numbers can we make using these cards?

J) How many 3-digit numbers can we make using these cards?

2	8	1	5	6

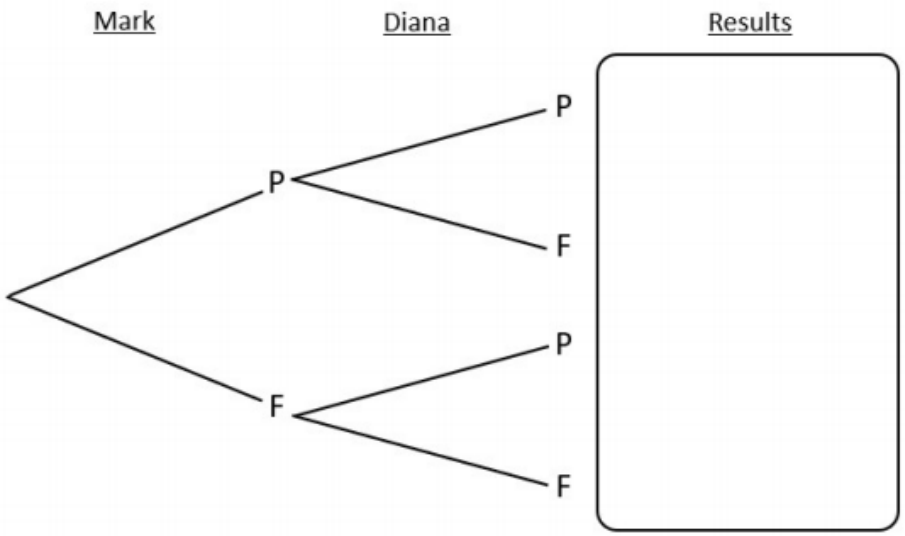
K) How many ways can we make 3 numbers from these cards?

L) The number 156 is made. How many different numbers use these same digits?

M) If we don't care about their order (the number they make):
how many ways can we pick 3 digits from the 5 cards?

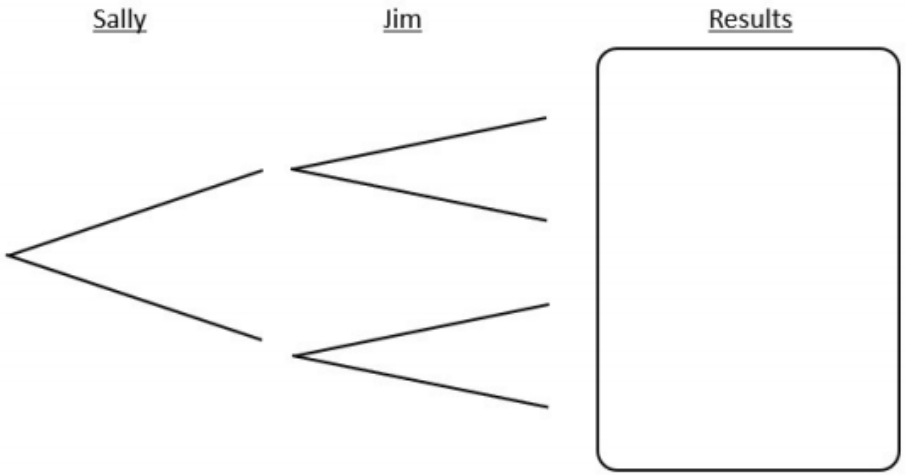
1. The probability Mark passes his driving test is $\frac{1}{3}$. The probability Diana passes is $\frac{5}{6}$.

Complete the Tree Diagram and find the probability they both pass their tests.



2. The probability Sally passes her history test is $\frac{4}{5}$. The probability Jim passes is $\frac{2}{3}$.

a) Complete the Tree Diagram and find the probability they both fail their tests.
b) What is the probability at least one of them passes?



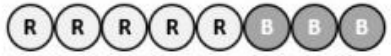
3. The probability Jim passes his maths test is $\frac{7}{10}$. The probability he passes English is $\frac{4}{5}$.

a) Complete a Tree Diagram and find the probability he passes both tests.
b) What is the probability he fails both tests?
c) What is the probability he passes only one test?

4. The probability Helen passes her English test is $\frac{4}{9}$. The probability she passes History is $\frac{3}{7}$.

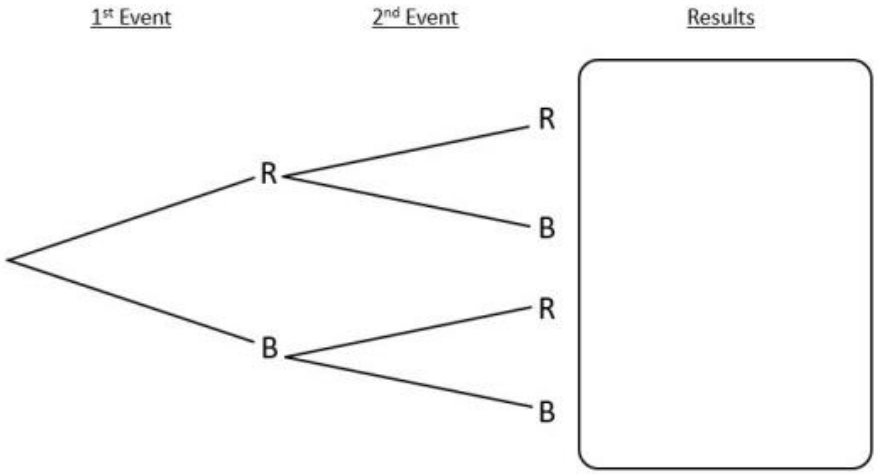
Complete a Tree Diagram and find the probability she passes at least one test.

Conditional Tree Diagrams

a) 

There are 5 red and 3 blue buttons in a sack.

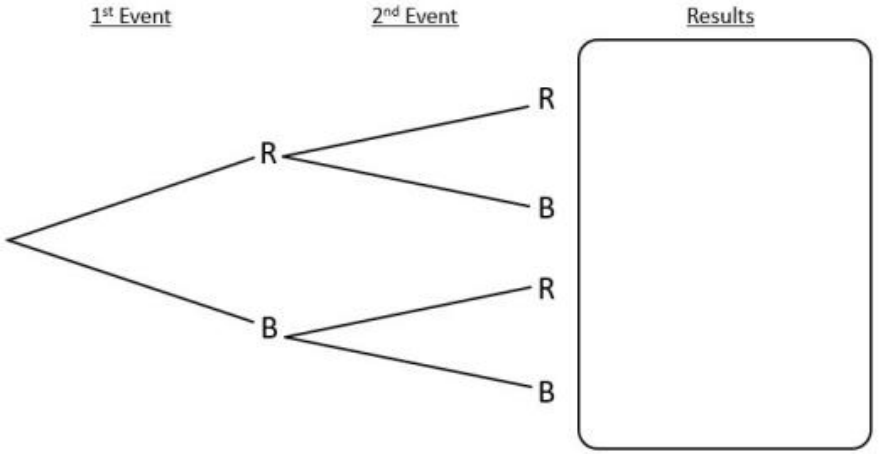
A button is taken out and not replaced. Then another button is taken out.
What is the probability both buttons are blue?



b) 

There are 2 red and 6 blue buttons in a sack.

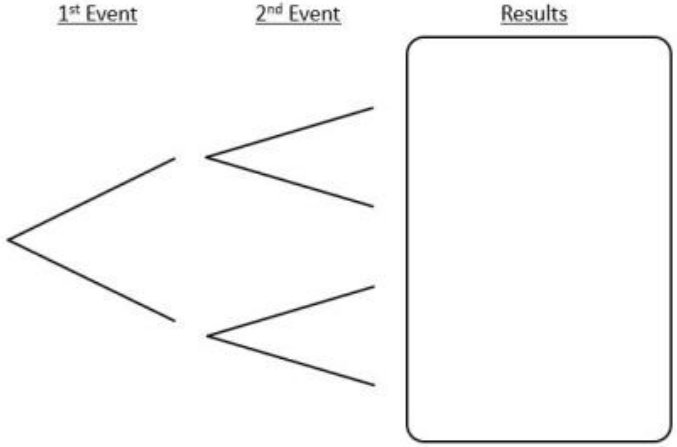
A button is taken out and not replaced. Then another button is taken out.
What is the probability both buttons are red?
What is the probability of choosing *at least one* red button?



c) 

There are 4 red and 5 green buttons in a sack.

A button is taken out and not replaced. Then another button is taken out.
What is the probability of choosing *at least one* red button?
What is the probability of choosing *only one* red button?

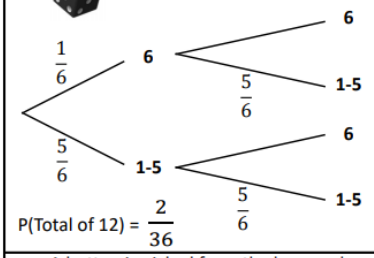


d) A science assessment has a practical and written test. Students have an 80% chance of passing the written test. If they pass the written test there is a 60% chance they pass the practical test. If they fail the written test, there is a 30% chance they will pass the practical test.

1) Draw a Probability Tree to show these events.
2) What is the probability a student passes both tests?
3) What is the probability a student passes only one of the tests?

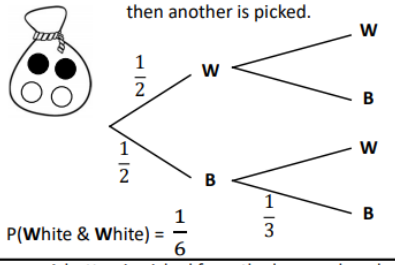
TRUE or **FALSE**? Complete the tree diagrams. Sort the cards into two piles: **TRUE & FALSE**

A A dice is rolled twice.



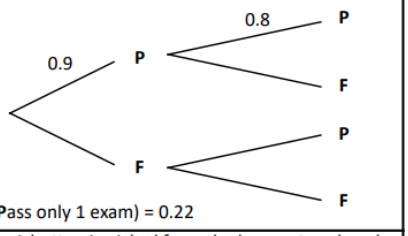
P(Total of 12) = $\frac{2}{36}$

B A button is picked from the bag, not replaced, then another is picked.



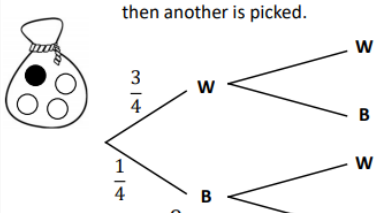
P(**W**hite & **W**hite) = $\frac{1}{6}$

C If a student fails their first exam, the probability they pass the second exam is 0.4



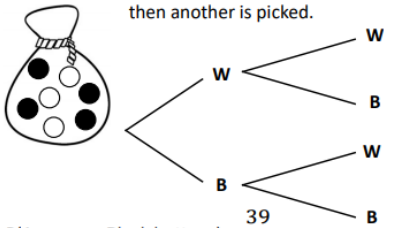
P(**P**ass only 1 exam) = 0.22

D A button is picked from the bag, replaced, then another is picked.



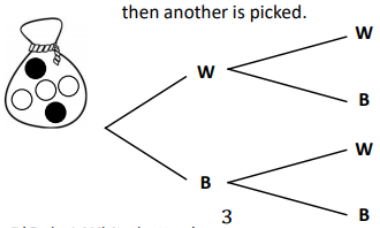
P(**W**hite & **W**hite) = $\frac{9}{16}$

F A button is picked from the bag, replaced, then another is picked.



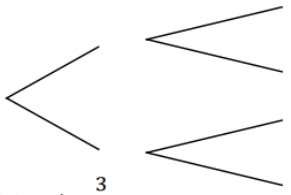
P(1 or more **B**lack buttons) = $\frac{39}{49}$

F A button is picked from the bag, **not** replaced, then another is picked.



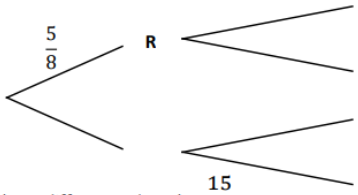
P(Only 1 **W**hite button) = $\frac{3}{5}$

G A bag has 3 red circles & 5 green circles. A shape is picked, **not** replaced, & another picked.



P(**G**reen & **G**reen) = $\frac{3}{14}$

H A bag has 5 red circles & some green circles. A circle is picked, replaced, & another picked.



P(Two different colours) = $\frac{15}{32}$

I A bag has

6 red circles,
4 green circles &
5 yellow circles.

2 shapes are picked.

P(Red & Green) = $\frac{7}{35}$

Challenges:

A **biased** coin has a probability of 0.9 showing up **heads** when flipped.

You flip this coin six times.

Write your answers to the following questions as decimals.

a) What is the probability that the coin showed up **tails** on the second flip?
b) What is the probability that the coin showed up **tails** on the sixth flip?
c) What is the probability that the coin *only* showed up **tails** on the sixth flip?
d) What is the probability that the coin only showed up **tails** once out of the six times it was flipped?

Exam Practice:

https://www.mathsgenie.co.uk/resources/6-product-rule.pdf

https://www.mathsgenie.co.uk/resources/5-probability-trees.pdf

Week 5:

- **LI: I can use set notation**
- **LI: I can calculate probabilities from a Venn diagram**

Demonstration Videos:

https://corbettmaths.com/2019/03/27/set-notation/

https://corbettmaths.com/2016/08/07/venn-diagrams/

Tasks:

Highest Common Factors & Set Notation

$A \cap B$ **Intersection**: The overlap of **A** and **B**.

EXAMPLE

A = { Factors of 12 } = { 1, 2, 3, 4, 6, 12 }

B = { Factors of 18 } = { 1, 2, 3, 6, 9, 18 }

A ∩ **B** = { 1, 2, 3, 4, 6 }

Highest Common Factor of 12 & 18 = 6

C = { Factors of 16 } = { }

D = { Factors of 24 } =

E = { Factors of 36 } =

1) **C** ∩ **D** = { }
HCF of 16 & 24 =

2) **C** ∩ **E** =
HCF of 16 & 36 =

3) **D** ∩ **E** = { 1, 2, 3, 4, 6, 12 }
HCF of 24 &

4) **A** ∩ **B** ∩ **C** = { 1, 2, 4 }
HCF of

F = { Factors of 30 } =

G = { Factors of 40 } =

H = { Factors of 45 } =

I = { Factors of 54 } =

J = { Factors of 72 } =

5) **F** ∩ **G** =
HCF of

6) **H** ∩ **I** =
HCF of

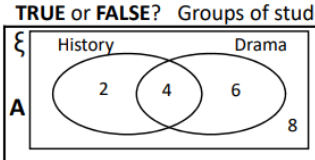
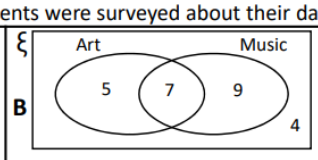
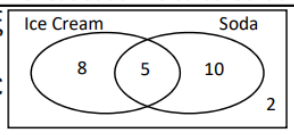
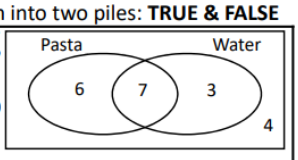
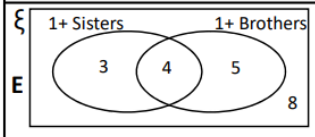
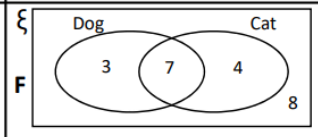
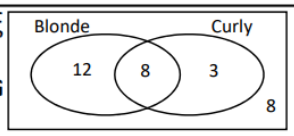
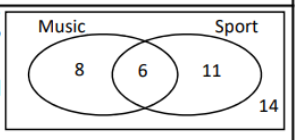
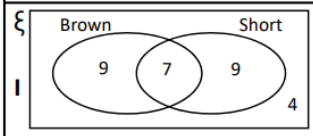
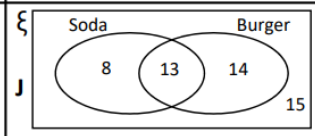
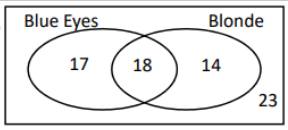
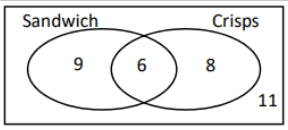
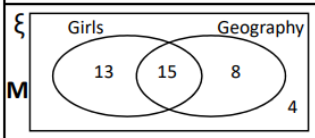
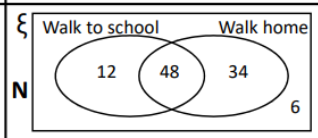
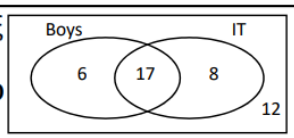
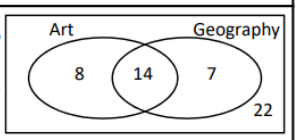
7) **G** ∩ **J** =
HCF of

8) **I** ∩ **J** =
HCF of

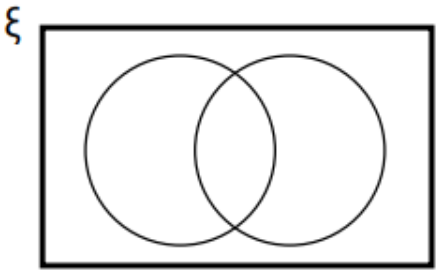
9) **A** ∩ **D** ∩ **H** =
HCF of

10) **B** ∩ **E** ∩ **J** =
HCF of

TRUE or **FALSE**? Groups of students were surveyed about their daily life. Cut out all 16 cards. Sort them into two piles: **TRUE & FALSE**

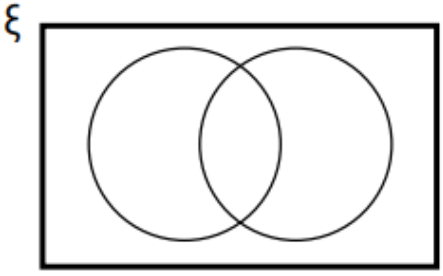
A  The probability of picking a student who studies drama is 0.6	**B**  The probability of picking someone who studies art and music is 1/3	**C**  From those that had a soda, the probability of them also having ice cream is 1/3	**D**  The probability of choosing a student who didn't drink water or have pasta for lunch is 0.2
E  The probability a student was a single child is 2/5	**F**  The probability of picking a student with only a pet dog is 3/22	**G**  From those with blonde hair, the probability of selecting a student with curly hair is 8/12	**H**  From students that had music or a sport as a hobby, the probability of picking one who did both is 0.25
I  The probability of picking a student with short, but not brown hair is 16/29	**J**  The probability of picking a student who didn't have a burger for lunch is 0.46	**K**  The probability of picking a blonde student is 3/9	**L**  From those that had a sandwich or crisps, the probability they only had a sandwich is 9/23
M  From boys, the probability that a student studies geography is 0.5	**N**  The probability a student either walks home or walks to school, but not both is 0.46	**O**  The probability of a girl studying IT is 40%	**P**  From art and geography students, the probability of picking someone who only studies one is 14/29

100 members of a club were asked if they have a brother or a sister.
50 people have a sister
59 people have only a brother
33 people have both a brother and sister.
Represent this information in a Venn diagram.



40 students are asked if they study geography or history.
27 students study history.
24 students student geography.
3 students study neither.

Complete the Venn Diagram.



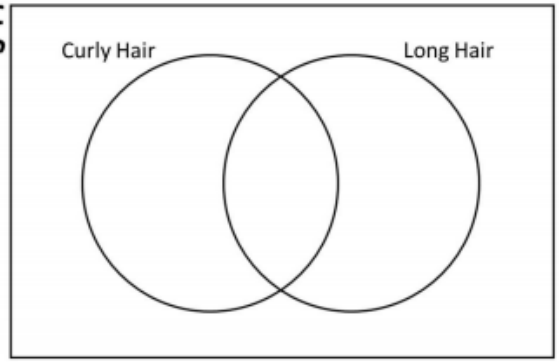
What is the probability of selecting a student who studies both history and geography?

① 24 students were surveyed about their hair.

The results are below.

Curly	Long	Short
Chris	Chris	Edward
Fred	Diana	Anna
Anna	Kris	Viv
Tess	Fred	Lisa
Olly	Noel	Will
Mark	Robert	Tess
Iona	Yuna	Ben
Jessica	Zoe	Olly
Ben	Shay	Xena
	Peter	Jessica
	Mark	
	George	
	Iona	
	Hannah	

Complete the Venn diagram using letters for the student's names.



If you pick a student at random, what is the probability...

P(Curly Hair) =

P(NOT Curly Hair) =

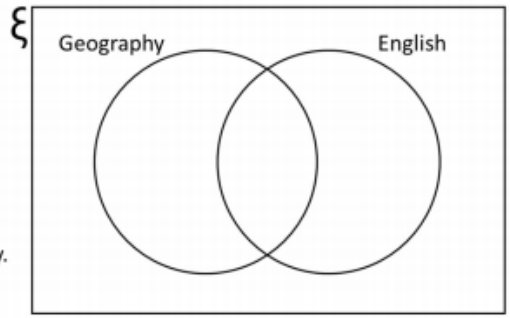
P(Long AND Curly Hair) =

P(Long AND NOT Curly Hair) =

P(Curly OR Short Hair) =

② 50 students were asked if they study Geography or English.

- 5 study Geography and not English.
- 25 study English and not Geography.
- 20 study English and Geography.



If I pick a student at random, what is the probability they...

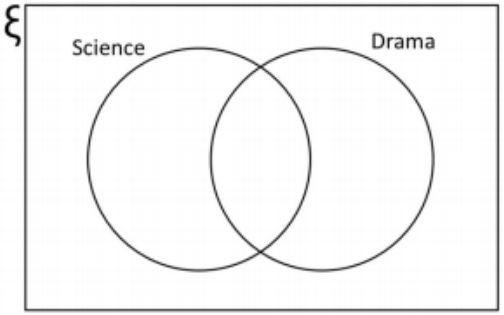
P(study English) =

P(study Geography) =

P(study Geography AND English) =

③ 70 students were asked if they study Science or Drama.

- 13 study Science and Drama.
- 37 study Science and not Drama.
- 8 study Drama and not Science.



If I pick a student at random, what is...

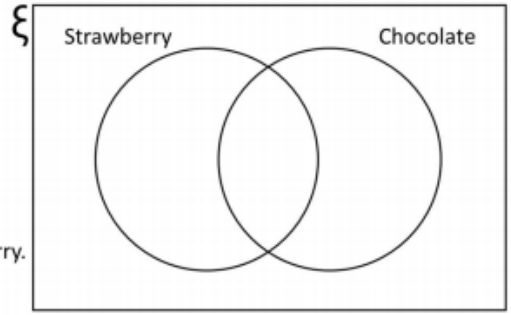
P(study Drama) =

P(study Science) =

P(don't study Science OR Drama) =

④ 45 people bought one or two scoops of ice cream.

- 20 bought strawberry.
- 10 didn't buy chocolate or strawberry.
- 30 bought chocolate.



How many people bought both flavours?

If I pick a person at random, what is...

P(strawberry) =

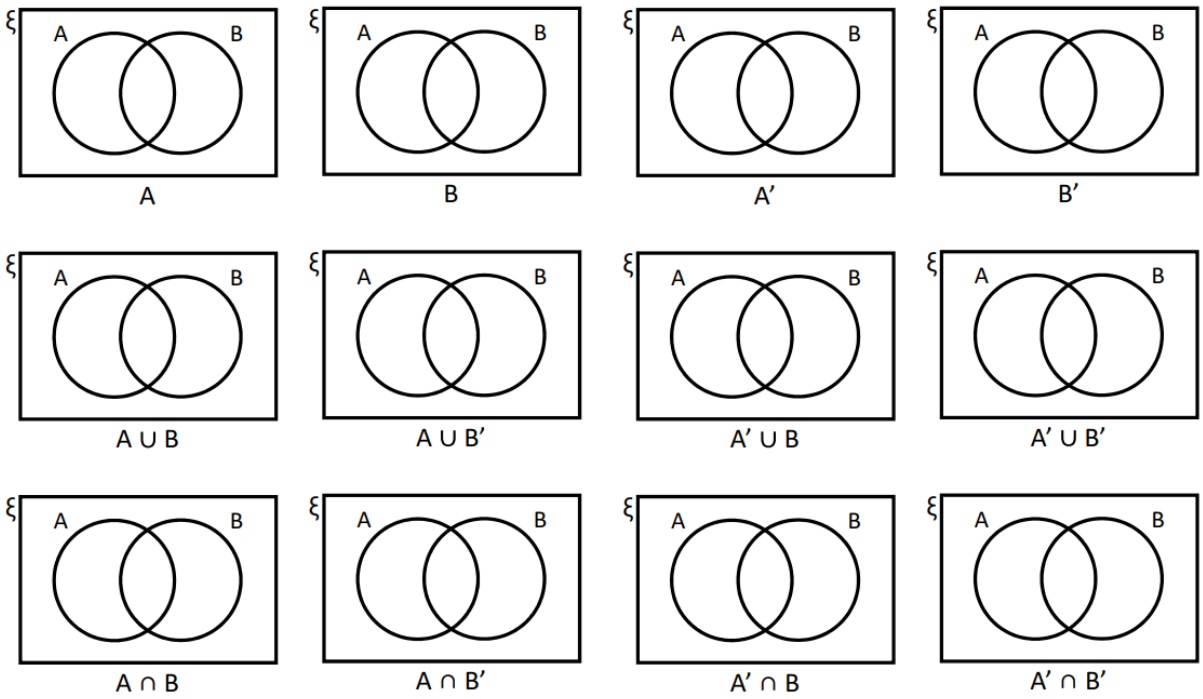
P(only chocolate) =

P(only one flavour) =

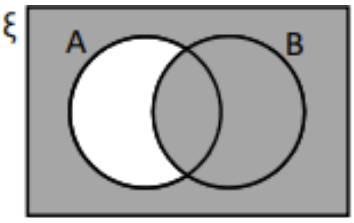
Complement: ′
The opposite of a set.
B′ = everywhere not in B

Intersection: ∩
The overlap of regions.
A ∩ B = everywhere A and B overlap

Union: ∪
The sum of regions.
A ∪ B = A added to B



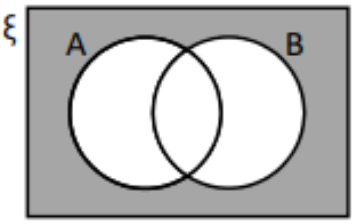
1 (a) Which of these represents the shaded region? Circle your answer.



[1 mark]

$B \cap A'$ A' $B' \cup A'$ $B \cup A'$

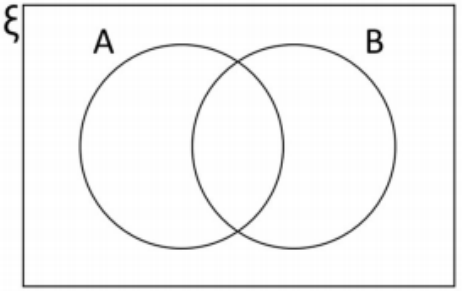
1 (b) Which of these represents the shaded region? Circle your answer.



[1 mark]

$(A \cup B)'$ $A' \cap B'$ $(A \cap B)'$ $A \cap B$

① $\xi = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$
$A = \{1, 2, 3, 4, 5, 9, 10\}$
$B = \{3, 5, 6, 7, 10\}$



Complete the Venn diagram.

If I pick a number at random what is...

P(A) =

P(A AND B) = P(A ∩ B) =

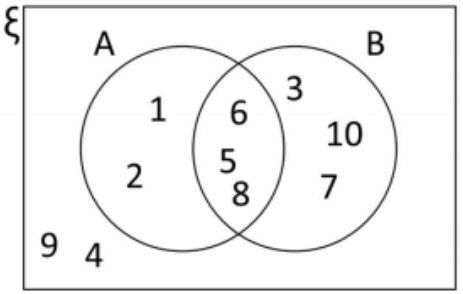
P(NOT A) = P(A') =

P(A OR B) = P(A ∪ B) =

P(B') =

P(A OR NOT B) = P(A ∪ B') =

② Remember!
A' = **NOT** A
A ∩ B = A **AND** B
A ∪ B = A **OR** B



True or False?

$P(A) = \frac{1}{2}$ T / F

$P(B) = \frac{4}{5}$ T / F

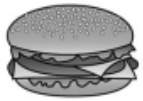
$P(A') = \frac{4}{10}$ T / F

$P(A \cap B) = \frac{3}{10}$ T / F

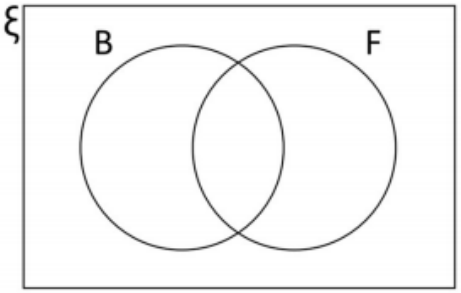
$P(A \cup B) = \frac{7}{10}$ T / F

$P(A \cup B') = \frac{2}{5}$ T / F

③ 50 students were asked about their lunch.



25 students had a burger (B)
35 students had fries (F)
15 students had both.



Complete the Venn diagram.
How many students had neither F or B?
If a student was chosen at random, what is...

P(B) =

P(B ∩ F) =

P(F ∪ B) =

P(F) =

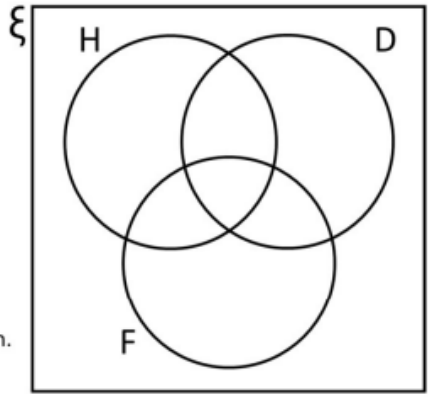
P(B') =

P(F' ∩ B') =

④ 100 students were asked about their school subjects:

15 studied History (H), French (F) and Drama (D).
40 studied Drama and History.
25 studied History and French.
55 studied History.
22 studied French and Drama.
3 studied only Drama.
40 studied French.

Complete the Venn diagram with this information.



P(H) =

P(D') =

P(D ∩ F) =

P(H ∪ D) =

P(F') =

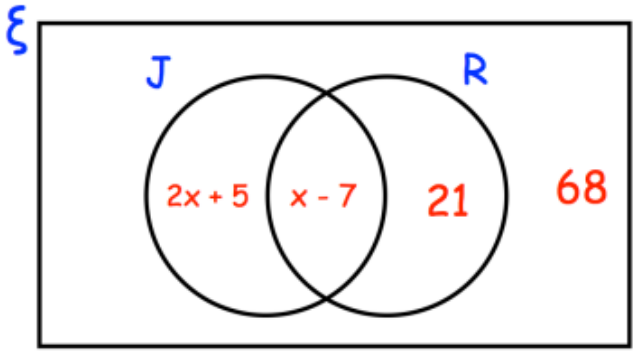
P(H ∩ F ∩ D) =

P(D ∪ F) =

Challenges:

The Venn diagram shows information about the cars in a car park.

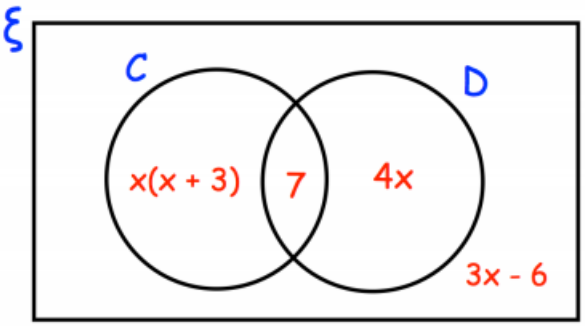
ξ = 150 cars in the car park
R = red cars
J = cars manufactured in Japan



A car is chosen at random.
Work out the probability that it is red.

The Venn diagram shows information about the pets owned by 40 students

ξ = 40 students
C = students who own a cat
D = students who own a dog



A student is chosen at random.
They own a cat.
Work out the probability that they own a dog.

Exam Practice:

https://www.mathsgenie.co.uk/resources/5-venn-diagrams.pdf

Stewards Academy

Week 6:

- **LI: I can use cumulative frequency graphs, box and whisker plots, and histograms**
- **LI: I can make predictions using data, and comment on the accuracy of those predictions**
- **LI: I understand sampling and sampling methods**

Demonstration Videos:

http://corbettmaths.com/2013/05/15/drawing-and-reading-box-plots/

http://corbettmaths.com/2012/08/09/drawing-cumulative-frequency-graphs/

http://corbettmaths.com/2012/08/09/reading-cumulative-frequency-graphs/

http://corbettmaths.com/2012/08/20/drawing-histograms/

http://corbettmaths.com/2012/08/19/finding-frequencies-from-histograms/

Tasks:

A

	Smallest	Lower Quartile	Median	Upper Quartile	Largest	Range
Height (cm)	134	140	150	163	175	41

B

	Smallest	Lower Quartile	Median	Upper Quartile	Largest	Range
Height (cm)	82	140	146	160	174	92

C

	Smallest	Lower Quartile	Median	Upper Quartile	Largest	Range
Height (cm)	129	140	150	153	155	26

D

	Smallest	Lower Quartile	Median	Upper Quartile	Largest	Range
Height (cm)	134	139	140	148	154	20

E

	Smallest	Lower Quartile	Median	Upper Quartile	Largest	Range
Height (cm)	136	141	150	161	165	29

F

	Smallest	Lower Quartile	Median	Upper Quartile	Largest	Range
Height (cm)	82	90	100	108	124	42

G

	Smallest	Lower Quartile	Median	Upper Quartile	Largest	Range
Height (cm)	82	90	100	118	124	42

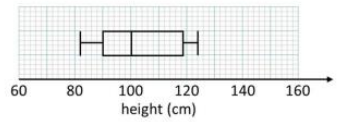
H

	Smallest	Lower Quartile	Median	Upper Quartile	Largest	Range
Height (cm)	98	114	140	152	154	56

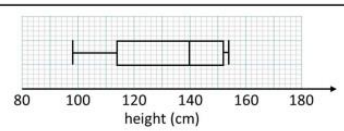
I

	Smallest	Lower Quartile	Median	Upper Quartile	Largest	Range
Height (cm)	46	76	100	108	130	84

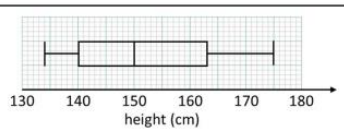
1



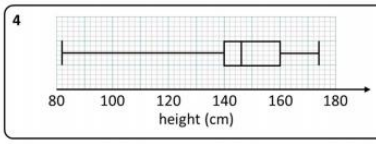
2



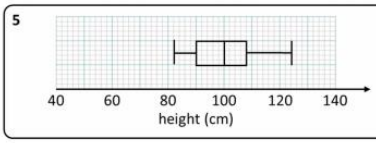
3



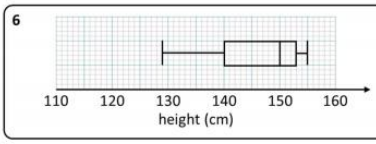
4



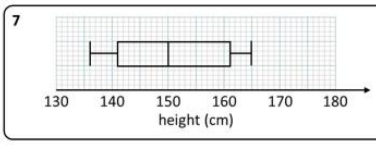
5



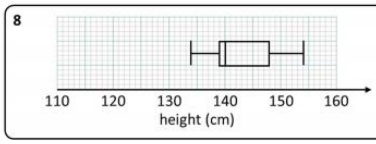
6

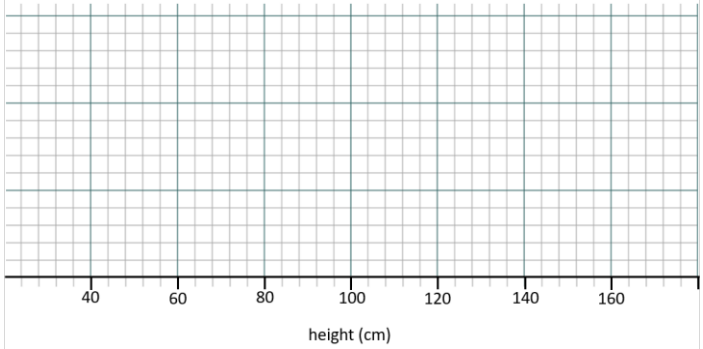


7



8





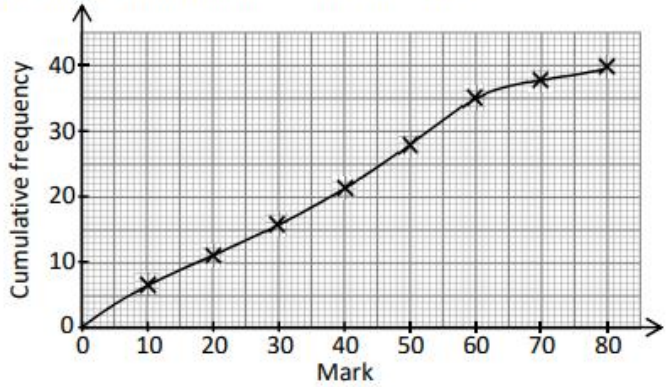
Draw the missing box plot from above.

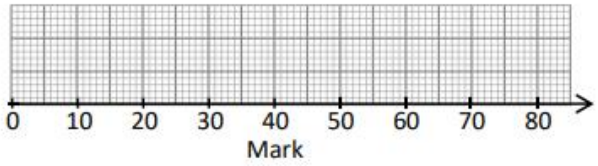
Cumulative Frequency Graphs & Box Plots

1) The cumulative frequency graph below shows the results of a Year 8 science test.
Josh got the highest mark in the class with 76.
Samantha got the lowest with 7.

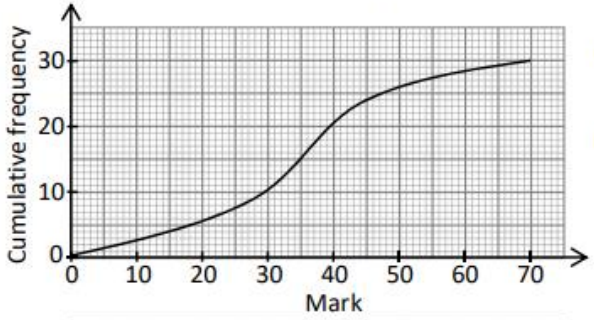
A) Find the Median, Upper Quartile and Lower Quartile from the graph.

B) Combine all this data to create a box plot.



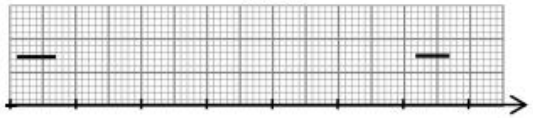


2) This cumulative frequency graph shows the results of a Year 10 science test.



A) Use the data to complete the box plot.

B) What comparisons can you make between the Year 8s and the Year 10s?



3) These two tables show the results for Year 7 and Year 10 end-of-year English tests.

Year 7
Min = 8
Max = 99

Mark (m)	F.	C.F.
$0 \leqslant m \leqslant 20$	15	
$21 \leqslant m \leqslant 40$	22	
$41 \leqslant m \leqslant 60$	18	
$61 \leqslant m \leqslant 80$	11	
$81 \leqslant m \leqslant 100$	4	

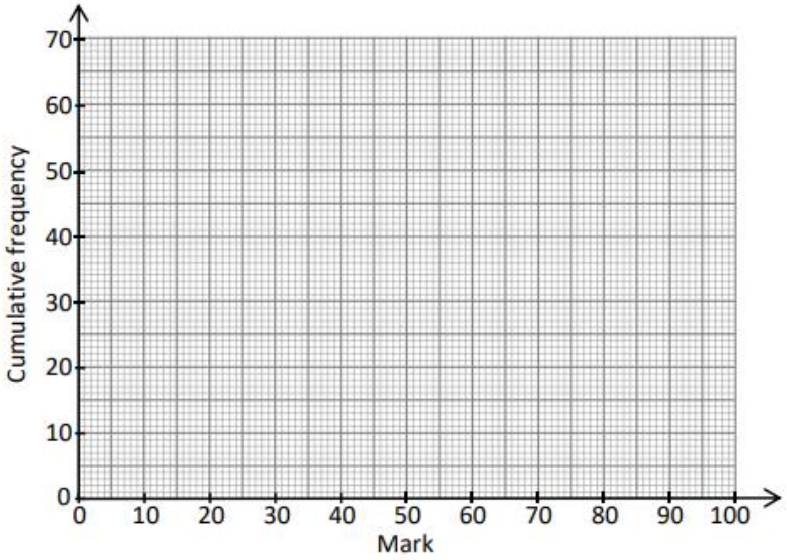
Year 10
Min = 0
Max = 92

Mark (m)	F.	C.F.
$0 \leqslant m \leqslant 10$	1	
$11 \leqslant m \leqslant 20$	1	
$21 \leqslant m \leqslant 30$	7	
$31 \leqslant m \leqslant 40$	12	
$41 \leqslant m \leqslant 50$	16	
$51 \leqslant m \leqslant 60$	13	
$61 \leqslant m \leqslant 70$	15	
$71 \leqslant m \leqslant 80$	2	
$81 \leqslant m \leqslant 90$	2	
$91 \leqslant m \leqslant 100$	1	

A) Plot both sets of data on the single grid.

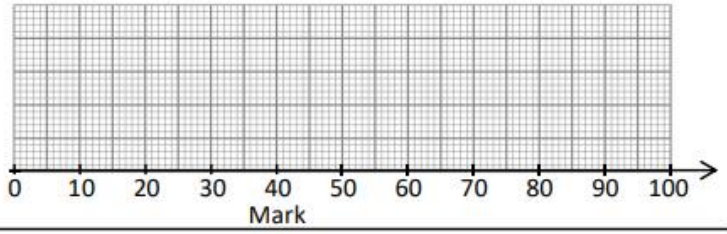
B) Use the graphs to plot two box plots on the same grid.

C) Compare the data. Which class did best?



Year 7

Year 10



Stewards Academy

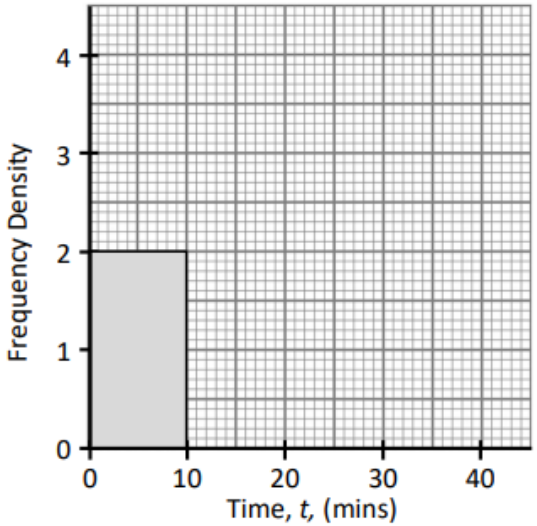
Histograms

1) People were surveyed about the time it took to get to their local shop.

Time, t, (mins)	Frequency	Class Width	Frequency Density
$0 < t \leqslant 10$	20		
$10 < t \leqslant 15$	15		
$15 < t \leqslant 20$	20		
$20 < t \leqslant 40$	30		

Notice that the classes (groups) are different sizes.
To represent them fairly, we must show how *relatively* dense the class is.
We do this using 'Frequency Density': Frequency ÷ Class Width

a) Complete Class Width & Frequency Density for each class.
b) Use the data to complete the histogram.



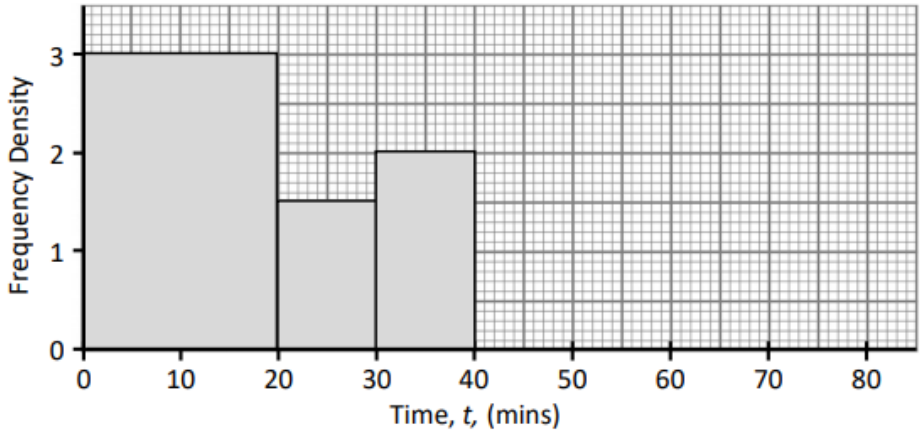
How many people is one square worth?

Estimate:

a) How many people took 5 minutes or less to walk to work.
b) How many people took between 30 & 40 minutes to walk to work.

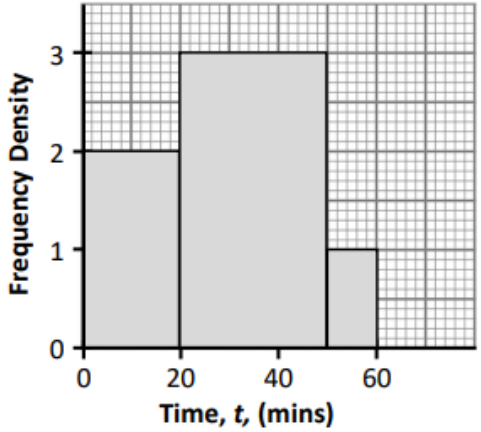
Why are these estimates?

2) Students were surveyed about the time they spent doing homework last night. Complete the graph & table.



Time, t, (mins)	Frequency	Class Width	Frequency Density
$0 < t \leqslant 20$			
$20 < t \leqslant 30$			
$30 < t \leqslant 40$			
$40 < t \leqslant 80$	40	40	1

3) As a logic test, adults were given a puzzle to complete.
The histogram shows the results. Complete the frequency table.



Time, t, (mins)	Freq.
$0 < t \leqslant 20$	
$20 < t \leqslant 50$	
$50 < t \leqslant 60$	

Which group is the median in?

How far into that group is the median?

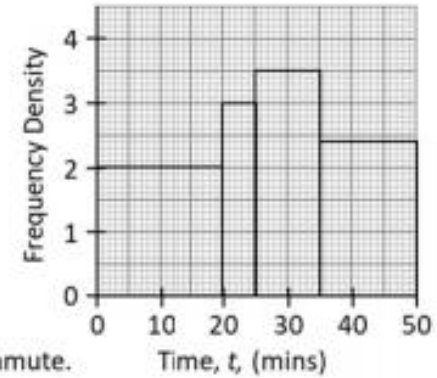
Mark the median on the histogram. What is its value?

Histograms: Reading

1) The histogram shows the time taken by workers to commute.

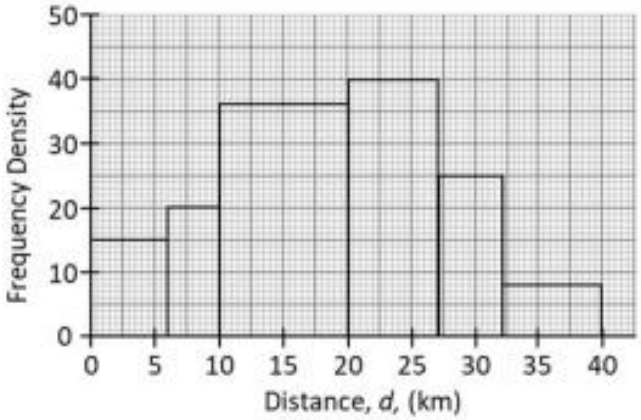
a) Complete the frequency table.

Time, t, (mins)	Freq.
$0 < t \leqslant 20$	
$20 < t \leqslant 25$	
$25 < t \leqslant 35$	
$35 < t \leqslant 50$	



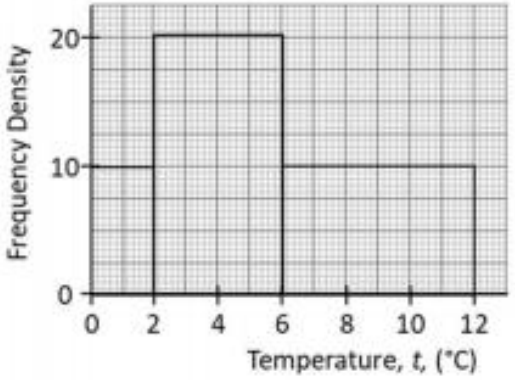
b) Calculate an estimate for the mean time taken to commute.

2) The histogram shows the distance workers commute.



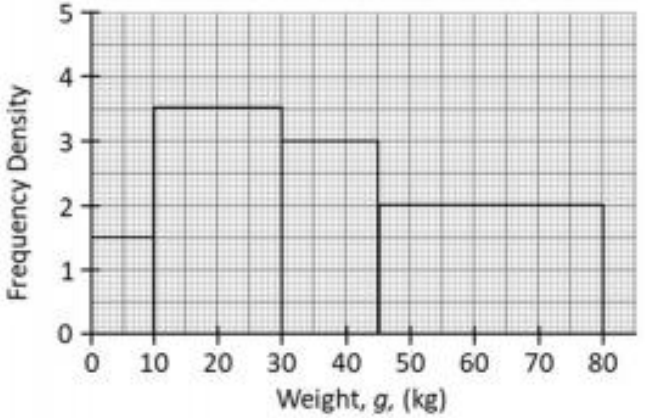
a) How many people commute ...less than 10 km?
b) ...more than 20 km?
c) ...between 10 km and 15km?
d) ...less than 2 km?
e) ...more than 22 km?
f) ...more than 7 km?

3) The histogram shows temperatures on different winter days.



Use the histogram to estimate...
a) ...the median.
b) ...the lower quartile.
c) ...the upper quartile.
d) What is the inter-quartile range?

4) The histogram shows the weight of different packages.



a) Estimate the median.
b) Estimate the inter-quartile range.
c) Estimate the mean.

Questions	Question Title
1	Multiplication with surds
2	Negative vectors
3	Order of operations, simplifying expressions
4	Estimating calculations
5	Solving linear inequalities
6	Express one number as a fraction of another
7	Using gradient to find points
8a	Calculating relative frequency
8b	Relative frequency and testing for bias
9	Range from a set of data, add and subtract fractions
10	Algebraic inverse proportion
11	Perimeter problem solving with algebra
12	Comparing numbers in standard form
13	Converting volume units
14a	Sequences from pictures, comparing with ratio
14b	Ratio problem solving
15	Expectation
16	Percentage increase, compare quantities using ratio
17	Sine rule
18	Surface area of a complex shape
19a/b	Cumulative frequency diagram calculations
19c	Interpreting box plots
20	Sequences with algebra, simultaneous equations
21	Enlarge a shape by a negative scale factor
22	Shading sets in Venn diagrams
23	Fraction problem solving
24a	Order of operations, laws of indices
24b	Laws of indices (fractional powers)
25a	Cosine graphs
25b	Cosine graphs, graph transformations
26	Change subject of a formula, fractions, ratio
27a	Solving quadratic equations by factorising
27b	Solving quadratic equations by completing the square
28	Dividing with surds, simplifying surds
29a	Graph transformations - translation
29b	Graph transformations - reflection in the x-axis
30	Using exact values of sine, cosine and tangent