

PRIFYSGOL CYMRU

Y Drindod Dewi Sant

UNIVERSITY OF WALES

Trinity Saint David

FOLD → Complete section, remove strip, fold as indicated and SEAL

Examination Answer Book

24 Pages

Instructions to candidates

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right and seal to hide your name.
3. The answers must be **legibly** written. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. **Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.**

1	Student Number	P148970
2	Title of Examination Paper	ADS
3	Module Code	M5X0623
4	Date and Time of Examination	1/2/2018 11:18
5	Examination Venue	MH312
6	Seat Number	

7	Number of Answer Books handed in	
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[illegible]

Please complete this section and SEAL before the examination starts.

(Block Capitals) Forename(s) RUAIDHRI

Surname: COOK

PULL & TEAR

FOR ADMINISTRATIVE USE ONLY, CAREFULLY REMOVE PERFORATED STRIP

testArray1 - 5000 Elements

Avg Elapsed Time aFunc3 - ~~691.98~~ ✓
aFunc2 - ~~62.83~~ ✓
aFunc1 - ~~13.68~~ ✓
Main - ~~768.41~~ ✓

testArray2 - 10,000 Elements

Avg Elapsed Time aFunc3 - ~~2,676.19~~ ✓
aFunc2 - ~~57.63~~ ✓
aFunc1 - ~~26.94~~ ✓
Main - ~~2,760.82~~ ✓

testArray3 - 15,000 Elements

Avg Elapsed Time aFunc3 - ~~5,965.79~~ ✓
aFunc2 - ~~59.25~~ ✓
aFunc1 - ~~38.72~~ ✓
Main - ~~6,063.76~~ ✓

testArray4 - 20,000 Elements

Avg Elapsed Time aFunc3 - ~~10,577.66~~ ✓
aFunc2 - ~~57.38~~ ✓
aFunc1 - ~~55.84~~ ✓
Main - ~~10,690.89~~ ?

testArray5 - 40,000 Elements

Avg Elapsed Time aFunc3 - ~~42,414.97~~ ✓
aFunc2 - ~~102.08~~ ✓
aFunc1 - 56.38 ✓ error
main - ~~42,573.44~~ ✓

↑ need to main timing

$\log N$ - time stays constant with slight

N - When size doubles, time doubles

$N \log N$ - When size doubles, time doubles with a bit extra

N^2 - Increases fourfold

2^N - Increases exponentially

Q1.

~~I believe aFunc3 is N^2 as the results seem to be increasing fourfold as the size doubles~~

~~I believe aFunc2 is $\log N$, this is because the average time seems to stay constant with a slight deviation on average time between each array.~~

I believe aFunc1

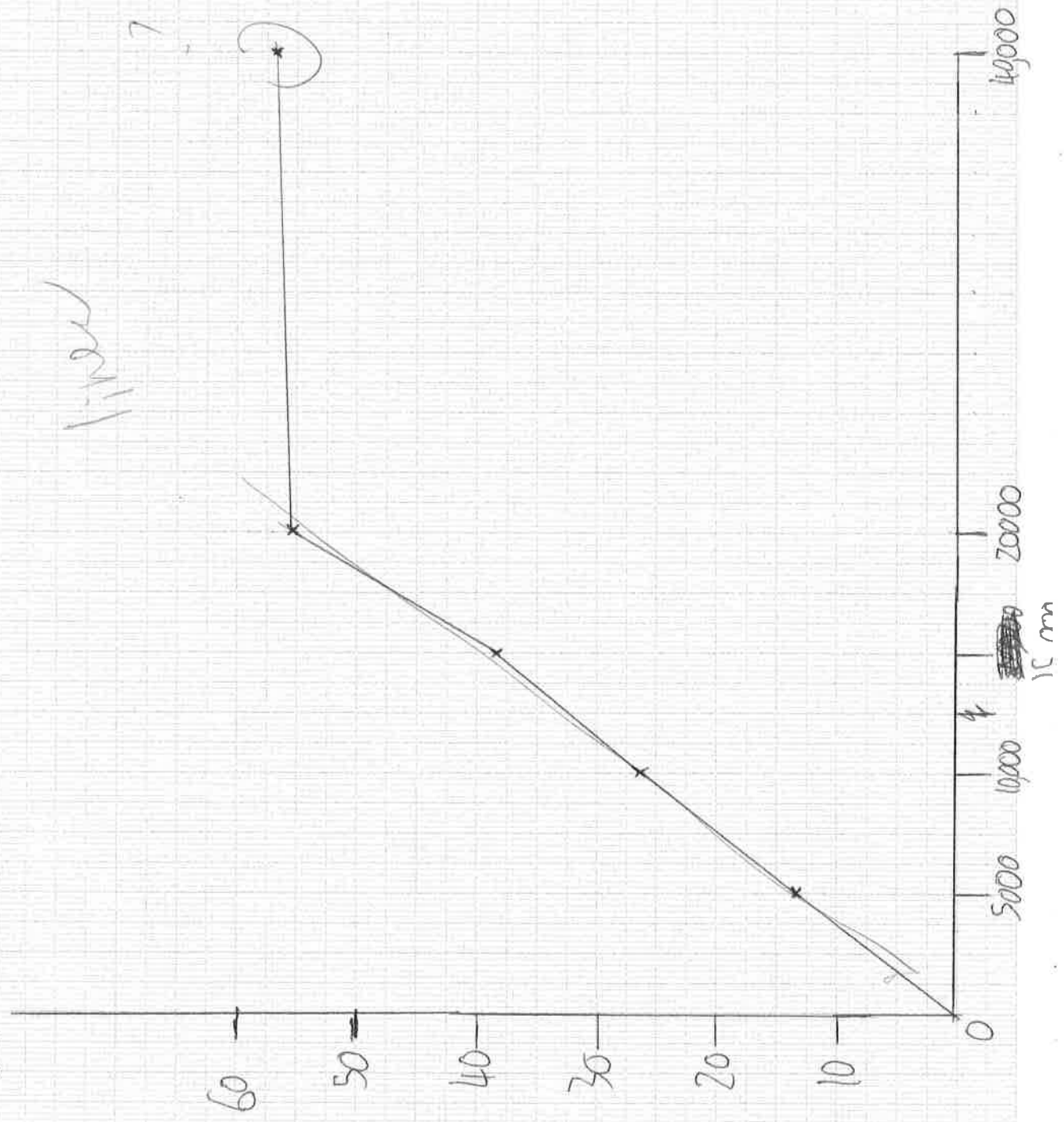
Q1.

Experiment. From the graph I can see that ~~as~~ as the ~~size~~ size doubles so does the time taken, ~~but with a slight increase~~ however the final ~~time~~ time only sees a minimal increase in time ~~and~~ and a plateau which leads me to believe divide and conquer is being used and the Big Oh notation is $N \log N$. N - does!

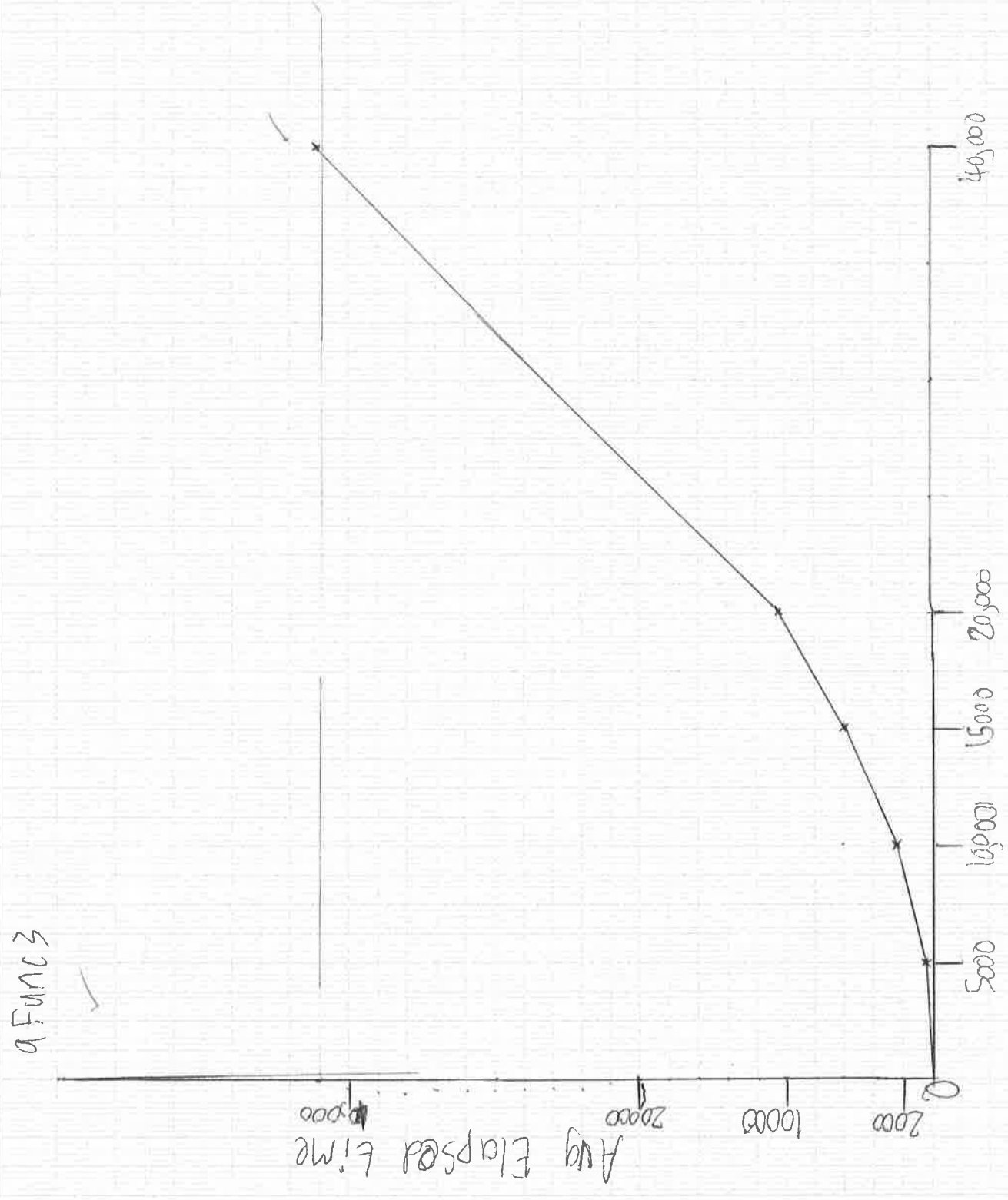
2.

Ruaidhri cook

a Func 1

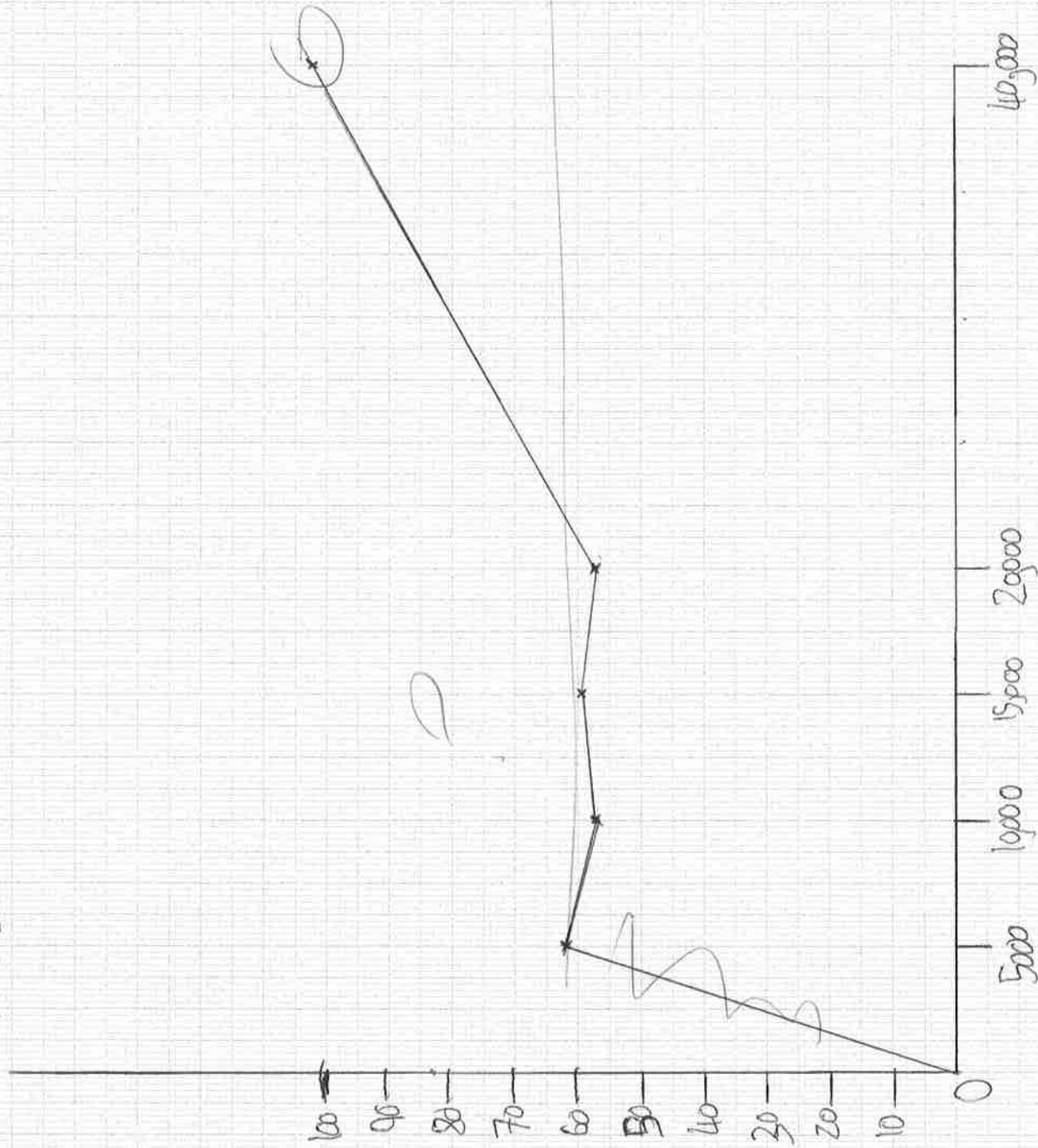


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d FURCZ



Experiment 2

I believe aFunc3 is N^2 as the results seem to be increasing by fourfold as the size doubles.

I believe aFunc2 is $\log N$, this is because the ~~avg~~ average time seems to stay constant with a slight deviation on Average Time between each Array.

const time.

$$\frac{18\frac{1}{2}}{25}$$

$$\frac{13\frac{1}{2}}{25}$$

Q3. Pre-order (left to right)

a. Pre-order:

First Node - A

~~A, C, E, E, R, R, E~~
A, C, E, E, H, R, R, E, T, S

Post-order:

First Node - T

T, R, H, R, E, E, C, A, E, S

In-order:

First Node - A

A, E, E, C, R, H, R, T, S

- b. The letter S would be inserted into the binary tree by assessing where it is in the alphabet. If it is after the node in the alphabet it will fork to the right side of the tree, however if it is before or the same letter in the alphabet it will fork left to the next node. So 'S' would first fork left as it is the same as 'S', it would then fork right as it is after 'E', it would then fork right again because it is after 'R', and there it would be inserted as the right branch of 'R'.

c. Continued on page 8.

Q3. $2\frac{1}{2}$ $10\frac{1}{2}$ $2\frac{1}{2}$ $10\frac{1}{2}$ $2\frac{1}{2}$

4. ~~Q.~~ Hashing is the allocation of a dynamic Set into a table, ~~using~~ ~~insert, delete~~
 how?

1/2
4

6.

0	
1	8
2	23
3	36 ✓
4	
5	
6	

6/6

7, 14, 21, 28, 35,

$$36 - 35 = 1$$

Remainder is 1

1 slot is filled, so the next slot must be tried

2 slot is filled, so the next slot must be tried

3 slot is empty so 36 goes in 3 slot

5.

C.

0	
1	8
2	~~23~~ 23
3	
4	
5	36
6	

$$(\text{hash}(k) + i^2) \bmod 7$$

remainder still 1

1 Slot filled so look

(1x1) slot ahead.

2 Slot filled so look

(2x2) slots ahead

5 slot not filled so

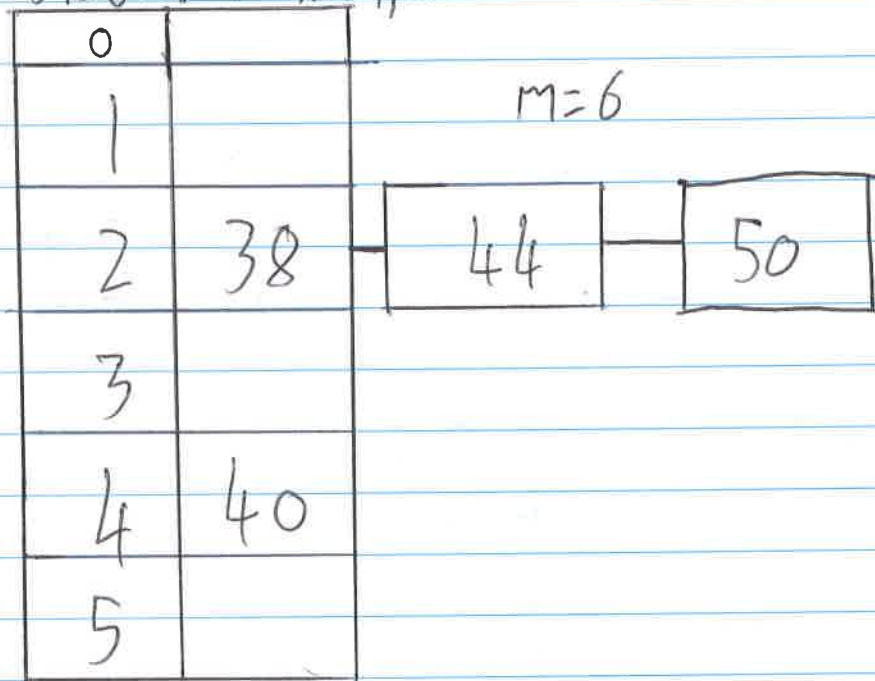
insert 36 here

~~1/2~~
1/8

This method is an improvement on the regular linear probing as it reduces clustering, ~~however~~ ~~quadratic~~ this is because the slots it inserts the values into are more eratic and spread out rather than sticking the value on the end of already existing clusters which is often the cause of big cluster forming. ~~Because adding values are often added to a slot separating two clusters.~~ Quadratic probing ~~significantly~~ significantly reduces the likelihood of this by having the value inserted a squared number of slots away from the occupied slot.

6.

Separate chaining differs from closed hashing as it will ~~avoid~~ avoid collision by chaining values in the same slot. For example:



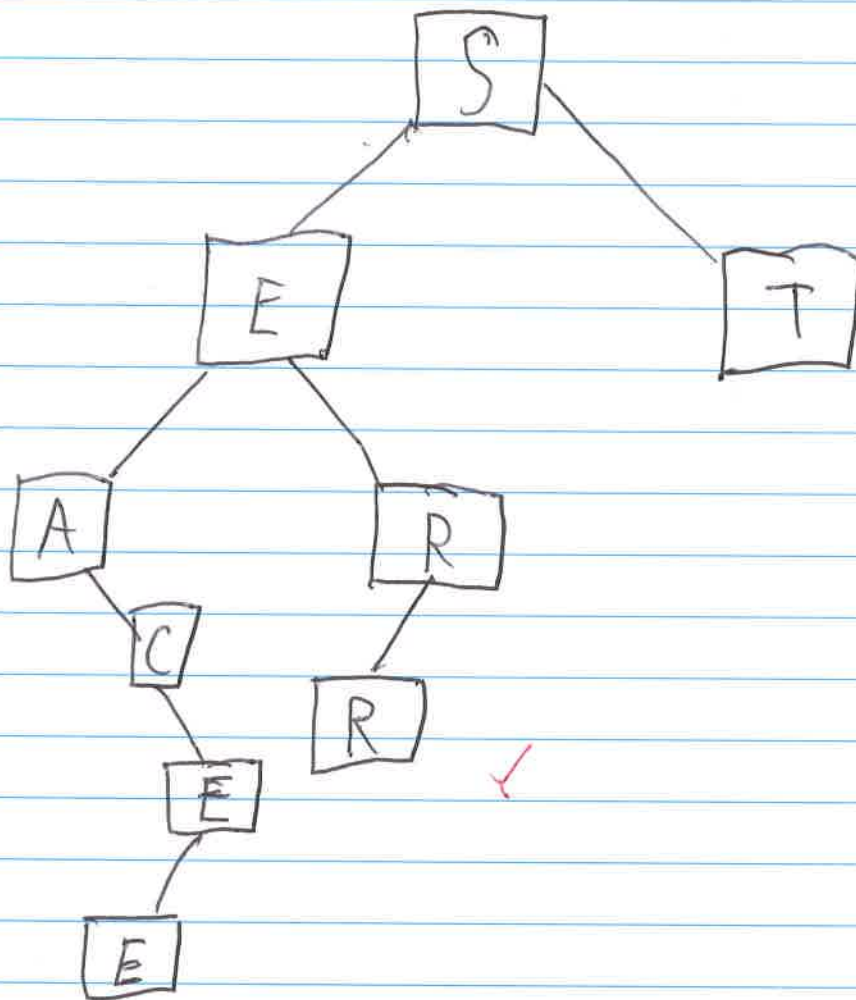
This can be advantageous as it will avoid clustering, however it is essentially putting the values into a list which will make it slow when searching/sorting through the data. ~~with this said it would cause the data to be searched through at the~~ Big oh notation rate of $\log N$ meaning the time stays almost constant. $O(N)$

$$\frac{21}{25}$$

$$\frac{21^2}{25^2}$$

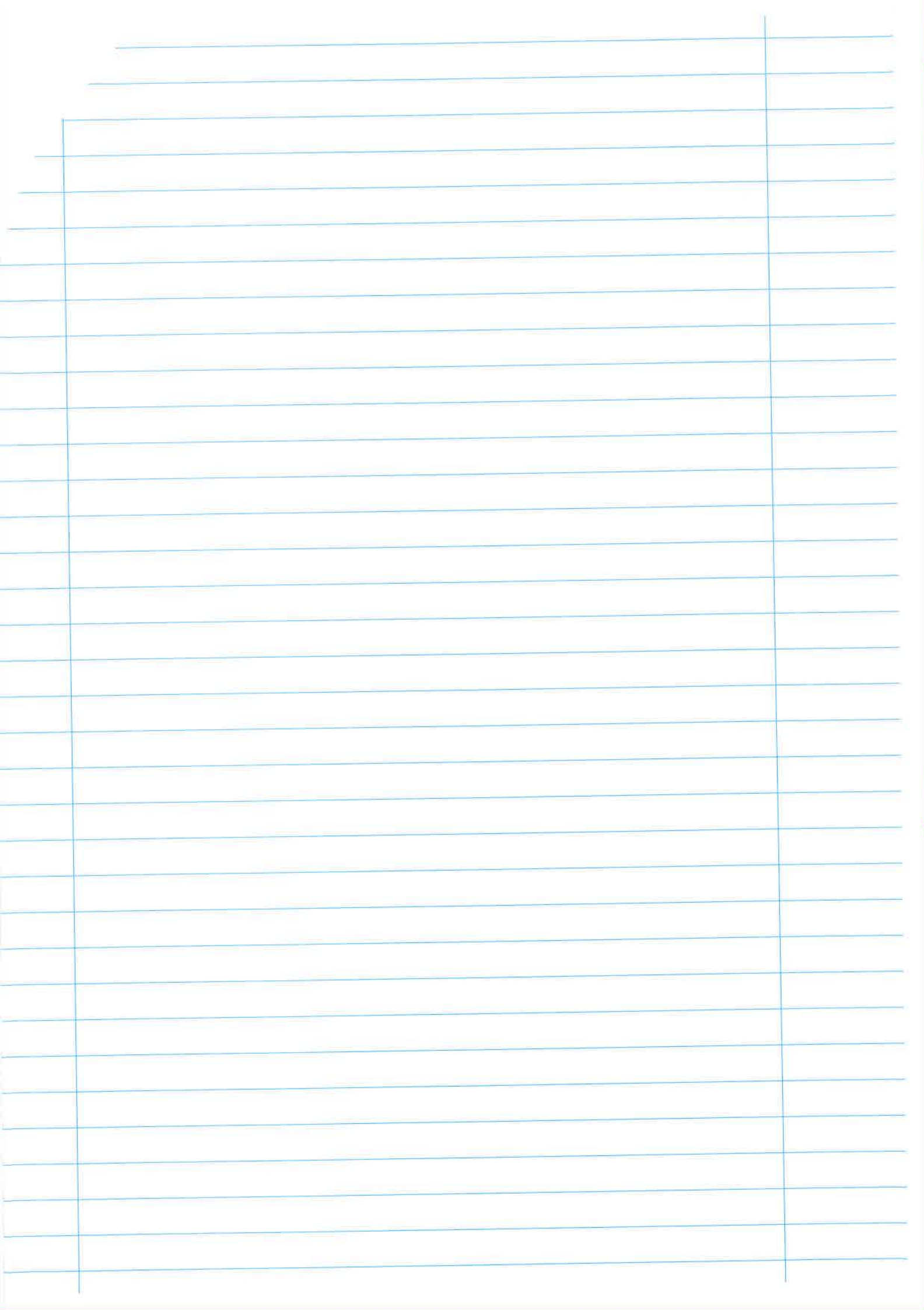
7.

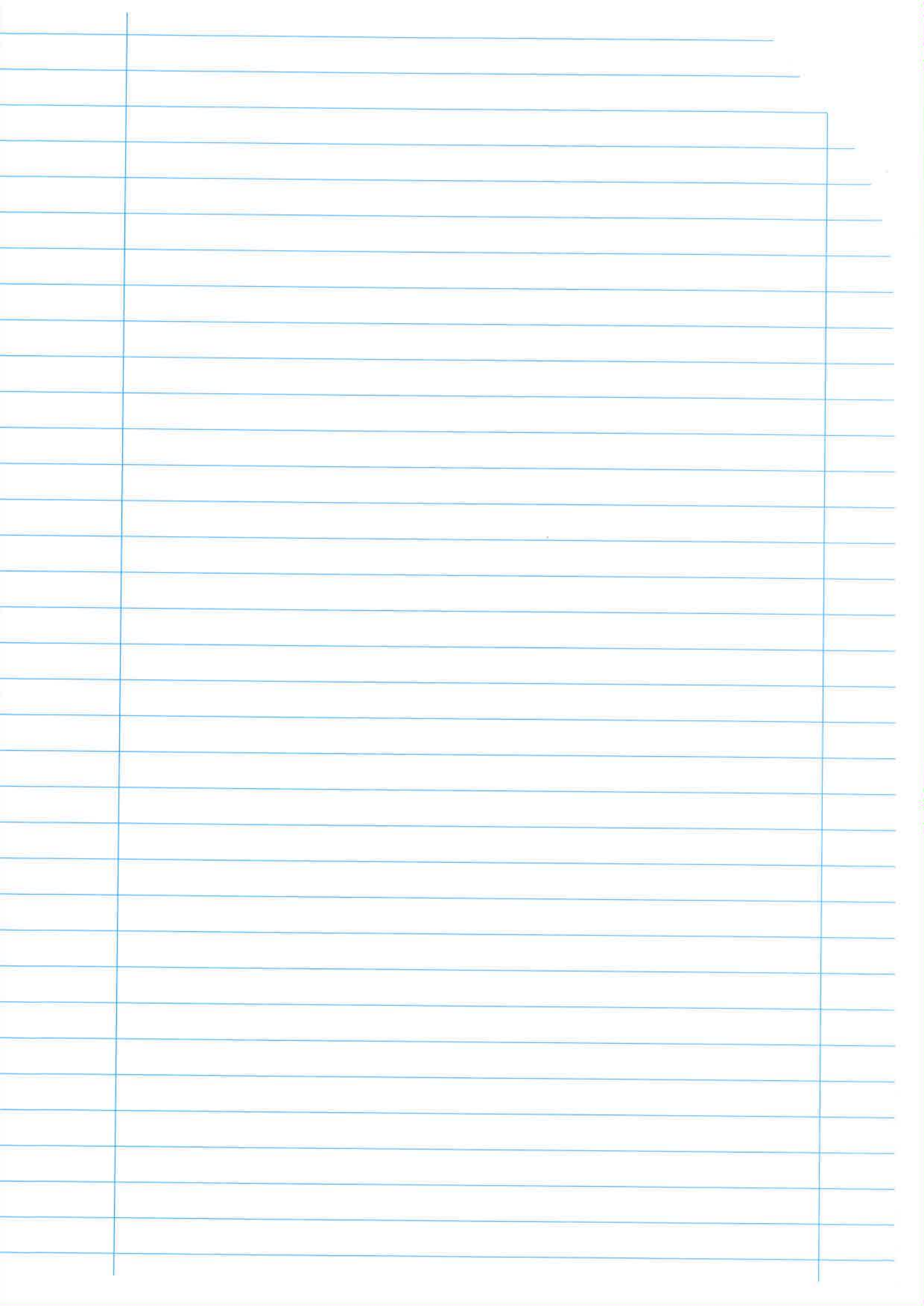
Q3
C.

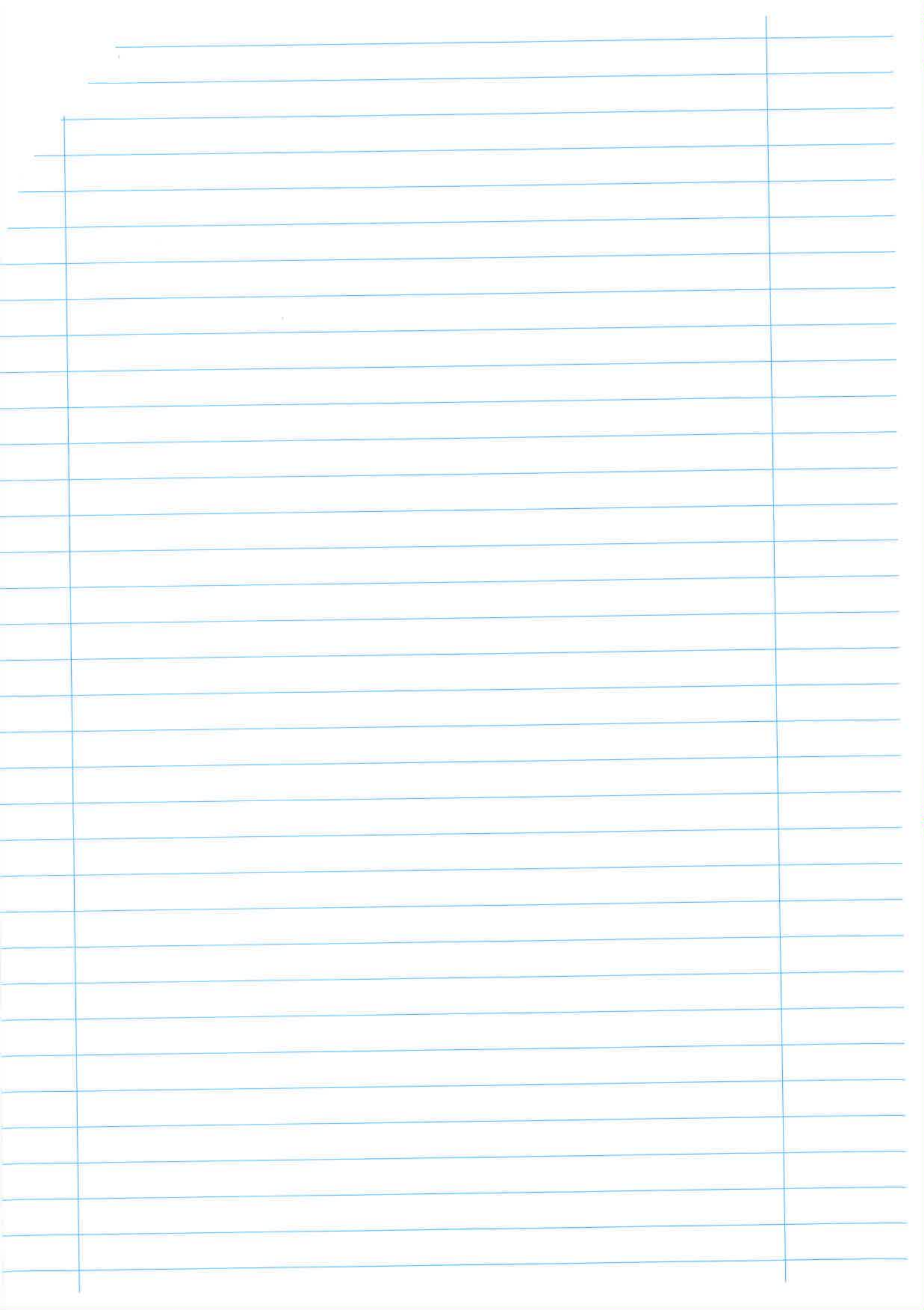


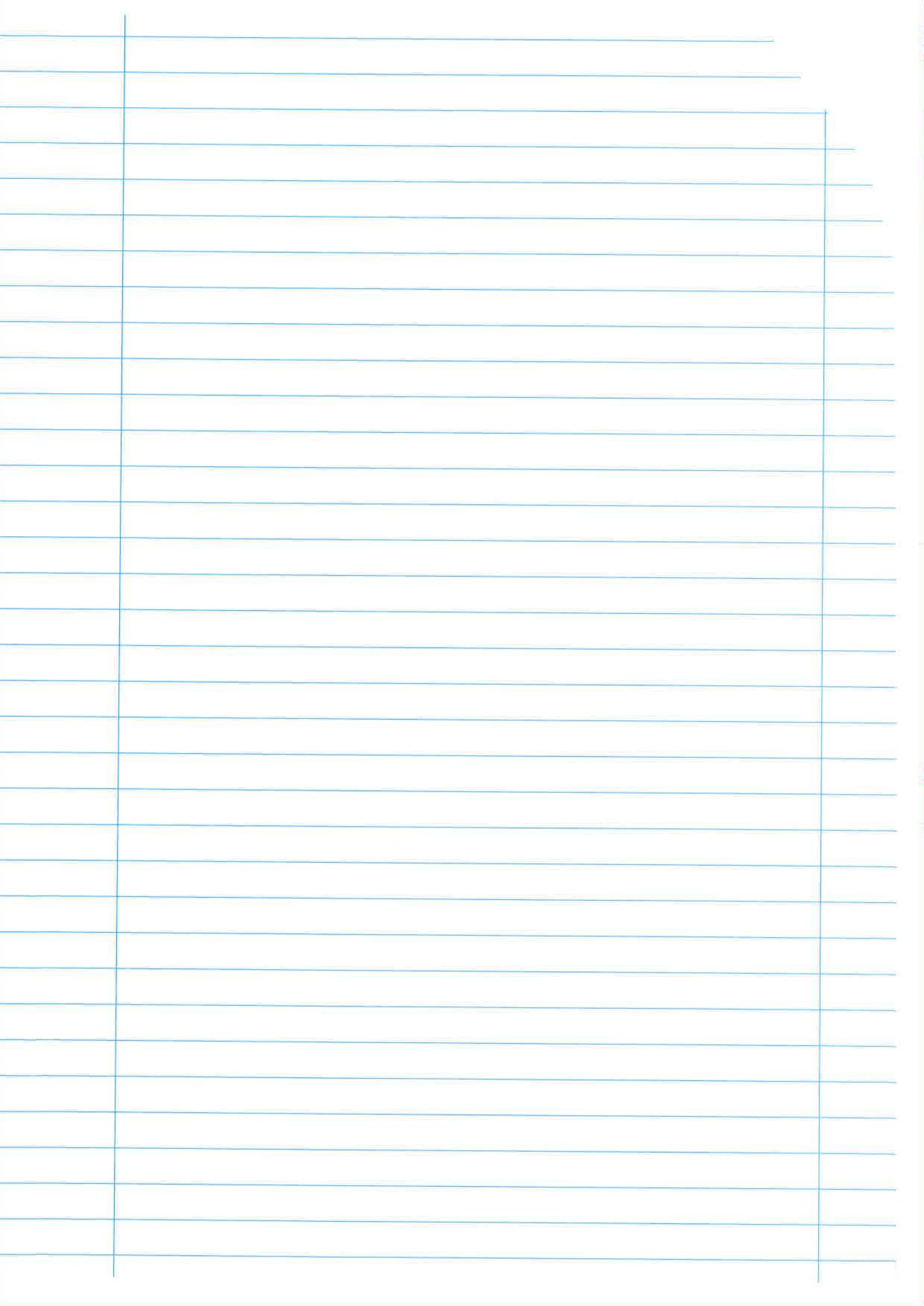
The letter H would be removed by decoupling its ~~node~~ node from the main tree (R) and decoupling the 'R' node ~~as well as~~ from its right branch. The A node would then be coupled to the main tree as a left branch of 'R'.

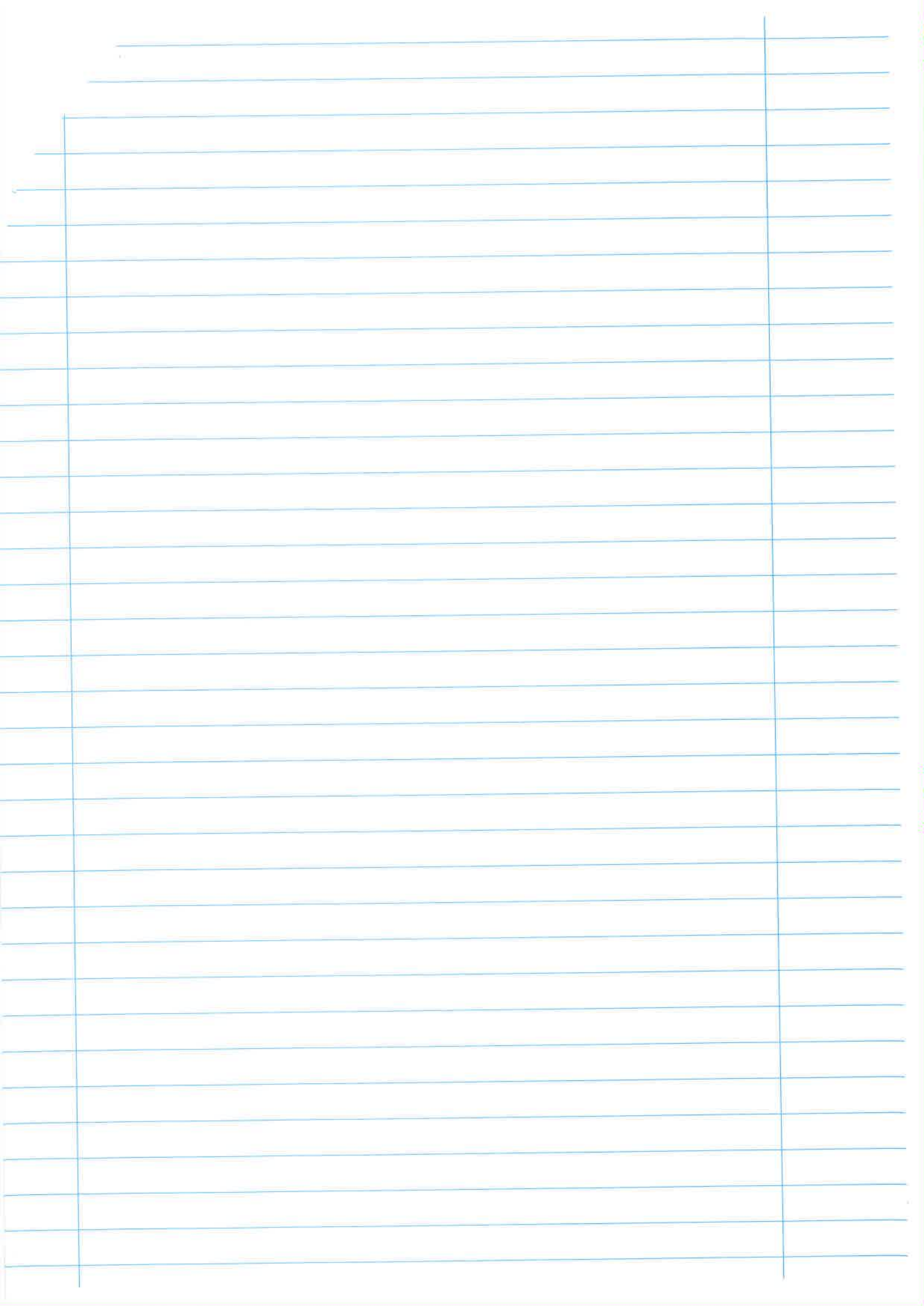
explain in
more detail 2/4
the method.

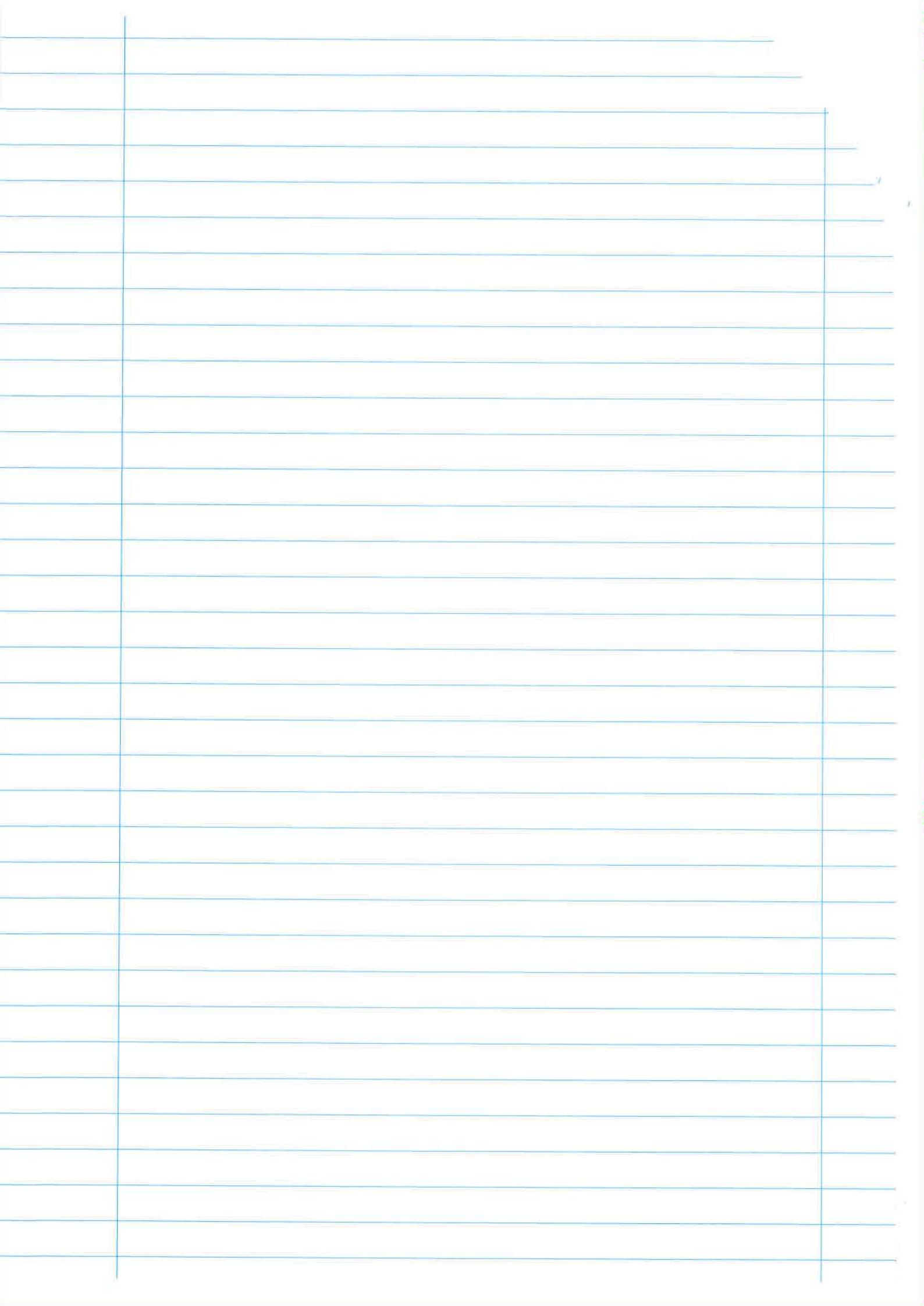


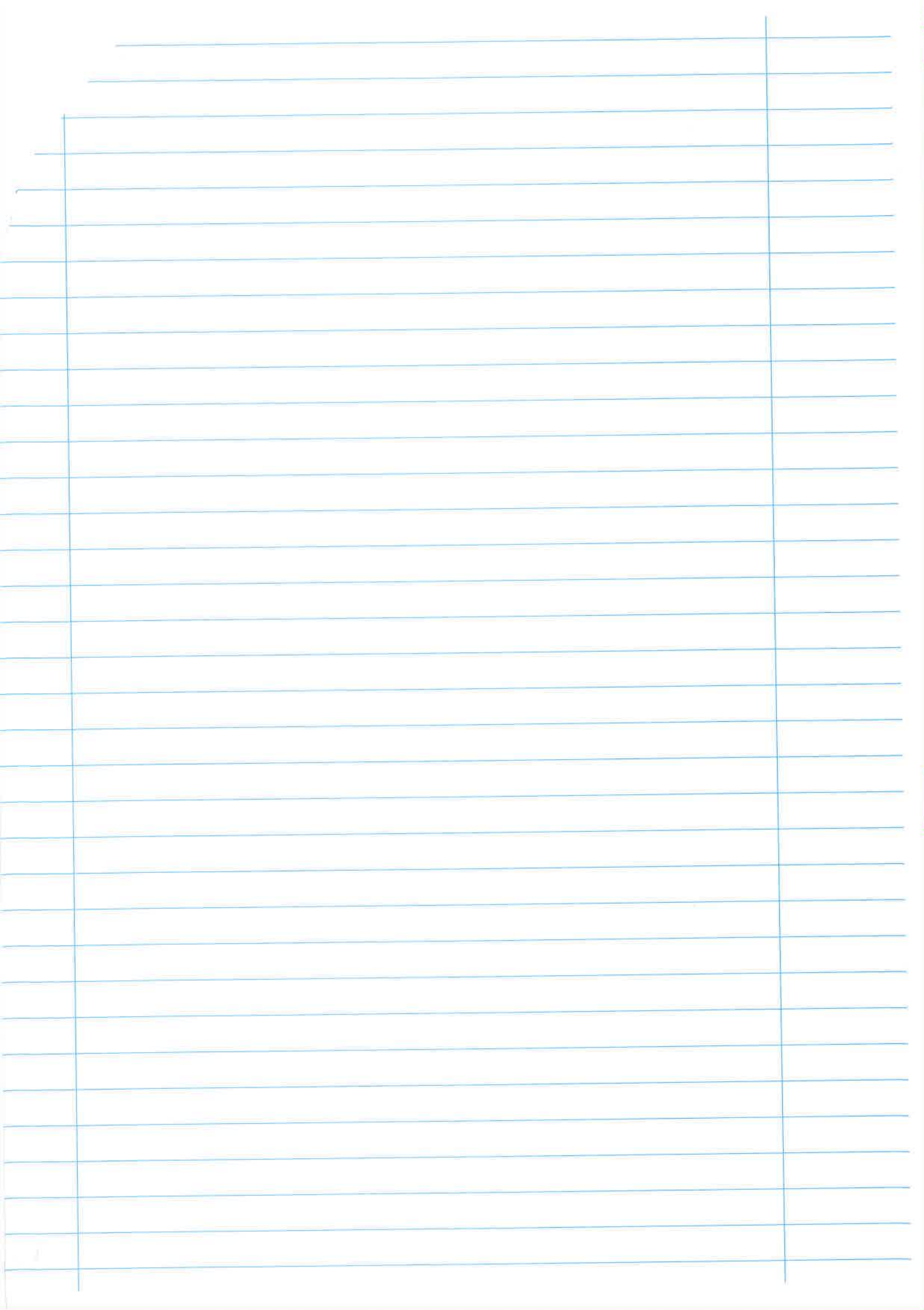


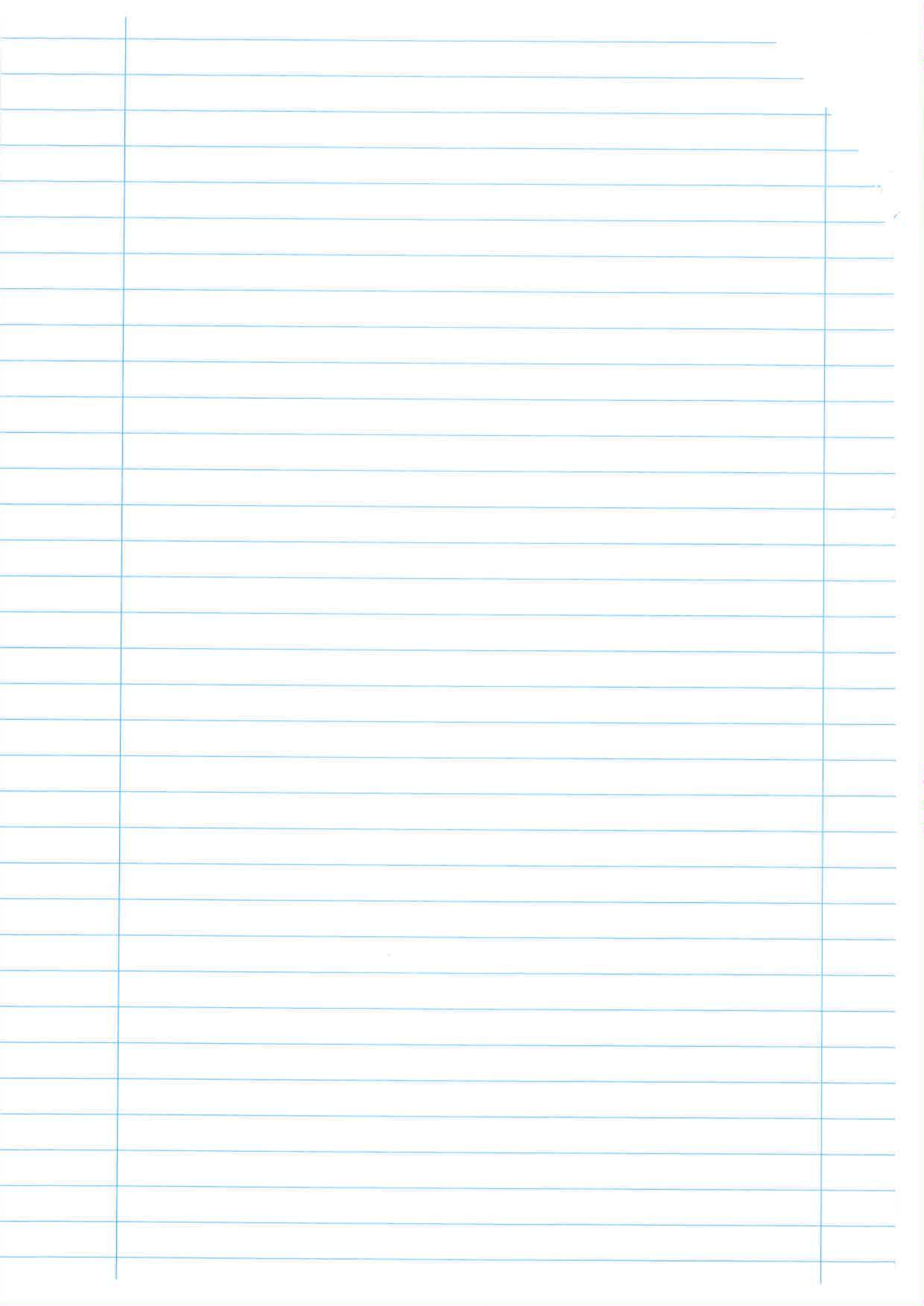


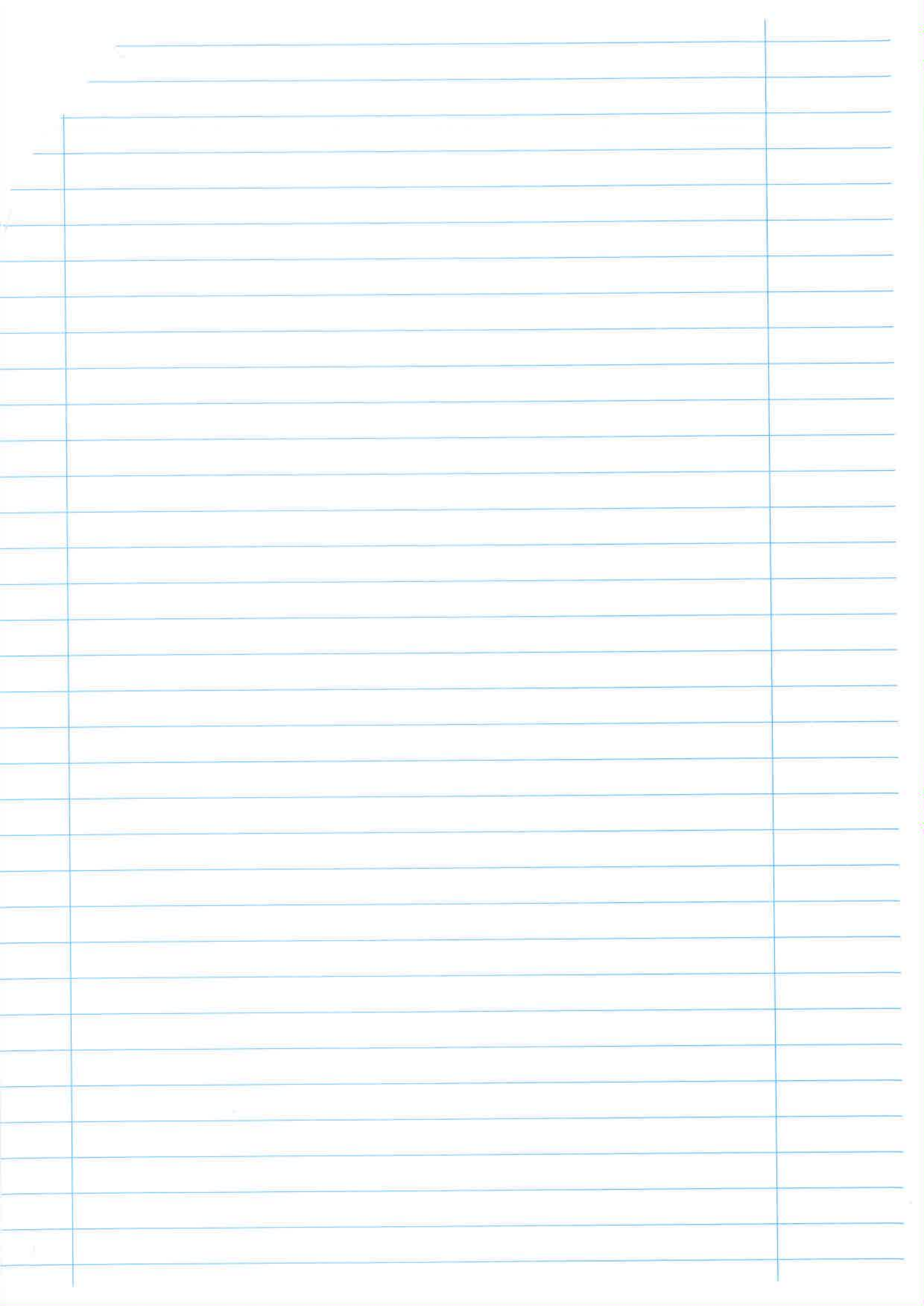


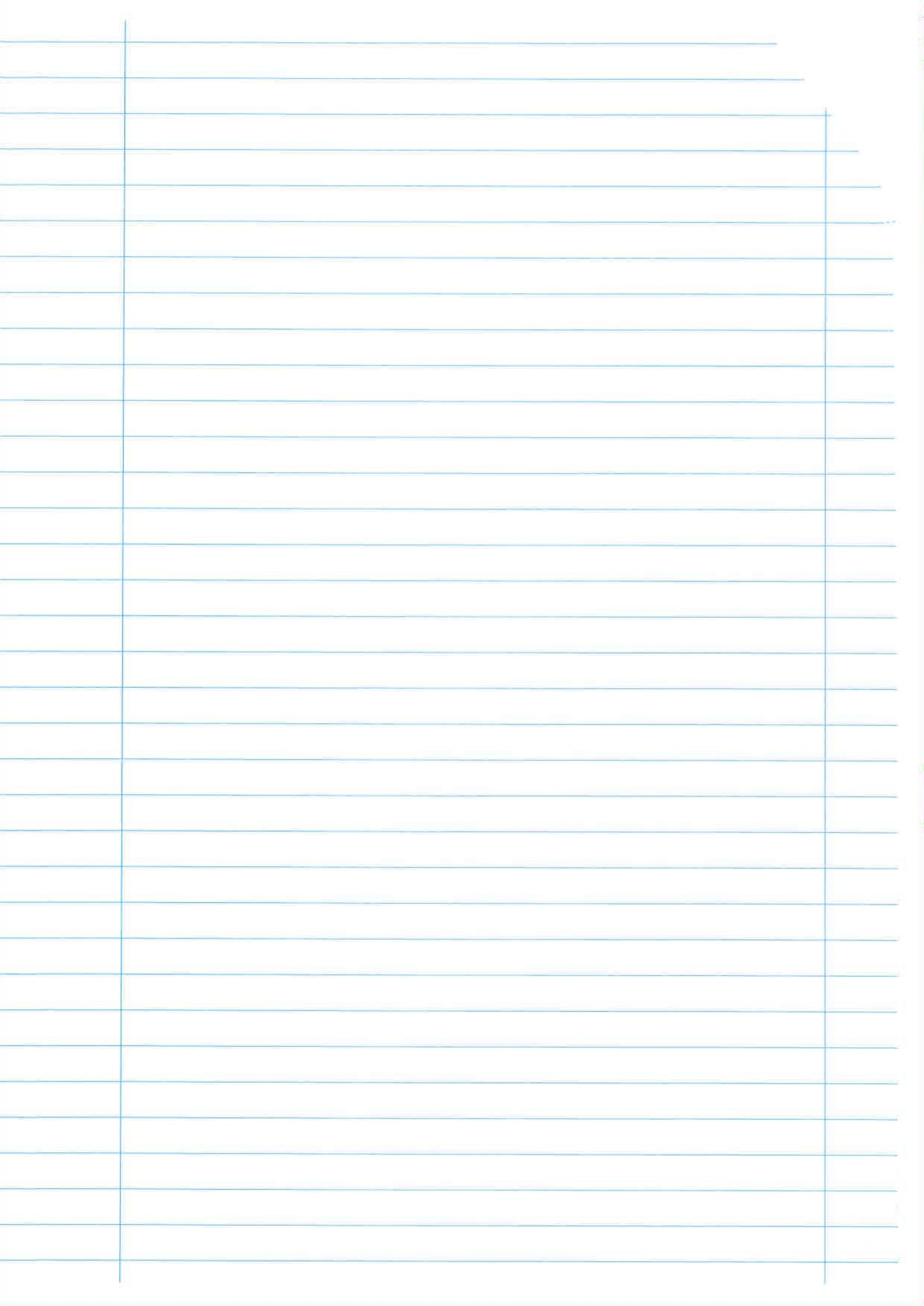


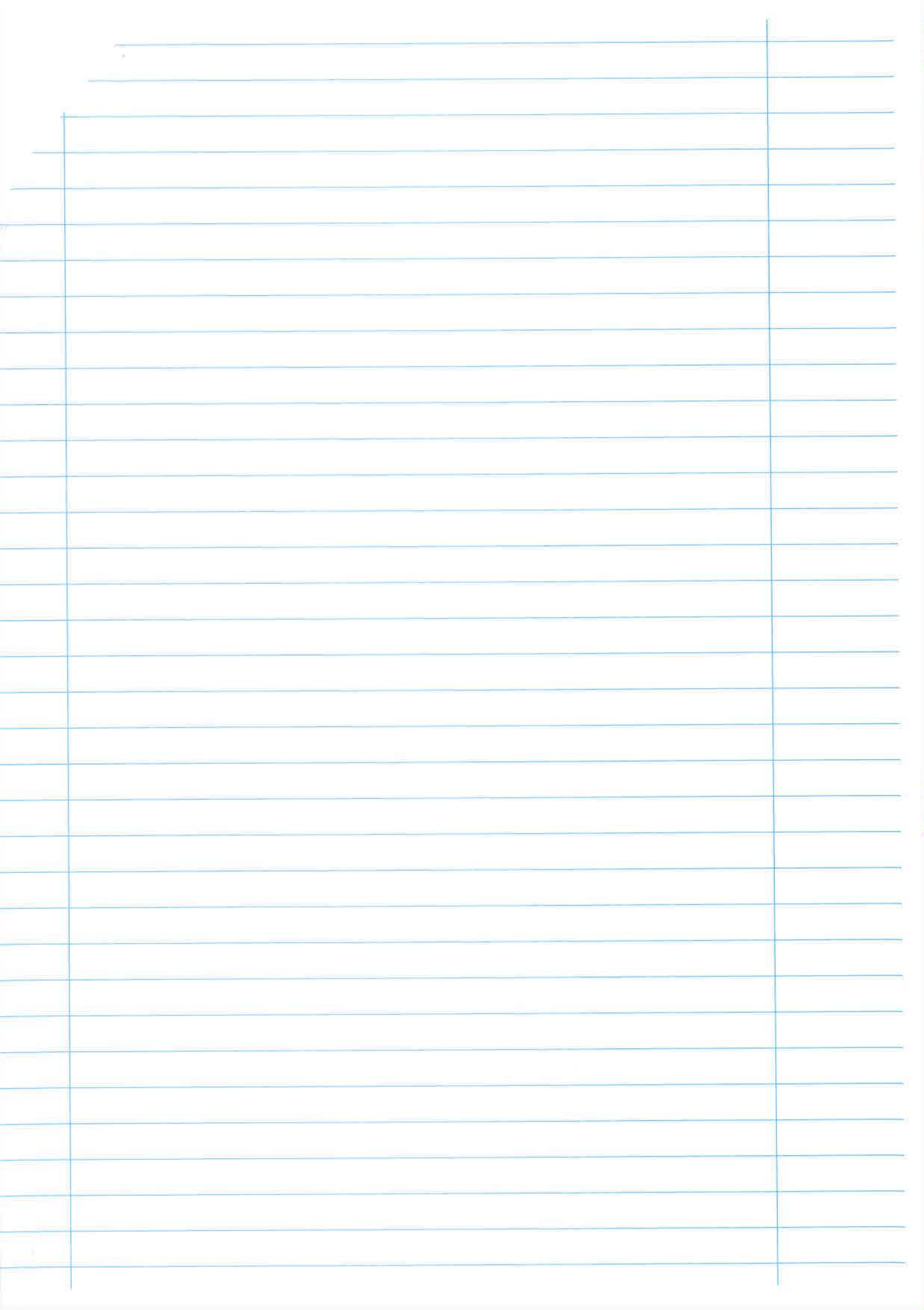


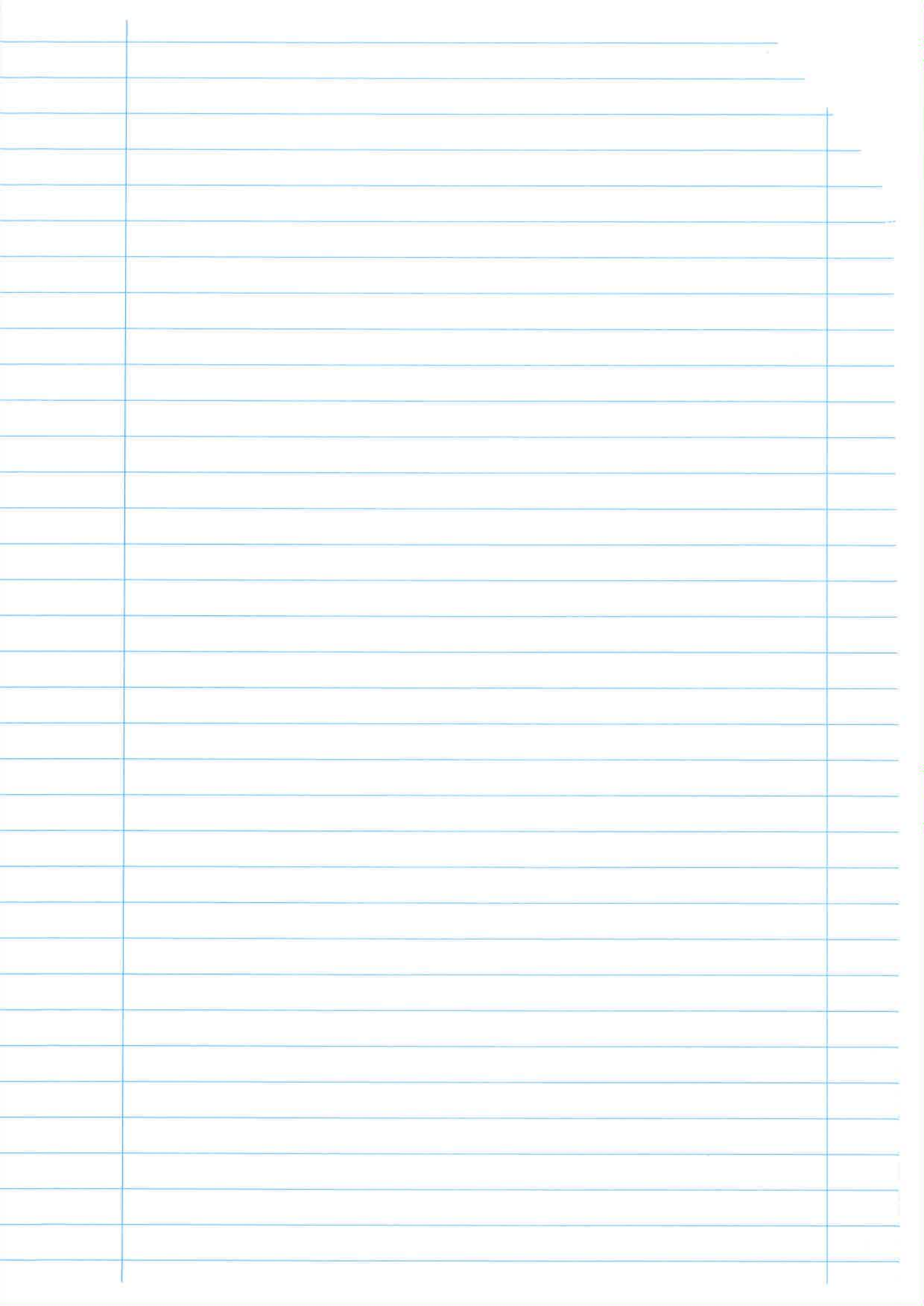


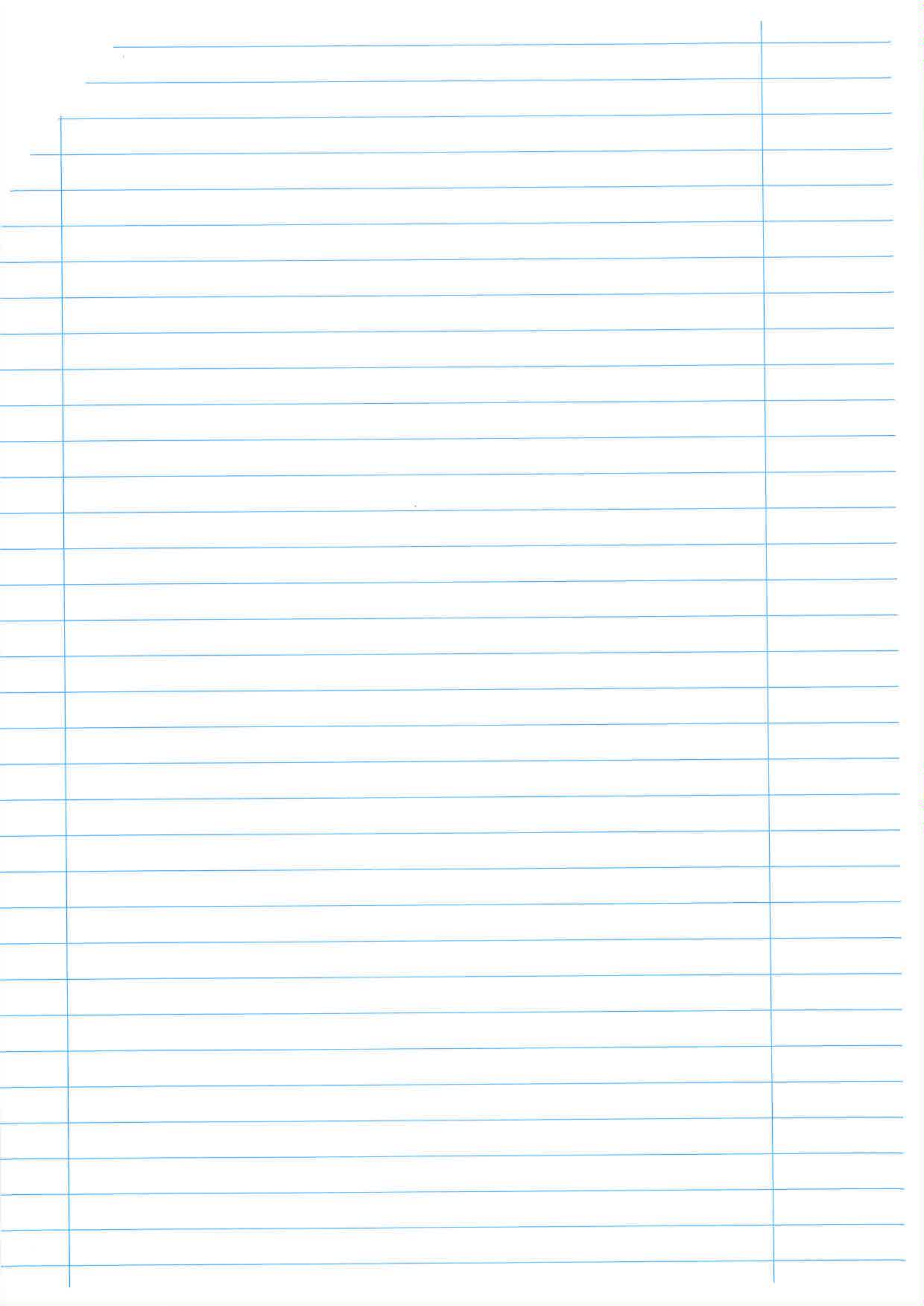


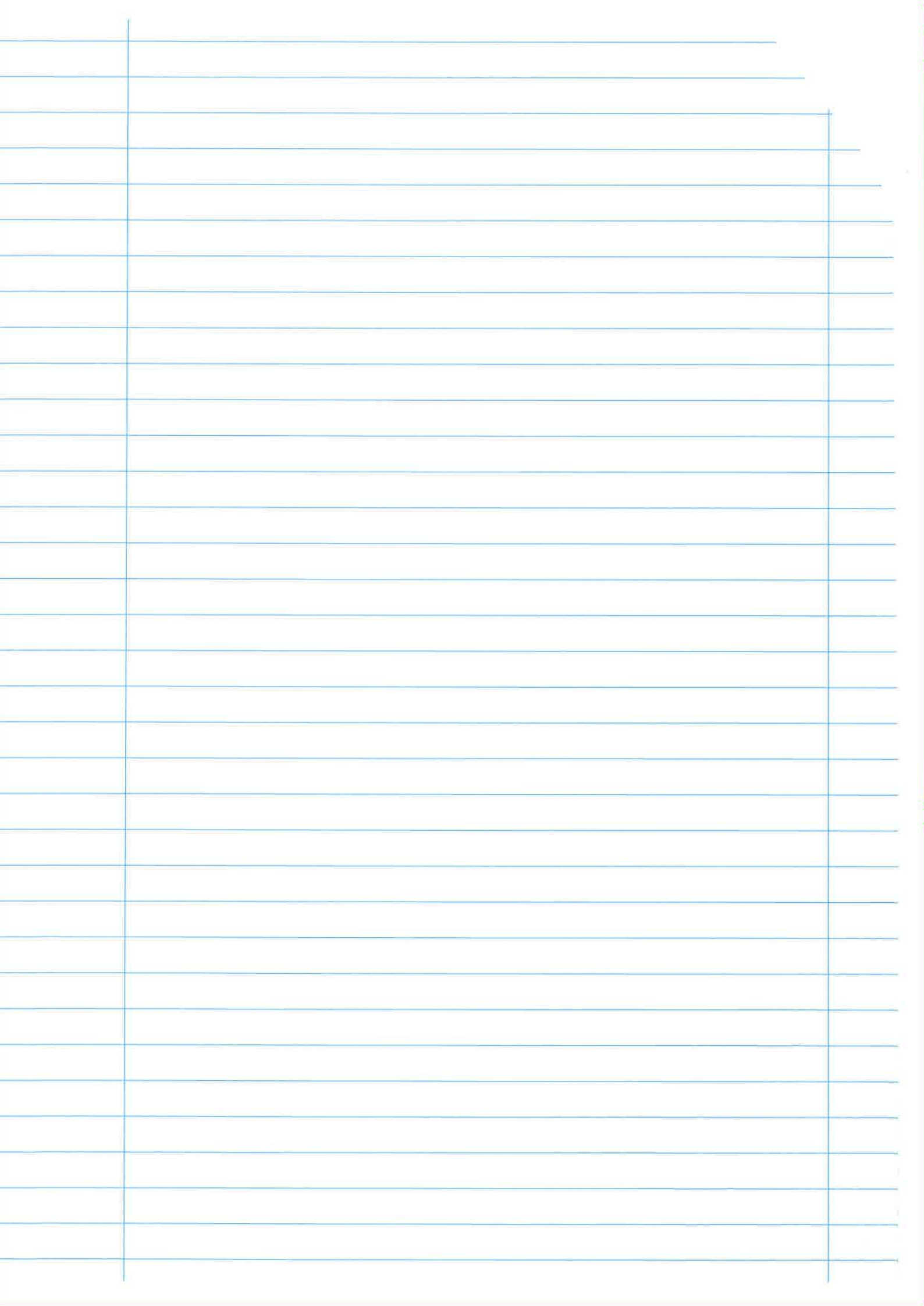












Raidhi Cook

aFunc3

Avg Elapsed Time

2000

10,000

20,000

40,000

0
1
2
3
4
5

20

40

60

80

100

0

1
2
3
4
5

TestArray

aFunc2

10

20

30

40

50

60

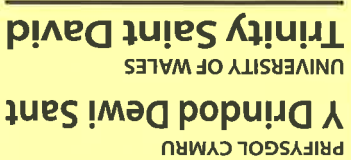
0

1
2
3
4
5

aFunc1

TYNWCH A
RHWYGWCH

AR GYFER DEFNYDD GWEINYDDOL YN UNIG, TYNNWCH Y STRIBYN TYLLOG I FFWRDD YN OFALUS



1. Rhowch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
2. Rhowch eich enw yn y lle a ddarperir i'r dde a seliwrch i guddio eich enw.
3. Rhaid i'r atebion fod mewn llawysgrifen **ddarlennadwy**. Gall yr Arholwyr naill ai anwybyddu sgrïpt annarllennadwy, neu drefnu iddi gael ei theipio a chael yr ymgaisydd i dalu.
4. Ysgrifennwch eich atebion mewn inc.
5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnwch llinell drwyddynr.
6. Ni ddylid rhwygo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.
7. Os defnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwyliwr/gwyliwyr.
8. Rhaid dychwelyd pob llyfr. Ni chaniateir mynd â llyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchiadau.

1	Rhif Myfyriwr	
2	Teitl y Papur Arholiad	
3	Cod y Modwl	
4	Dyddiad ac Amser yr Arholiad	
5	Lleoliad yr Arholiad	
6	Rhif Sedd	
Nifer y Llyfrau Atebion a Rhwyngyd		

[illegible]

(See the other side for English version)

Cyfenw

(LLYTHRENNAU BREISION) Enw(au) cyntaf

PLYGWCH