Year 11 into 12 Transition

A Level Further Mathematics

Summer work

- To be completed before your first Further Maths lesson in September (we will go through the answers in that lesson…)

Name: _____

Higher Probability

Date:

Time: 65 minutes

Total marks available: 59

Total marks achieved: _____

Questions

Q1.

There are 20 sweets in a box.
x of the sweets are red.
The rest of the sweets are yellow.

Tom takes at random a sweet from the box.

Write down an expression, in terms of x, for the probability that Tom takes a yellow sweet.

.....

(Total for Question is 2 marks)

Q2.

Josh plays a game with two sets of cards.

Set A	1	2	4	5	7
Set B	3	6	8	9	

Josh takes at random one card from each set.
He adds the numbers on the two cards to get the total score.

(a) Complete the table to show all the possible total scores.

	Set A				
Set B	**1**	**2**	**4**	**5**	**7**
3	4	5	7	8	10
6	7	8	10		
8					
9					

(1)

(b) What is the probability that Josh's total score will be greater than 12?

.....

(2)

Josh's year group are raising money for a sponsored skydive.

60 students are each going to play Josh's card game once.
Each student pays 50p to play the game.

Josh pays £1.50 to any player getting a total of 8

(c) Show that Josh can expect to make a profit of £21 from his game.

(4)

(Total for Question is 7 marks)

Q3.

Ali throws a biased dice 200 times.

The table shows information about his results.

Score	Frequency
1	47
2	4
3	25
4	56
5	38
6	30

Charlie throws the dice 550 times.
Work out an estimate for the total number of times that Charlie will get a score of 4

.....

(Total for Question is 3 marks)

Q4.

There are only red counters, blue counters, white counters and black counters in a bag.

The table shows the probability that a counter taken at random from the bag will be red or blue.

Colour	red	blue	white	black
Probability	0.2	0.5		

The number of white counters in the bag is the same as the number of black counters in the bag.

Tania takes at random a counter from the bag.

(a) Work out the probability that Tania takes a white counter.

.....

(2)

There are 240 counters in the bag.

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

.....

(2)

(Total for Question is 4 marks)

Q5.

Jane has a packet of seeds.
The probability that a seed will grow is 0.75
(a) What is the probability that a seed will **not** grow?

.....

(1)

Jane plants 200 of these seeds.
(b) Estimate the number of the seeds that will grow.

.....

(2)

(Total for Question is 3 marks)

Q6.

Four friends each throw a biased coin a number of times.
The table shows the number of heads and the number of tails each friend got.

	Ben	Helen	Paul	Sharif
heads	34	66	80	120
tails	8	12	40	40

The coin is to be thrown one more time.

(a) Which of the four friends' results will give the best estimate for the probability that the coin will land heads?
Justify your answer.

.....

.....

.....

(1)

Paul says,

"With this coin you are twice as likely to get heads as to get tails."

(b) Is Paul correct?
Justify your answer.

.....

.....

.....

(2)

The coin is to be thrown twice.

(c) Use all the results in the table to work out an estimate for the probability that the coin will land heads both times.

.....

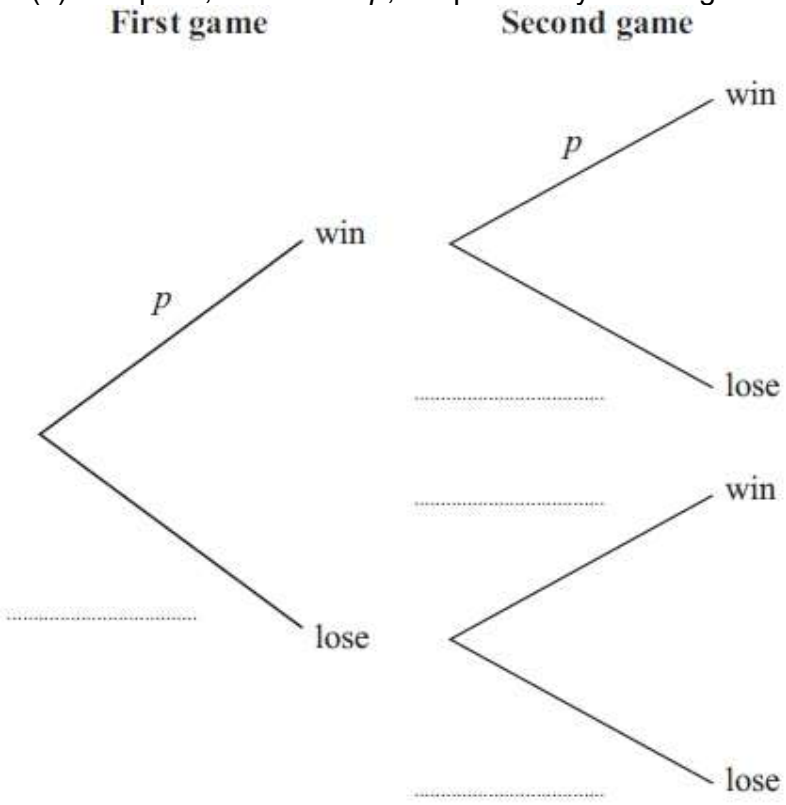
(2)

(Total for question is 5 marks)

Q7.

The probability that Rebecca will win any game of snooker is p.
She plays two games of snooker.

(a) Complete, in terms of p, the probability tree diagram.



(2)

(b) Write down an expression, in terms of p, for the probability that Rebecca will win both games.

.....

(1)

(c) Write down an expression, in terms of p, for the probability that Rebecca will win exactly one of the games.

.....

(2)

(Total for Question is 5 marks)

Q8.

Isobel plays a game against Eric.

Isobel is twice as likely as Eric to win the game.
The probability that the game is drawn is 0.1

(a) Work out the probability that Eric wins the game.

. . . . . .

(2)

Isobel and Eric play the game three times.

(b) Work out the probability that all three games are drawn.

. . . . . .

(2)

(c) Work out the probability that Eric wins at least one of the three games.

. . . . . .

(3)

(Total for Question is 7 marks)

Q9.

The probability that Sanay is late for school tomorrow is 0.05
The probability that Jaden is late for school tomorrow is 0.15

Alfie says that the probability that Sanay and Jaden will both be late for school tomorrow
is 0.0075 because 0.05 × 0.15 = 0.0075

What assumption has Alfie made?

.....

.....

(Total for question = 1 mark)

Q10.

Lily and Anna take a test.

The probability that Lily will pass the test is 0.6

The probability that Anna will pass the test is 0.8

(a) Work out the probability that both of these girls fail the test.

.....

(3)

(b) Work out the probability that both of these girls pass the test or that both of these girls fail the test.

.....

(3)

(Total for Question is 6 marks)

Q11.

Thelma spins a biased coin twice.
The probability that it will come down heads both times is 0.09

Calculate the probability that it will come down tails both times.

.....

(Total for question is 3 marks)

Q12.

Fiza has 10 coins in a bag.
There are three £1 coins and seven 50 pence coins.

Fiza takes at random, 3 coins from the bag.

Work out the probability that she takes exactly £2.50

.....

(Total for Question is 4 marks)

Q13.

Sami asked 50 people which drinks they liked from tea, coffee and milk.

All 50 people like at least one of the drinks
19 people like all three drinks.
16 people like tea and coffee but do **not** like milk.
21 people like coffee and milk.
24 people like tea and milk.
40 people like coffee.
1 person likes only milk.

Sami selects at random one of the 50 people.

(a) Work out the probability that this person likes tea.

.....

(4)

(b) Given that the person selected at random from the 50 people likes tea, find the probability that this person also likes exactly one other drink.

.....

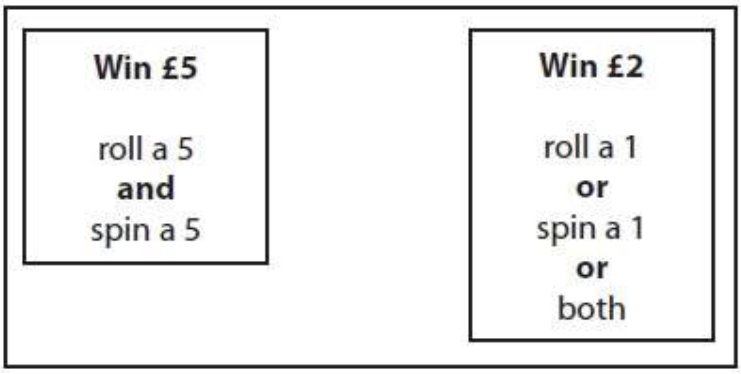
(2)

(Total for question = 6 marks)

Q14.

David has designed a game.
He uses a fair 6–sided dice and a fair 5–sided spinner.
The dice is numbered 1 to 6
The spinner is numbered 1 to 5

Each player rolls the dice once and spins the spinner once.
A player can win £5 or win £2



David expects 30 people will play his game.
Each person will pay David £1 to play the game.

(a) Work out how much profit David can expect to make.

£ .....

(4)

(b) Give a reason why David's actual profit may be different to the profit he expects to make.

.....

.....

(1)

(Total for question = 5 marks)

Name: _____

Higher Statistics

Date:

Time: 55 minutes

Total marks available: 51

Total marks achieved: _____

Questions

Q1.

***** Mr and Mrs Jennings are planning a holiday to Italy.

They will go on holiday with their 11 year old daughter.

The table below shows some information about the prices of flights.

Flight to Italy	%%%		**Flight to Italy**
Date	**Price per adult (£)**	**Date**	**Price per adult (£)**
28th October	282	4th November	305
29th October	283	5th November	303
30th October	282	6th November	285
31st October	272	7th November	283
Child fares	0 to 2 years old		No charge Over 2
to 12 years old	75% of the adult fare		

Mr and Mrs Jennings and their daughter want to fly to Italy on 29th October.
They want to fly back from Italy on 6th November.

They have £1600 to spend on flights.
Do they have enough money for the flights?

You must show all your working.

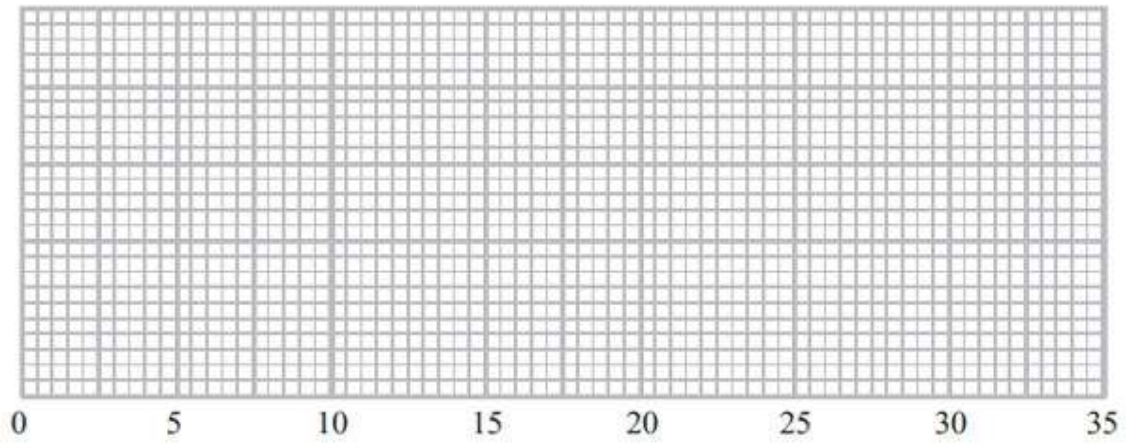
(Total for Question is 6 marks)

Q2.

The table below shows information about the times, in minutes, a group of students took to answer 10 maths questions.

	Least	Lower quartile	Median	Upper quartile	Greatest
Time in minutes	14	18	20	25	30

On the grid below, draw a box plot to show the information in the table.



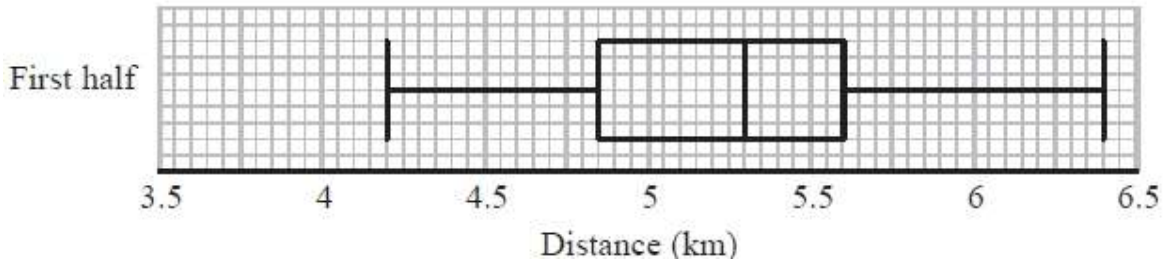
(Total for Question is 3 marks)

Q3.

Colin took a sample of 80 football players.

He recorded the total distance, in kilometres, each player ran in the first half of their matches on Saturday.

Colin drew this box plot for his results.



(a) Work out the interquartile range.

.....km

(2)

There were 80 players in Colin's sample.

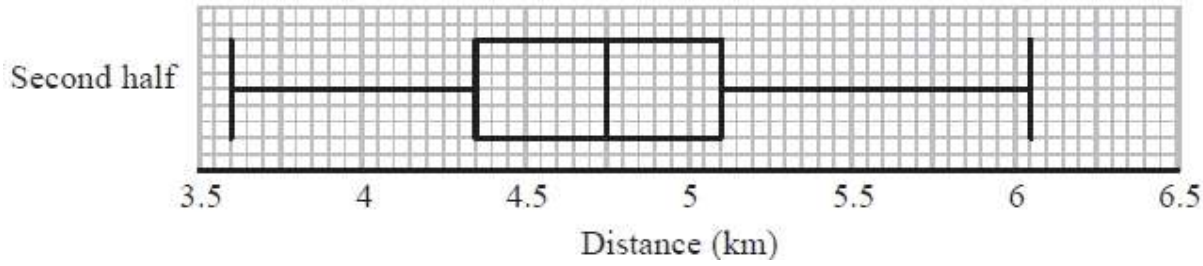
(b) Work out the number of players who ran a distance of more than 5.6 km.

.....

(2)

Colin also recorded the total distance each player ran in the second half of their matches.

He drew the box plot below for this information.



(c) Compare the distribution of the distances run in the first half with the distribution of the distances run in the second half.

.....

.....

.....

(2)

(Total for Question is 6 marks)

Q4.

* Toga wants to estimate the number of termites in a nest.

On Monday Toga catches 80 termites.
He puts a mark on each termite.
He then puts all 80 termites back in the nest.

On Tuesday Toga catches 60 termites.
12 of these termites have a mark on them.

Work out an estimate for the total number of termites in the nest.
You must write down any assumptions you have made.

.....

(Total for question = 4 marks)

Q5.

* A farmer wants to estimate the number of rabbits on his farm.

On Monday he catches 120 rabbits.
He puts a tag on each rabbit.
He then lets the rabbits run away.

On Tuesday the farmer catches 70 rabbits.
15 of these rabbits have a tag on them.

Work out an estimate for the total number of rabbits on the farm.
You must write down any assumptions you have made.

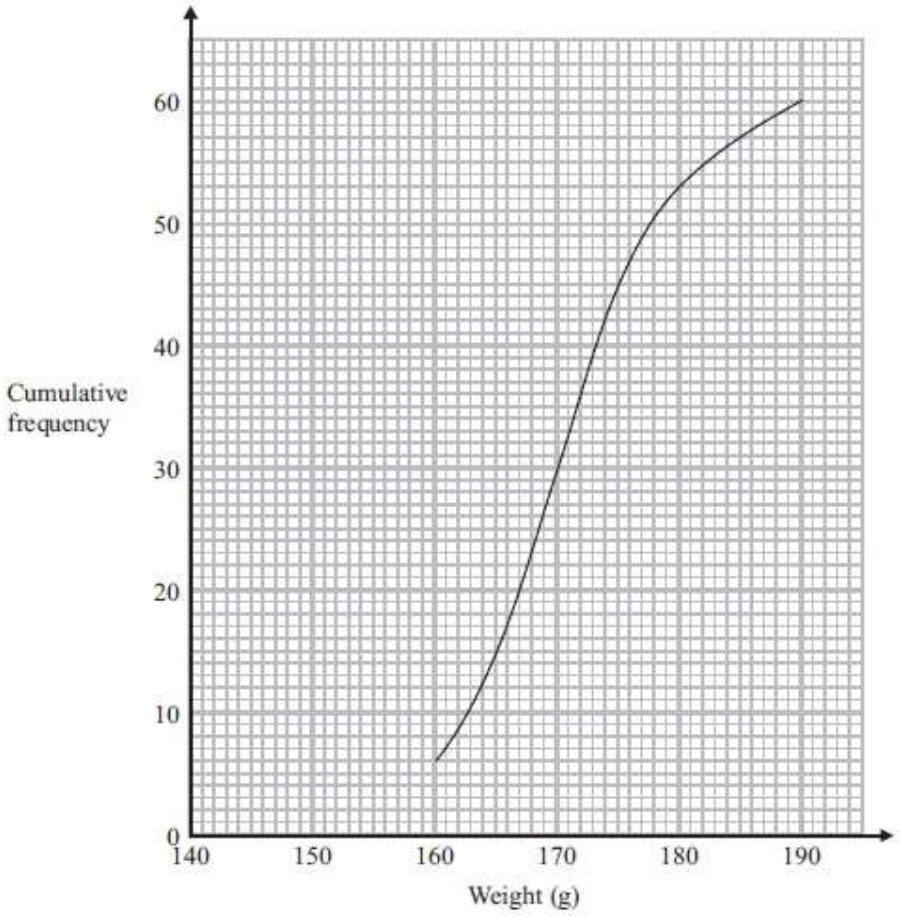
(Total for Question is 4 marks)

Q6.

Harry grows tomatoes.
This year he put his tomato plants into two groups, group A and group B.

Harry gave fertiliser to the tomato plants in group A.
He did not give fertiliser to the tomato plants in group B.

Harry weighed 60 tomatoes from group A.
The cumulative frequency graph shows some information about these weights.



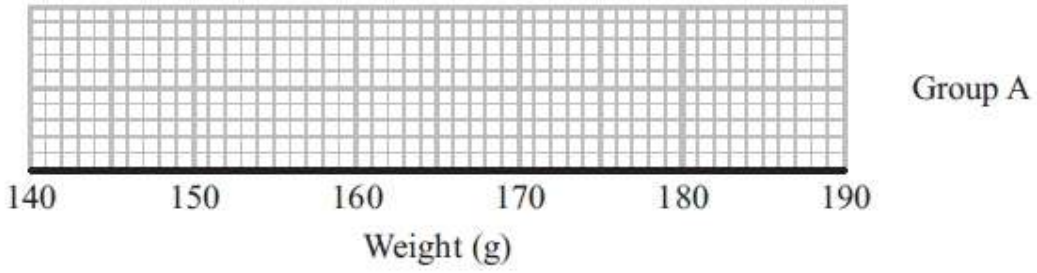
(a) Use the graph to find an estimate for the median weight.

. . . . . g

(1)

The 60 tomatoes from group A
had a minimum weight of 153 grams
and a maximum weight of 186 grams.

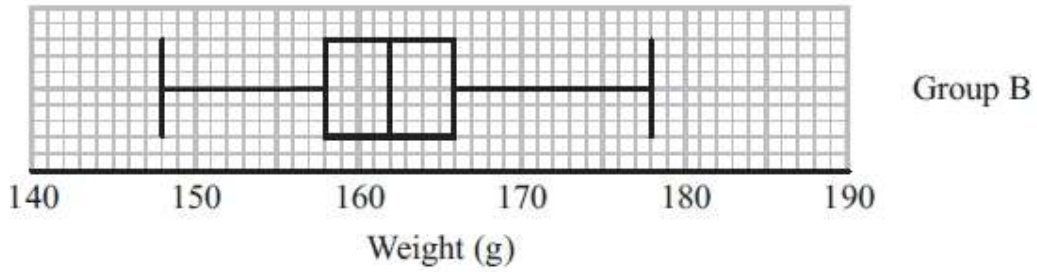
(b) Use this information and the cumulative frequency graph to draw a box plot for the 60 tomatoes from group A.



(3)

Harry did not give fertiliser to the tomato plants in group B.

Harry weighed 60 tomatoes from group B.
He drew this box plot for his results.



(c) Compare the distribution of the weights of the tomatoes from group A with the distribution of the weights of the tomatoes from group B.

.....

.....

.....

.....

(2)

(Total for Question is 6 marks)

Q7.

The table shows some information about the times, in minutes, 60 people took to get to work.

Time (x minutes)	Frequency		
$0 < x \leqslant 10$	5		
$10 < x \leqslant 30$	11		
$30 < x \leqslant 50$	23		
$50 < x \leqslant 80$	13		
$80 < x \leqslant 100$	8		

(a) Calculate an estimate for the mean.

.....minutes

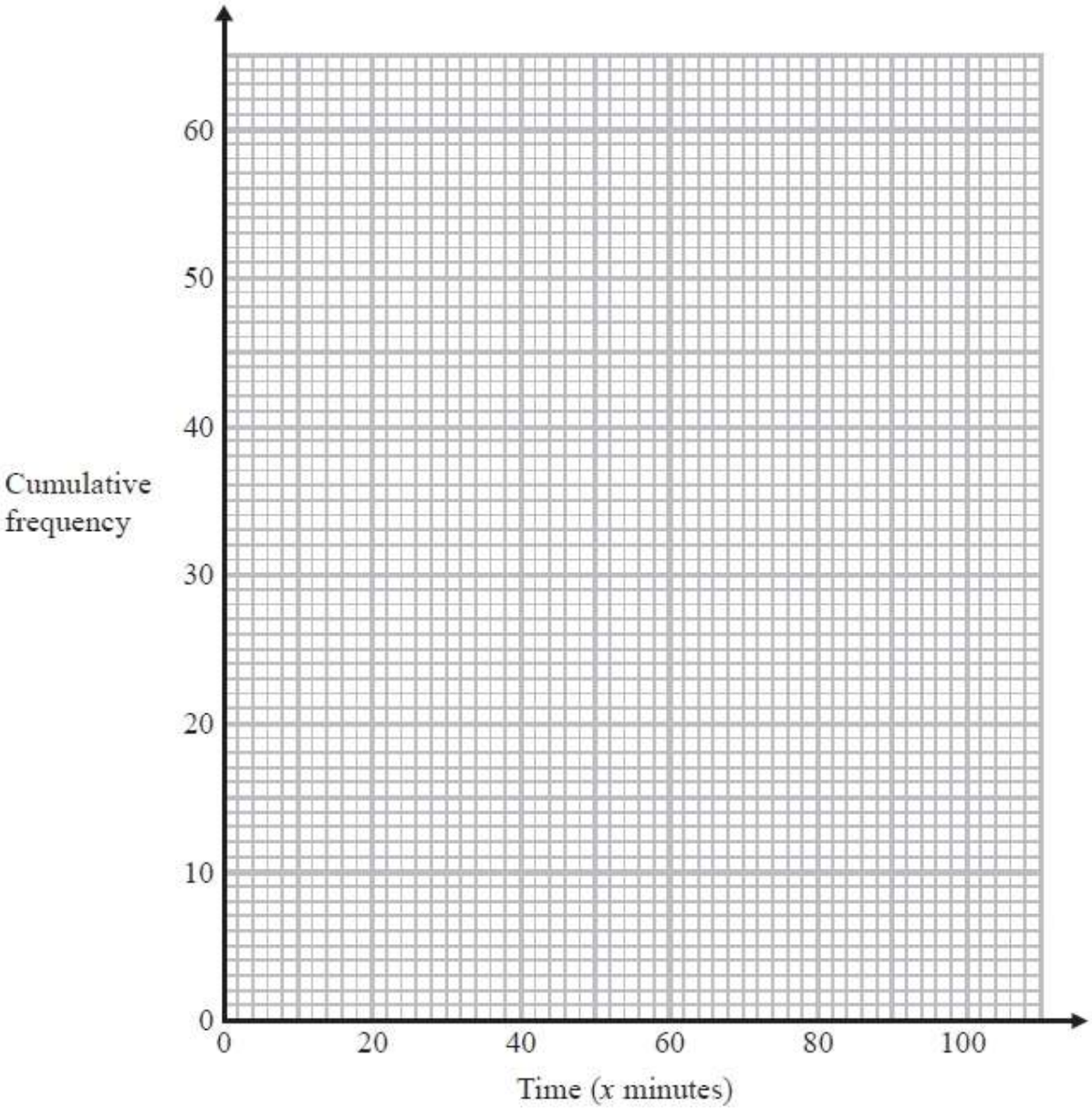
(4)

(b) Complete the cumulative frequency table.

Time (x minutes)	Cumulative frequency
$0 < x \leqslant 10$	
$0 < x \leqslant 30$	
$0 < x \leqslant 50$	
$0 < x \leqslant 80$	
$0 < x \leqslant 100$	

(1)

(c) On the grid draw a cumulative frequency graph for your table.



(2)

(d) Find an estimate for the number of people who took **more** than 1 hour to travel to work.

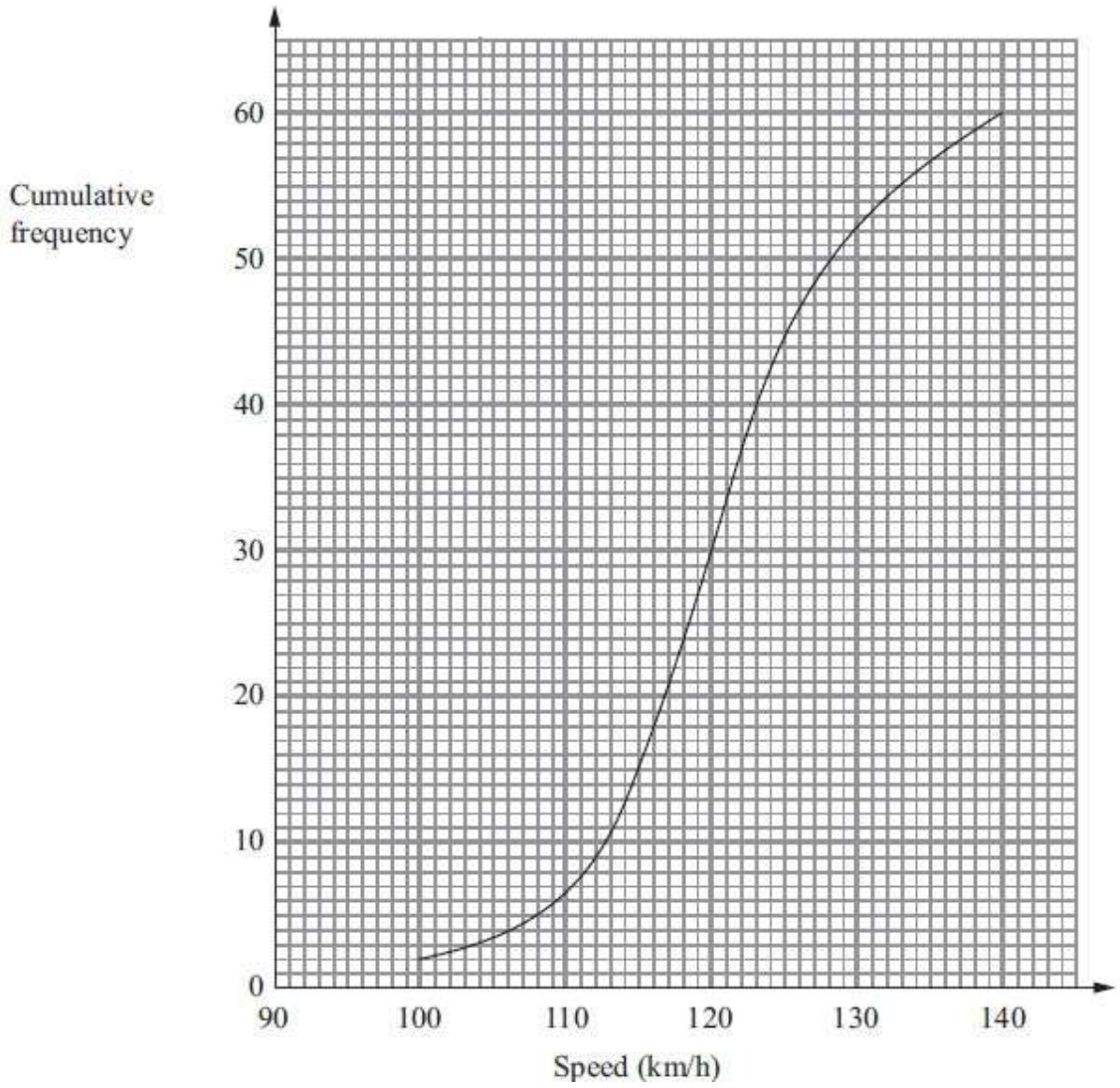
.....

(2)

(Total for Question is 9 marks)

Q8.

The cumulative frequency graph shows information about the speeds of 60 cars on a motorway one Sunday morning.



(a) Use the graph to find an estimate for the median speed.

. . . . . km/h

(1)

The speed limit on this motorway is 130 km/h.
The traffic police say that more than 20% of cars travelling on the motorway break the speed limit.

(b) Comment on what the traffic police say.

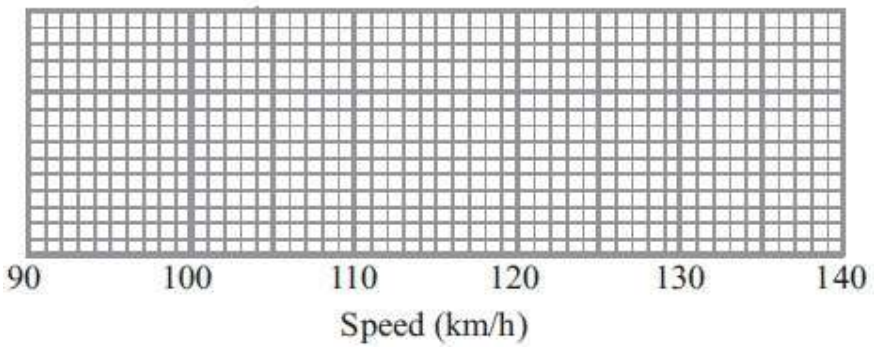
(3)

For these 60 cars

the minimum speed was 97 km/h
and the maximum speed was 138 km/h.

(c) Use the cumulative frequency graph and the information above to draw a box plot showing information about the speeds of the cars.

(3)



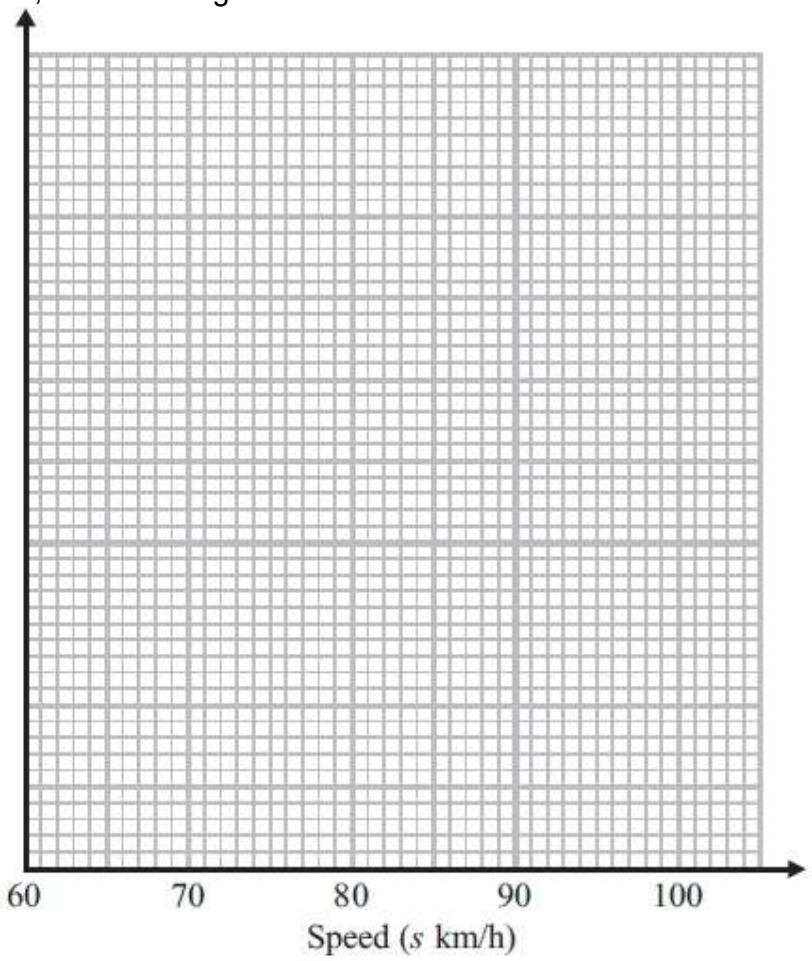
(Total for Question is 7 marks)

Q9.

The table gives some information about the speeds, in km/h, of 100 cars.

Speed (s km/h)	Frequency
$60 < s \leq 65$	15
$65 < s \leq 70$	25
$70 < s \leq 80$	36
$80 < s \leq 100$	24

(a) On the grid, draw a histogram for the information in the table.



(3)

(b) Work out an estimate for the number of cars with a speed of more than 85 km/h.

.....

(2)

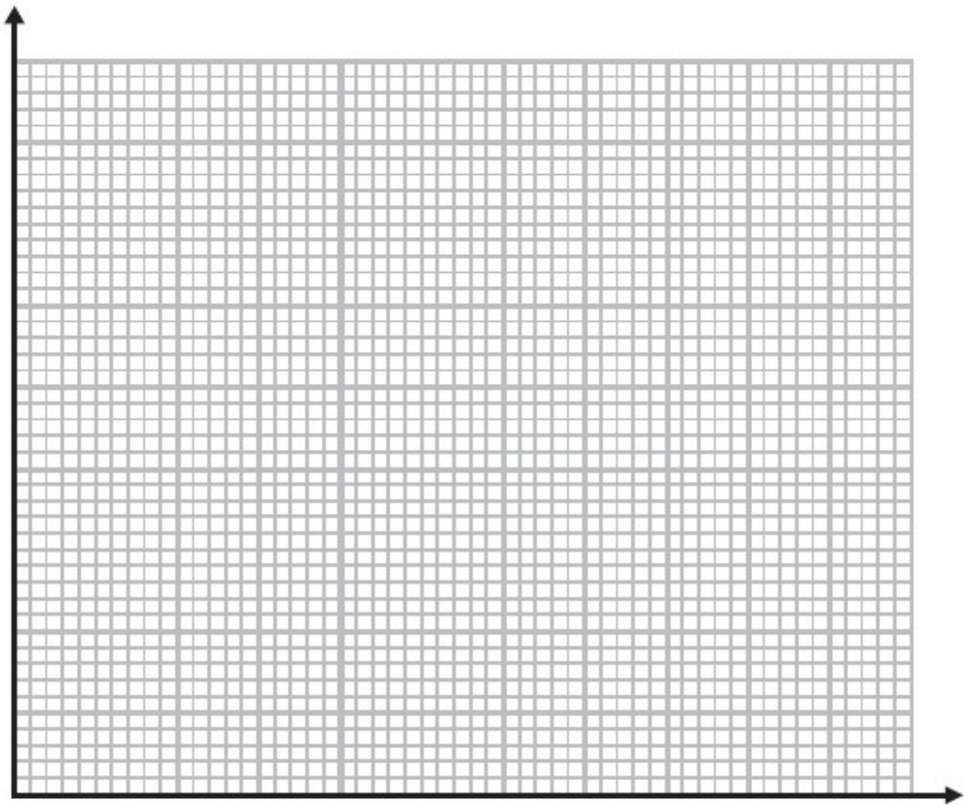
(Total for Question is 5 marks)

Q10.

The table shows some information about the total rainfall, in millimetres, recorded at 85 weather stations one month.

Rainfall (mm)	Frequency
$0 < x \leqslant 20$	16
$20 < x \leqslant 30$	27
$30 < x \leqslant 45$	36
$45 < x \leqslant 50$	6

(a) Draw a histogram for this information.



(3)

(b) One of the weather stations is selected at random.
Work out the probability that the rainfall recorded was over 40 mm.

.....

(3)

(Total for Question is 6 marks)

Name: _____

Higher Algebra

Date:

Time: 60 minutes

Total marks available: 51

Total marks achieved: _____

Questions

Q1.

Rationalise the denominator $\frac{3}{\sqrt{7}}$

. . . . . .

(Total for Question is 2 marks)

Q2.

Simplify $\frac{x+1}{2} + \frac{x+3}{3}$

.....

(Total for Question is 3 marks)

Q3.

Simplify fully $\frac{4}{2-x} - \frac{3}{x}$

.....

(Total for question = 3 marks)

Q4.

$m = \sqrt{\frac{k^3 + 1}{4}}$

Make *k* the subject of the formula.

.....

(Total for question is 3 marks)

Q5.

Write $\frac{3}{b} + \frac{2}{a-b}$ as a single fraction in its simplest form.

.....

(Total for Question is 3 marks)

Q6.

Simplify fully $\dfrac{3x^2 - 6x}{x^2 + 2x - 8}$

.....

(Total for Question is 3 marks)

Q7.

Write $(5 - \sqrt{5})^2$ in the form $a + b\sqrt{5}$, where a and b are integers.

.....

(Total for Question is 2 marks)

Q8.

Rationalise the denominator of $\frac{(6-\sqrt{5})(6+\sqrt{5})}{\sqrt{31}}$

Give your answer in its simplest form.

.....

(Total for Question is 3 marks)

Q9.

Show that $\dfrac{1}{1+\dfrac{1}{\sqrt{2}}}$ can be written as $2 - \sqrt{2}$

(Total for question = 3 marks)

Q10.

(a) Rationalise the denominator of $\frac{5}{\sqrt{2}}$

.....

(2)

(b) Expand and simplify $(2+\sqrt{3})^2-(2-\sqrt{3})^2$

.....

(2)

(Total for Question is 4 marks)

Q11.

***** Prove algebraically that the difference between the squares of any two consecutive integers is equal to the sum of these two integers.

(Total for Question is 4 marks)

Q12.

Prove that

$(2n + 3)^2 - (2n - 3)^2$ is a multiple of 8

for all positive integer values of n.

(Total for Question is 3 marks)

Q13.

Show that $\frac{3x + 6}{x^2 - 3x - 10} \div \frac{x + 5}{x^3 - 25x}$ simplifies to ax where a is an integer.

(Total for question = 4 marks)

Q14.

Solve $\frac{x+2}{3x} + \frac{x-2}{2x} = 3$

x = ...

(Total for question is 3 marks)

Q15.

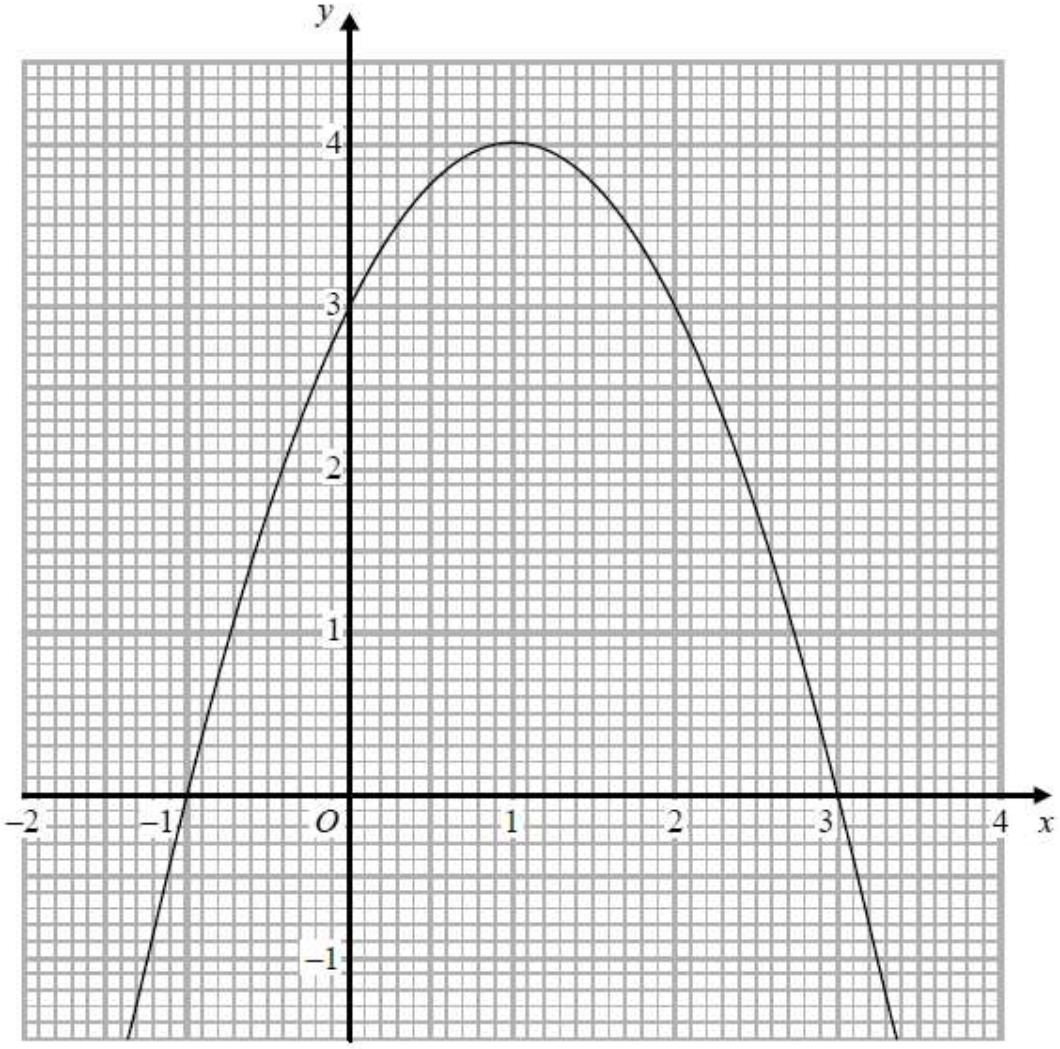
Solve $\frac{4x-1}{5} + \frac{x+4}{2} = 3$

x = ...

(Total for Question is 3 marks)

Q16.

The graph of $y = f(x)$ is drawn on the grid.



(a) Write down the coordinates of the turning point of the graph.

(....., ...)

(1)

(b) Write down the roots of $f(x) = 2$

.....

(1)

(c) Write down the value of f(0.5)

.....

(1)

(Total for question = 3 marks)

Q17.

The function f is such that

$$f(x) = 4x - 1$$

(a) Find $f^{-1}(x)$

$f^{-1}(x) =$ .....

(2)

The function g is such that

$$g(x) = kx^2 \text{ where } k \text{ is a constant.}$$

Given that fg(2) = 12

(b) work out the value of k

$k =$ .....

(2)

(Total for question = 4 marks)