

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

AS STATISTICS

Unit Statistics 2

Wednesday 14 June 2017

Morning

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- the blue AQA booklet of formulae and statistical tables.

You may use a graphics calculator.

Instructions

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Write the question part reference (eg (a), (b)(i) etc) in the left-hand margin.
- You must answer each question in the space provided for that question. If you require extra space, use an AQA supplementary answer book; do **not** use the space provided for a different question.
- Do not write outside the box around each page.
- Show all necessary working; otherwise marks for method may be lost.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- The **final** answer to questions requiring the use of tables or calculators should normally be given to three significant figures.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 75.

Advice

- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
- You do not necessarily need to use all the space provided.



J U N 1 7 S S O 2 0 1

Answer **all** questions.

Answer each question in the space provided for that question.

- 1** The table shows, for 2012, the country and regional breakdown of expenditure on research and development (R&D) in the UK by sector performing the R&D. The figures are in millions of pounds.

	Sector performing the R&D				Total
	Government	Higher Education	Business	Private Non-Profit	
North East	0	237	282	23	542
North West	75	581	1 784	4	2 444
Yorkshire & Humber	58	503	603	1	1 165
East Midlands	85	347	1 203	4	1 639
West Midlands	2	353	1 461	4	1 820
East of England	207	650	3 449	225	4 531
London	323	1 767	1 477	121	3 688
South East	793	1 033	4 086	111	6 023
South West	345	363	1 364	11	2 083
Total England	1 889	5 834	15 708	504	23 935
Wales	31	264	272	2	569
Scotland	233	973		9	1 922
Northern Ireland	21	141	420	0	582
Total UK	2 173	7 211	17 107	515	27 006

- (a) State the expenditure on R&D in 2012 by Private Non-Profit organisations in the East of England.
[1 mark]
- (b) The figure in the table representing expenditure on R&D by Business in Scotland in 2012 has been omitted.
Calculate the omitted figure.
[2 marks]
- (c) What percentage of the expenditure on R&D in the West Midlands in 2012 was by Higher Education?
[2 marks]
- (d) A statistician draws a pie chart to illustrate how the total expenditure on R&D was divided between the four countries of the UK in 2012.
Calculate the angle which should be used for England in this pie chart.
[2 marks]



7



- 2** A hotel has only two types of ground-floor rooms. There are 4 ground-floor double rooms and 6 ground-floor twin rooms.

The number of requests in one day for ground-floor double rooms, D , may be modelled by a Poisson distribution with a mean of 3.2

The number of requests in one day for ground-floor twin rooms, T , may be modelled by a Poisson distribution with a mean of 3.8

You may assume that the number of requests for ground-floor double rooms is independent of the number of requests for ground-floor twin rooms.

- (a)** Find the probability that, on one particular day, the hotel:

- (i)** receives exactly 3 requests for a ground-floor double room;

[2 marks]

- (ii)** receives at least 2 but fewer than 5 requests for a ground-floor twin room;

[3 marks]

- (iii)** can satisfy all the requests received for ground-floor double rooms and also for ground-floor twin rooms.

[3 marks]

- (b)** The hotel aims to be able to offer, on any one particular day, a ground-floor room of some type to every person requesting one, even if it is not of the type requested.

How many extra ground-floor rooms must the hotel make available if it is to achieve this aim on at least 99 per cent of days? Justify your answer with probabilities.

[4 marks]

QUESTION
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Answer space for question 2



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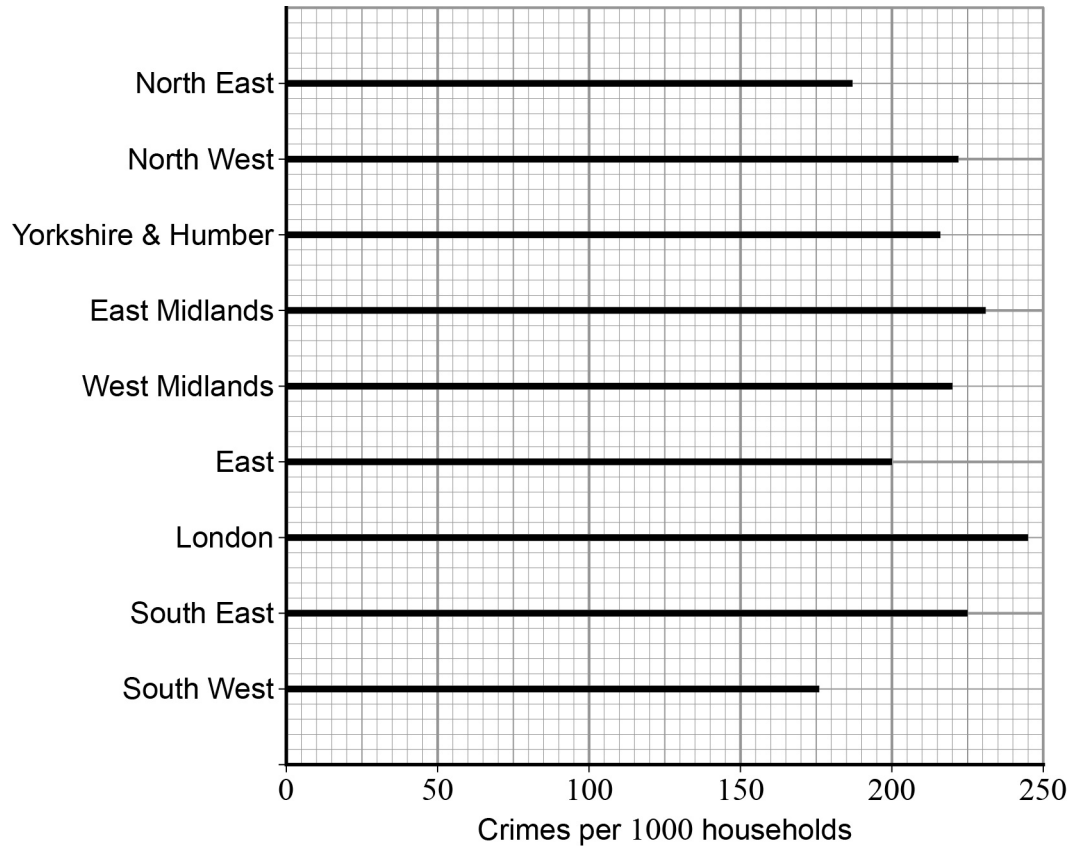
Answer space for question 2

12

3

It has been suggested that the rate of crimes against the household in a region is associated with the average level of household income in that region.

The line diagram shows, by region of England for 2013, data for crimes against the household expressed as a rate per 1000 households.



The table shows median gross weekly earnings for the same regions for 2013.

Region	Median gross weekly earnings (£)
North East	455.30
North West	472.50
Yorkshire & Humber	465.20
East Midlands	476.90
West Midlands	469.30
East	531.00
London	613.30
South East	555.80
South West	476.50

- (a) Complete the scatter diagram opposite by adding the points for London, South East and South West.

[3 marks]

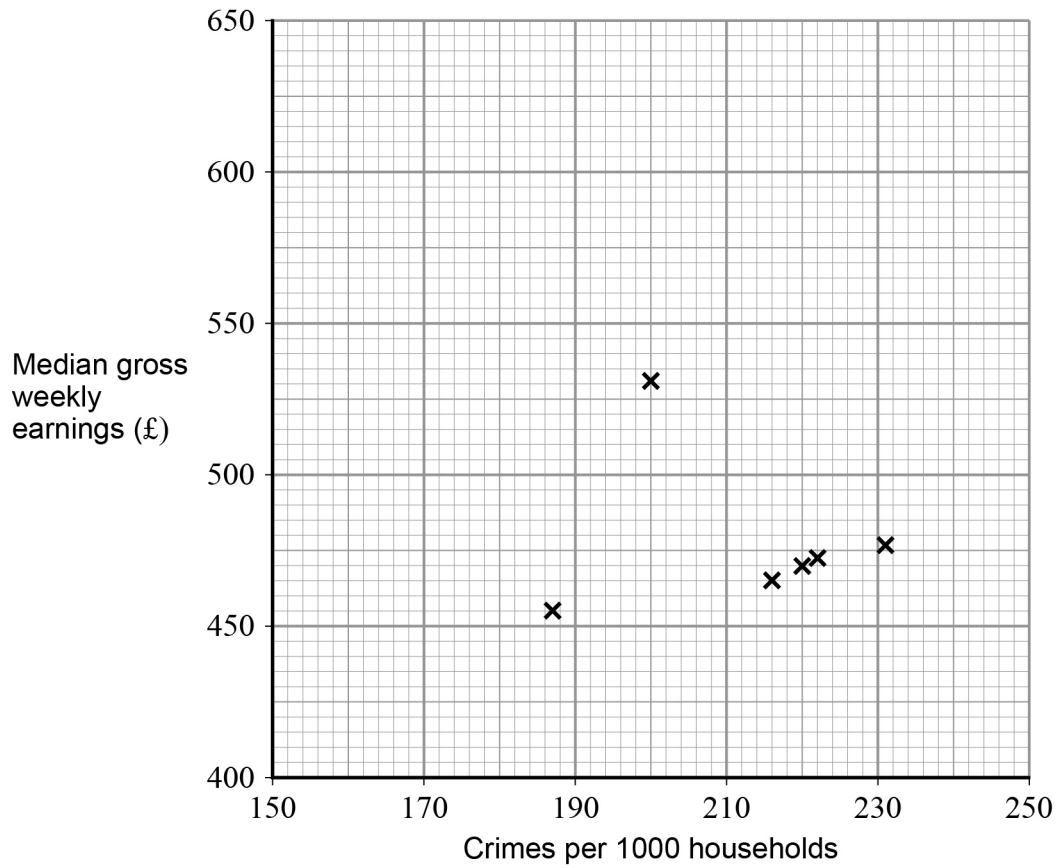
- (b) Comment on any correlation between the two sets of data.

[2 marks]



QUESTION
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REFERENCE

Answer space for question 3



- 4** Petra sells lockets on her market stall. For a fee, she will engrave letters on a locket when she sells it.

The table shows the **percentage** of Petra's total locket sales for each number of letters engraved on a locket.

Number of letters	0	1	2	3	4	5	6	7	8	>8
Percentage of lockets	26	18	6	9	12	13	9	5	2	0

- (a) (i)** Find the probability that the next customer who buys a locket from Petra asks her to engrave 4 or more letters on the locket.

[1 mark]

- (ii)** One morning, Petra sells 3 lockets.

Calculate the probability that she engraves some letters on exactly 2 out of these 3 lockets.

[3 marks]

- (iii)** Find the mean number of letters engraved on a locket and show that the variance is 5.81, correct to three significant figures.

[4 marks]

- (b)** The price of a locket is £5 and Petra charges 40 pence per letter for engraving.

- (i)** Find the mean cost of the lockets sold by Petra.

[2 marks]

- (ii)** Find the standard deviation of the cost of the lockets sold by Petra, giving your answer to the nearest penny.

[2 marks]

QUESTION
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Answer space for question 4



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QUESTION	PART	REFERENCE
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12

- 5** Anton and Erin are students at a university. They are investigating the number of hours, X , that students at their university spend undertaking private study each week. Investigations in previous years have shown that X has a mean value of 15.1 and a standard deviation of 2.7

A random sample of 90 of the current year's students produced the following summary statistics.

$$\sum x = 1413 \quad \sum (x - \bar{x})^2 = 721.5$$

- (a) Anton conducts a hypothesis test, using the 5% level of significance, to investigate whether the mean value of X has changed. He assumes that the standard deviation has remained at 2.7
- (i) Determine the critical values of \bar{x} for Anton's test, giving the values to two decimal places. **[4 marks]**
- (ii) State the conclusion that Anton should reach for his test. Justify your answer. **[2 marks]**
- (b) Erin conducts a hypothesis test, at the 2% level of significance, to investigate whether the mean value of X has **increased**. She does **not** assume that the standard deviation has remained at 2.7
- Carry out Erin's test, clearly stating the conclusion she should reach. **[6 marks]**
- (c) State, with a reason, which of Anton and Erin might have made a Type I error. **[2 marks]**

QUESTION
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Answer space for question 5



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QUESTION	PART	REFERENCE
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14

- 6** The table shows the quarterly total expenditure by British households on sugar and sweet products from quarter 2 of 2010 to quarter 2 of 2013, together with values of an appropriate moving average. The figures are in millions of pounds, to the nearest million. The data and moving averages are plotted on the graph opposite.

Year	Quarter	Sugar and sweet products (£million)	Moving average
2010	2	1879	
	3	1916	
	4	2689	2136
2011	1	2061	2186
	2	2078	2220
	3	2050	2281
	4	2934	2333
2012	1	2271	2344
	2	2119	2393
	3	2248	
	4	3178	2533
2013	1	2585	2561
	2	2232	

- (a) (i)** The value of one of the moving averages for 2012 is missing from the table.

Calculate this missing value.

[2 marks]

- (ii)** Plot this extra moving average on the graph and draw a trend line.

[2 marks]

- (b)** Estimate the seasonal effect for quarter 4.

[3 marks]

- (c)** Forecast the total expenditure by British households on sugar and sweet products for quarter 4 of 2013, showing the method you have used to make this forecast.

[3 marks]

- (d)** Explain why:

- (i)** it would be unwise to use the data to forecast the total expenditure by British households on sugar and sweet products for quarter 4 of 2020;

[1 mark]

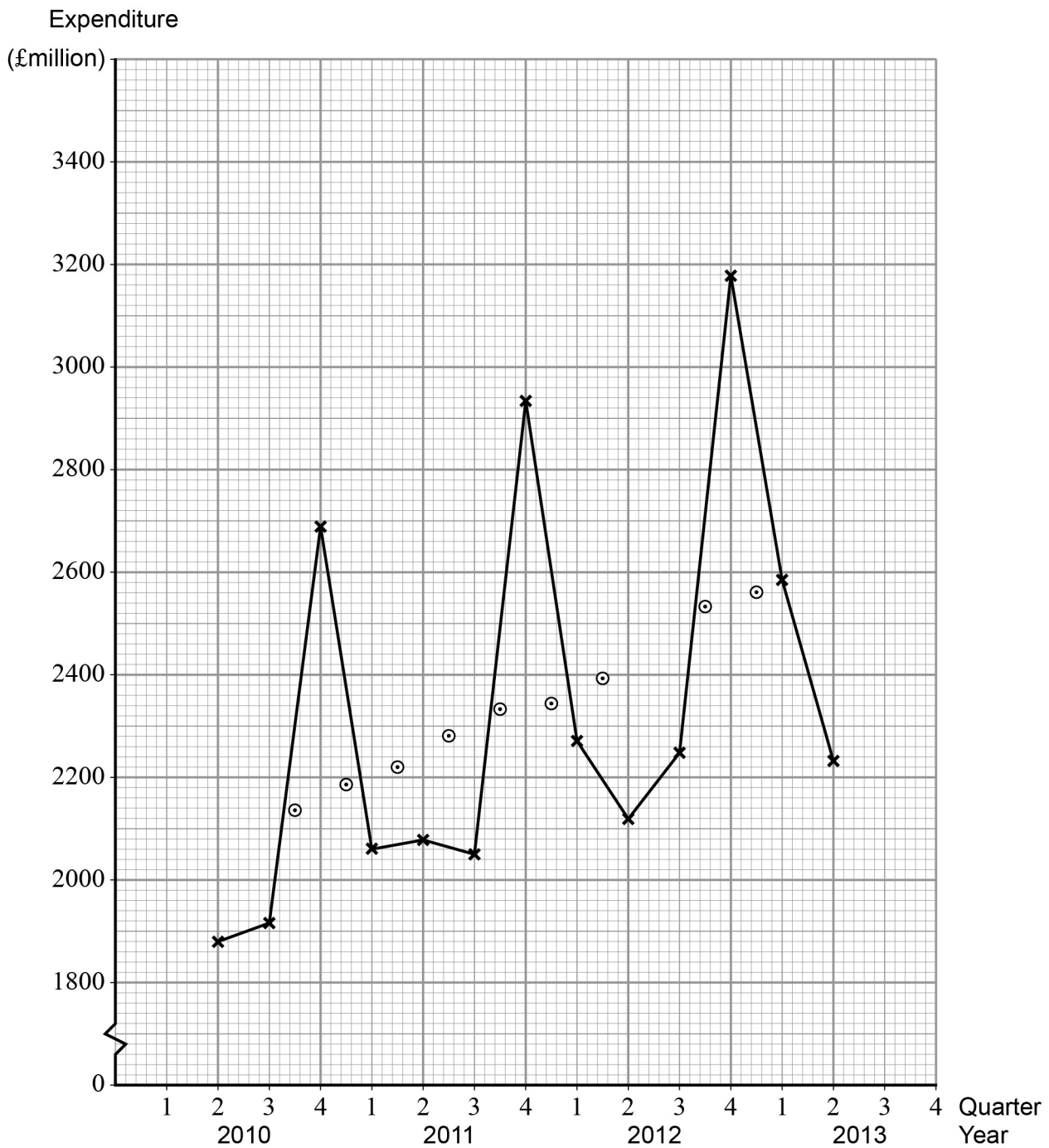
- (ii)** the trend line does not necessarily show that British people are on average eating an increasing amount of sugar and sweet products.

[1 mark]



QUESTION
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Answer space for question 6



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12

[illegible]

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7 (b) In Option 2, James will wait in the gym cafeteria and select groups of gym members there until 80 have been selected.

(i) Name this sampling method.

[1 mark]

(ii) State **one** advantage and **one** disadvantage of Option 2 compared with Option 1.

[2 marks]

QUESTION
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Answer space for question 7(b)



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7 (c) In Option 3, James will use a list of all the gym members, numbered 1 to 800, and a table of random numbers to select a simple random sample of 80

- (i) Describe how James could use the table of random numbers shown below, starting at the top left corner and working from left to right, to obtain his sample of 80 gym members.

State the numbers of the **first three** gym members identified by this method.

[4 marks]

- (ii) State **one** advantage and **one** disadvantage of Option 3 compared with Option 2.

[2 marks]

Table of random numbers

1 2 6 9 0	9 5 4 7 4	5 3 8 4 9	6 4 7 9 1	3 5 8 4 3
7 6 6 3 7	4 2 4 3 7	2 7 9 9 4	2 4 7 1 8	0 9 5 6 6
8 5 9 0 7	2 2 6 8 3	0 6 1 1 9	2 5 3 6 0	3 5 4 8 0
9 9 7 1 7	5 7 6 5 1	0 2 5 1 2	9 8 7 8 5	8 6 4 9 1
9 5 7 8 3	4 0 6 6 6	8 2 5 3 9	8 4 2 2 4	9 4 3 5 4
0 2 9 3 6	5 7 3 0 3	3 1 4 5 8	2 8 6 6 9	2 2 5 3 8
8 9 0 6 6	1 7 9 6 3	3 9 0 4 2	5 0 7 9 1	4 4 6 8 3
6 5 5 3 1	4 7 7 6 7	4 2 3 4 7	5 1 8 9 9	3 3 5 8 2
5 2 3 2 9	9 0 2 9 2	3 7 5 0 8	9 7 3 1 0	9 2 0 4 9
0 8 1 1 8	9 5 4 7 3	9 1 5 8 6	5 8 9 5 3	7 4 9 9 8
7 8 2 1 1	2 7 7 6 2	1 8 1 3 5	4 3 4 7 9	6 1 6 9 8
5 6 8 3 9	6 0 4 7 8	6 2 1 2 9	8 7 1 4 9	6 0 2 4 0
6 0 3 7 9	9 8 2 0 4	5 9 2 5 4	5 1 6 1 6	4 1 0 9 1
3 8 5 9 5	5 2 0 4 8	9 5 1 3 7	7 3 3 6 3	5 3 3 0 7
8 7 1 0 8	8 2 1 5 5	4 3 6 5 0	8 1 9 6 7	5 6 3 4 8
1 1 3 5 2	4 8 3 6 9	5 5 7 3 1	8 1 1 5 8	2 1 0 3 7
5 1 6 8 2	9 7 6 6 0	9 7 1 1 0	6 9 5 4 0	6 9 7 7 6
2 5 3 3 9	4 3 8 7 5	3 8 5 6 3	4 3 5 3 0	3 6 2 8 9
2 4 7 5 2	9 4 6 6 4	1 1 6 1 1	0 5 7 2 0	7 7 0 9 1
4 2 1 3 5	3 6 4 4 0	7 9 4 2 7	1 1 6 6 0	1 5 6 6 6
3 5 6 1 1	9 1 1 7 9	5 1 4 6 4	9 4 2 8 4	9 2 4 4 9
0 9 1 9 3	9 8 7 7 1	3 0 9 6 3	0 2 8 7 6	9 7 6 7 1
4 8 6 1 0	3 1 3 1 4	2 1 5 4 5	2 3 6 0 1	1 8 2 7 8
2 6 8 9 7	0 0 0 7 7	0 4 8 0 3	9 8 3 2 6	8 8 9 3 3
8 0 5 3 4	5 5 0 9 0	0 4 1 0 5	0 1 4 1 5	1 1 3 7 6

QUESTION
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Answer space for question 7(c)



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