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## LEVEL 3 CERTIFICATE

*Examiners' report*

# *QUANTITATIVE PROBLEM SOLVING (MEI)*

**H867**
For first teaching in 2015

# H867/02 Summer 2019 series

Version 1

# Contents

# Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates. The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report. A full copy of the question paper can be downloaded from OCR.

# Paper 2 series overview

This paper provided all candidates with opportunities to show their knowledge of the specification and their engagement with it. The mean and mode marks were 37 and 40 out of 60. There was no evidence of undue time pressure, and all the parts of all the questions were attempted by most candidates, although some were inevitably found more difficult than others.

A feature of this paper was the level of interpretation required; this accounted for a quarter of the marks. Most candidates took this in their stride; they clearly related well to the contexts involved. However, they tended to score more highly on the parts of questions requiring the use of standard statistical procedures, such as hypothesis tests.

The questions in Section B of this paper are based on pre-release material in the form of a large data set. A copy of this is also provided as an insert to the examination paper. Most candidates were clearly well prepared for this and so, for example, had no difficulty in finding such data values as were required in Questions 4 and 5.

The least satisfactory aspect of candidates' work came in the last two parts of Question 2. They were given data about the weight of rubbish on a small sample of beaches and required to use the figures to estimate the weight of rubbish on a local authority's beaches and the number of volunteers required to clean it up in a day. Many candidates did not analyse what should have been simple problems about an everyday situation.

# Section A overview

The three questions in this Section were based around everyday contexts and were mostly well answered. There were, however, exceptions: calculations based on the Normal distribution in 2(iii)(C) and scaling up from sample data in 2(iv) and 2(v).

The main areas covered by the questions were as follows:

1. Data handling
2. The Normal distribution and problem solving
3. The chi-squared test.

## Question 1 (i)

**1** A town has a rail users' group. They want to investigate what improvements to the present service people in the town would most value and produce the survey in Fig. 1.1 below.

Five of the group's members agree to interview people for the survey. They are given the instructions in Fig. 1.2.

The results are summarised in Table 1.3.

**Rail improvement survey**

Please look at the following list of possible improvements to the railway system and ring the **two** that you think are the most important.

A Cheaper fares
B Greater reliability
C More frequent trains
D Cleaner trains
E Less overcrowding on the trains
F Better information on the stations
G A simpler ticket structure.

For office use only

Category of respondent .....

**Fig. 1.1**

**Instructions**

Select people in the following categories
5 adult women
5 adult men
10 students. (Do not include any mature students.)

Give them the list of possible improvements and ask them to ring the **two** that they consider most important.

Collect their responses and fill in the category of each person.

**Fig. 1.2**

| Improvement | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| **Adult men** | 23 | 9 | 2 | 2 | 10 | 1 | 1 |
| **Adult women** | 20 | 2 | 0 | 17 | 9 | 0 | 4 |
| **Students** | 50 | 15 | 10 | 1 | 14 | 1 | 9 |
| **Total** | **93** | **26** | **12** | **20** | **33** | **2** | **14** |

**Table 1.3**

**(i)** Which one of the following terms best describes their sample?

Opportunity, simple random, stratified, quota, cluster, self-selected. **[1]**

This opening part was not well answered, even though similar questions have been set on previous papers. The wide spread of answers may possibly indicate that in some centres greater attention might be given to teaching the various sampling methods. Certainly, most candidates did not know that quota sampling had been used in this case.

## Question 1 (ii)

**(ii)** Make three statements describing different things that the rail users' group can learn from the survey. **[3]**

Most candidates were successful on this. Some gave three particular points and others gave three things that the rail users' group hoped to learn. Either was acceptable. These are illustrated in the two examples below. The main cause for losing marks was repeating essentially the same point.

### Exemplar 1

1 (ii) **Statement 1**

~~Cheaper fares are thought to be the most important by people~~ Cheaper fares are the most important improvement for all women, men, and students.

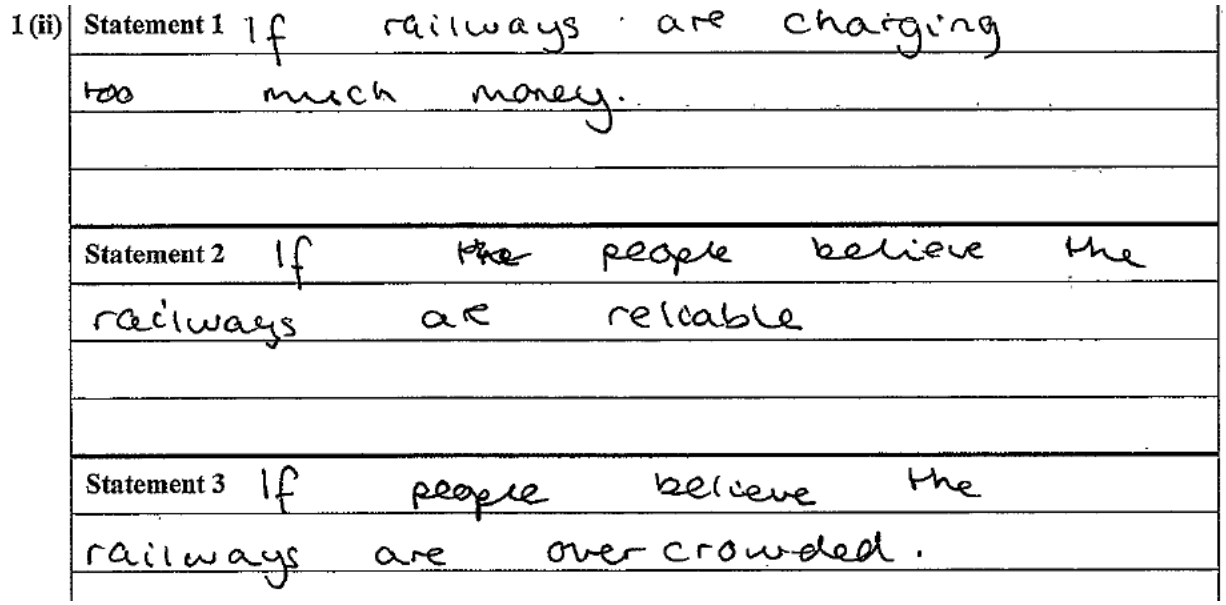
**Statement 2**

Better information on the stations is the least important improvement overall.

**Statement 3**

More frequent trains are more important for students than for adult men and women.

## Exemplar 2




## Question 1 (iii)

**(iii)** One of the interviewers did not carry out the instructions properly, as they did not interview the correct number of people.

What mistake did the interviewer make? **[1]**

Although most candidates did not get this part right, a fair number did give correct answers.

The row totals for the three groups were: Adult men 48, Adult women 52, Students 100. Since everyone gave two answers, the numbers of interviewees in the different categories were 24 men, 26 women and 50 students. However, between them 5 interviewers should have selected 25 men, 25 women and 50 students. So, it seems that one interviewer selected 1 woman too many and 1 man too few.

Whereas in part (ii) the relevant figures could be seen on the page, to answer this part candidates had to do some calculations for themselves. So, they had to interrogate the data.

## Question 2 (i)

**2** A local authority is responsible for a long coastline including 15 beaches that are used by holiday makers. The authority is planning to clean up the beaches before the start of the holiday season. The total length of the beaches is 45 km. The authority wants to estimate the weight of rubbish that they will have to take away and dispose of.

They choose 4 of the beaches and on each of them select, at random, 10 stretches of length 20 metres. They collect the rubbish from each of these stretches and weigh it.

**(i)** Give one reason why an estimate based on this sample may not be very accurate. **[1]**

There were several possible answers to this question. The sample was small, given the variability that could reasonably be expected in the underlying data. The mark was given for either part of this statement and for the same ideas expressed in the candidates' own words. Nearly everyone obtained this mark.

## Question 2 (ii)

The histogram in Fig. 2.1 shows the distribution of the weights from the stretches in the sample.

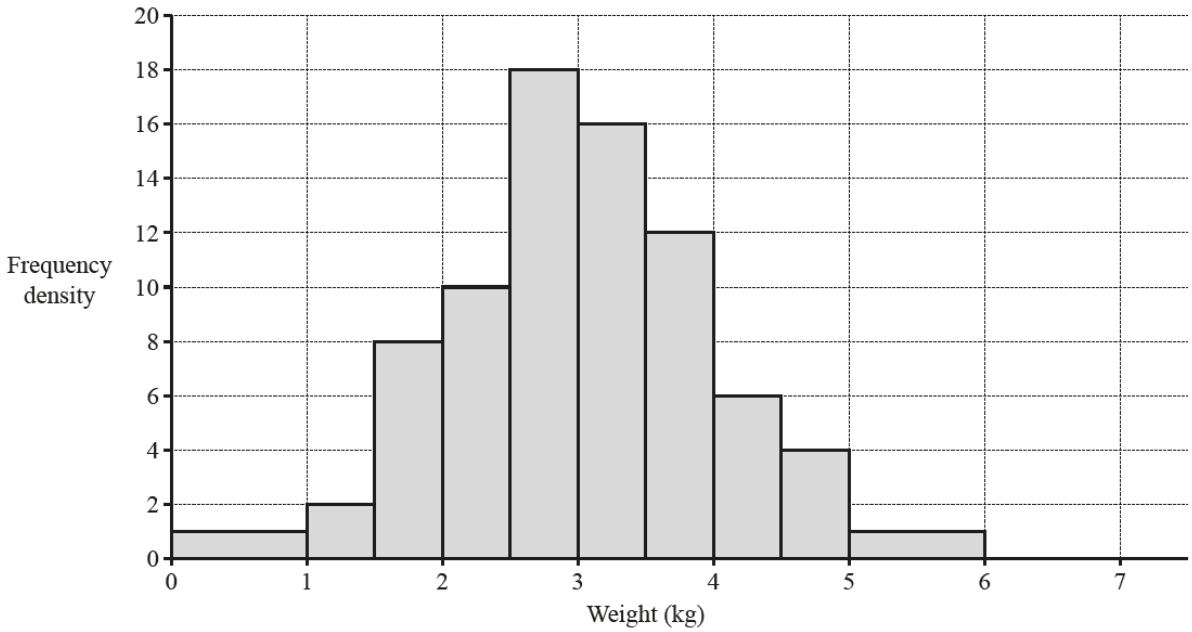



**Fig. 2.1**

**(ii)** Complete Table 2.2 in the answer space giving the frequencies in the different groups. **[2]**

**2 (ii)**

| Weight, $w$kg | $0 \leqslant w < 1$ | $1 \leqslant w < 1.5$ | $1.5 \leqslant w < 2$ | $2 \leqslant w < 2.5$ | $2.5 \leqslant w < 3$ |
|---|---|---|---|---|---|
| Frequency | **1** | | | **5** | **9** |

| $3 \leqslant w < 3.5$ | $3.5 \leqslant w < 4$ | $4 \leqslant w < 4.5$ | $4.5 \leqslant w < 5$ | $5 \leqslant w < 6$ | **Total** |
|---|---|---|---|---|---|
| | | | | | **40** |

**Table 2.2**

The graph in this question is a histogram rather than a frequency chart and this was emphasised by the particular figures given in the table. By far the majority of candidates realised this and obtained both marks; several set off wrong, and then realised their mistake and corrected it. There were a few, however, who decided the given information must be wrong.

## Question 2 (iii) (a)

**(iii)** ***(A)*** Identify one feature of the distribution shown in Fig. 2.1 that suggests that the Normal distribution would be a good model. **[1]**

Most candidates gave the correct answer that the distribution is approximately bell-shaped. The mark was not given to those who answered "Symmetrical" since this is not sufficient; however, it was given if they also mentioned a central mode.

## Question 2 (iii) (b)

**(B)** State an appropriate value for the mean of the Normal model. **[1]**

Most candidates obtained the expected answer of 3. 2.75 was also accepted. The commonest error was 4 and this was not given the mark.

## Question 2 (iii) (c)

**(C)** It is suggested that a value of 1.0 is appropriate for the standard deviation of the Normal distribution. Show that this value is consistent with the frequency in the sample data for $1 \leqslant w < 5$. **[3]**

This part was not well answered, even though similar questions have been set on previous papers.

It involved finding the *z*-values of 1 and 5, interpreting them as a percentage and then comparing this with the actual data.

Most of the correct responses came from stronger candidates. An example of one of them is given below.

### Exemplar 3

(C) $\sigma = 1$ $\bar{x} = 3$

38/40 of data between $1 \leq w < 5$

38/40 = 0 as 2 s.d bound

as 95%.

3 − 2(1) = 1

3 + 2(1) = 5

∴ 95% of data lies within

2 s.d. ∴ is consistent with

freq in sample data.

## Question 2 (iv)

**(iv)** Using the value for the mean you gave in part **(iii)(*B*)**, estimate the total weight of rubbish that the authority will have to remove from the 15 beaches used by holiday makers, giving your answer in tonnes. **[3]**

While there were plenty of good responses to this question there were many others where candidates did not develop a coherent method for estimating the amount of rubbish to be cleared. This involved scaling up from the sample data. There were several ways that it could be done; the simplest involved working out that the total number of stretches is 2250, each with 3 kg of rubbish, making 6750 kg or 6.75 tonnes overall. A successful response, using a different but equivalent approach is given in Exemplar 4 below.

A few candidates came out with totally implausible answers, for example tens of thousands of tonnes.

### Exemplar 4

**2 (iv)** assuming $\bar{x} = 3$ kg in 20 m
15 kg in 100 m, 150 kg in a km.
45 km: $150 \times 45 = 6750$ kg
$= 6.75$ tons of
rubbish in 15
beaches.

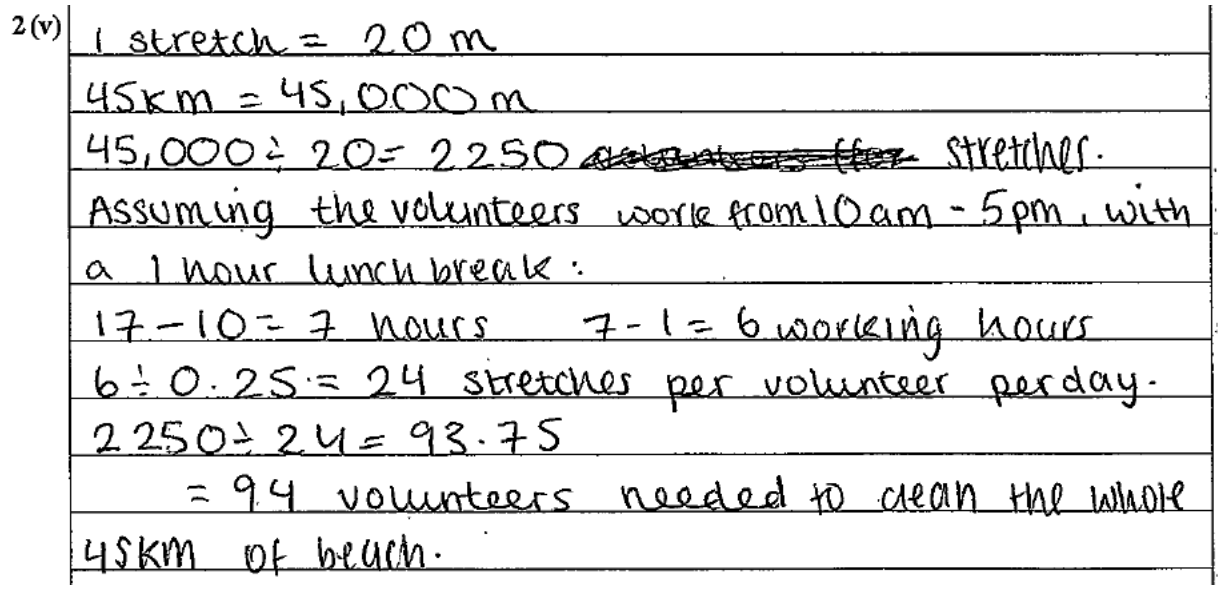
## Question 2 (v)

The authority is planning a campaign called "Beachclean". During one day local volunteers will collect all the rubbish in sacks and leave them in piles, one per beach, ready to be taken away.

**(v)** Given that each stretch takes one person about a quarter of an hour, make a rough estimate of the number of volunteers who would be needed, explaining your reasoning. **[2]**

This part too produced some chaotic answers, but not as many as the previous part. Candidates had to decide how long a volunteer would work in a day and full marks were not given to those who said it was 24 hours. The example below shows a successful response.

## Exemplar 5




## Question 3 (i)

**3** A new type of mouse is being found in woodlands in the UK. It is believed to have come from Asia. A naturalist fears that it may endanger two native species: the wood mouse and the yellow-necked mouse.

A friend expresses the hope that the three species may be able to live alongside each other. He suggests that this would be indicated if the proportions of the three different types of mice in various places are about the same.

They trap mice in three different woods, A, B and C, and record how many of each type they get. The results are given in Table 3.1. They then carry out a $\chi^2$ test on the proportions.

| Observed frequency, $f_o$ | New mouse | Wood mouse | Yellow-necked | Total |
|---|---|---|---|---|
| **Wood A** | 16 | 30 | 14 | **60** |
| **Wood B** | 16 | 28 | 16 | **60** |
| **Wood C** | 20 | 10 | 10 | **40** |
| **Total** | **52** | **68** | **40** | **160** |

**Table 3.1**

**(i)** State the null and alternative hypotheses for their test. **[1]**

Very few candidates gave correct statements of the null and alternative hypotheses. This was probably the worst answered question part on the whole paper. Few candidates used the word "proportion". Correct answers are:

$H_o$ The proportions of the different types of mouse are independent of the wood.

$H_1$ The proportions of the different types of mouse are not independent of the wood.

# Question 3 (ii)

**(ii)** Complete the tables in the answer space.

Show that, at the 5% significance level, the result is not significant. **[7]**

**3 (ii)**

| Expected frequency, $f_e$ | New mouse | Wood mouse | Yellow-necked | Total |
|---|---|---|---|---|
| **Wood A** | 19.5 | 25.5 | | **60** |
| **Wood B** | | | | **60** |
| **Wood C** | 13 | | | **40** |
| **Total** | **52** | **68** | **40** | **160** |

**Table 3.2**

| Contributions | New mouse | Wood mouse | Yellow-necked |
|---|---|---|---|
| **Wood A** | $\frac{(16-19.5)^2}{19.5} = 0.6282$ | 0.7941 | |
| **Wood B** | 0.6282 | 0.2451 | |
| **Wood C** | 3.7692 | 2.8824 | |

**Table 3.3**

This part of the question was very well answered with many candidates obtaining all 7 marks. An example of such a response is given below in Exemplar 6. The commonest mistakes occurred at the point of the procedure where the degrees of freedom had to be found and the answer used to find the critical value.

Some candidates lost the final mark by not showing the comparison between their test statistic and the critical value. This must be shown explicitly in questions on hypothesis tests.

## Exemplar 6

3 (ii)

| Expected frequency, $f_e$ | New mouse | Wood mouse | Yellow-necked | Total |
|---|---|---|---|---|
| Wood A | 19.5 | 25.5 | 15 | 60 |
| Wood B | 19.5 | 25.5 | 15 | 60 |
| Wood C | 13 | 17 | 10 | 40 |
| Total | 52 | 68 | 40 | 160 |

Table 3.2

| Contributions | New mouse | Wood mouse | Yellow-necked |
|---|---|---|---|
| Wood A | $\frac{(16-19.5)^2}{19.5} = 0.6282$ | 0.7941 | 0.06 |
| Wood B | 0.6282 | 0.2451 | ~~0.06~~ 0.06 |
| Wood C | 3.7692 | 2.8824 | 0 |

Table 3.3

$\chi^2 = \sum \frac{(f_o - f_e)^2}{f_e} = 9.080533$

degrees of freedom = $(3-1) \times (3-1) = 4$

5% significance level

critical value = 9.488

$9.081 < 9.488$ therefore insufficient evidence to reject $H_0$ in favour for $H_1$. Accept $H_0$.

## Question 3 (iii)

**3 cont** The naturalist then says "This proves that there is nothing to worry about. The test shows conclusively that the new mice pose no threat to the native species."

**(iii)** Give two criticisms of the naturalist's statement. **[2]**

There were several possible criticisms of the naturalist's statement and most candidates found one or two of them. Teachers using this question as classroom material might particularly emphasise the fact that you cannot show anything "conclusively" by statistics, and that the data do not cover changes over time. The response below was given both the marks.

### Exemplar 7

**3 (iii)**

**Criticism 1** Data is collected from only 1 time period, does not show any changes the mice's impacts may make.

**Criticism 2** Only 3 sites used, not representative of the whole mouse population across the country.

## Question 3 (iv)

Unknown to the naturalist and his friend, a group of scientists have been monitoring the situation in a different wood for 5 years. Each year they have trapped a sample of mice, using exactly the same methods. Their results are given in Table 3.4.

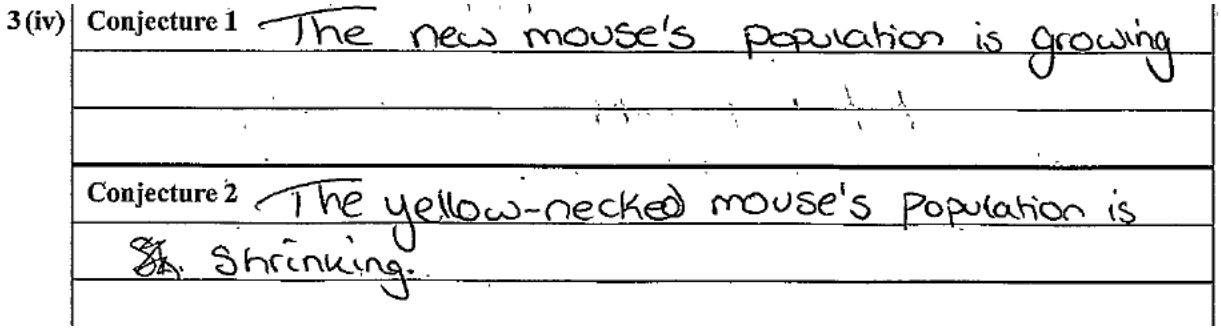
| Observed frequency, $f_o$ | New mouse | Wood mouse | Yellow-necked | Total |
|---|---|---|---|---|
| **Year 1** | 2 | 27 | 31 | **60** |
| **Year 2** | 5 | 22 | 27 | **54** |
| **Year 3** | 12 | 23 | 21 | **56** |
| **Year 4** | 19 | 21 | 12 | **52** |
| **Year 5** | 27 | 26 | 8 | **61** |

**Table 3.4**

**(iv)** State two conjectures that the scientists might make from their data. **[2]**

This question asked for two conjectures. While some candidates clearly understood what that meant others stated their summary of the data; many answers were somewhere in between and were given the benefit of the doubt in the marking. Two good statements are shown in the following Exemplar 8.

## Exemplar 8



# Section B overview

The questions in this Section were based on pre-release material in the form of a large set of data drawn from the CIA Factbook, giving figures for the various countries of the world for a number of fields. Most candidates were well prepared for this; some questions required them to find particular values from the large data set and this seems to have caused them no difficulty.

The main areas covered by these questions were as follows:

4. Accessing data from the pre-release material and carrying out relevant calculations

5. The Spearman hypothesis test for association

6. Modelling and working with appropriate data displays.

## Question 4 (i)

**The questions in this section are based on the pre-release data. A hard copy of this is provided with this examination paper.**

**4 (a) (i)** The land area of China is 9 326 410 $km^2$.

Show that, to 3 significant figures, its population density is 145 people per $km^2$. **[2]**

This question was very well answered. Nearly all candidates obtained the correct response.

## Question 4 (a) (ii)

**(ii)** To 3 significant figures, the population density of India is 416 people per $km^2$.

Estimate the land area of India. **[2]**

This too was well answered with few wrong answers.

## Question 4 (b) (i)

**(b) (i)** Show that, to 3 significant figures, the total GDP for Malaysia is $5.26 \times 10^{11}$ US$. **[2]**

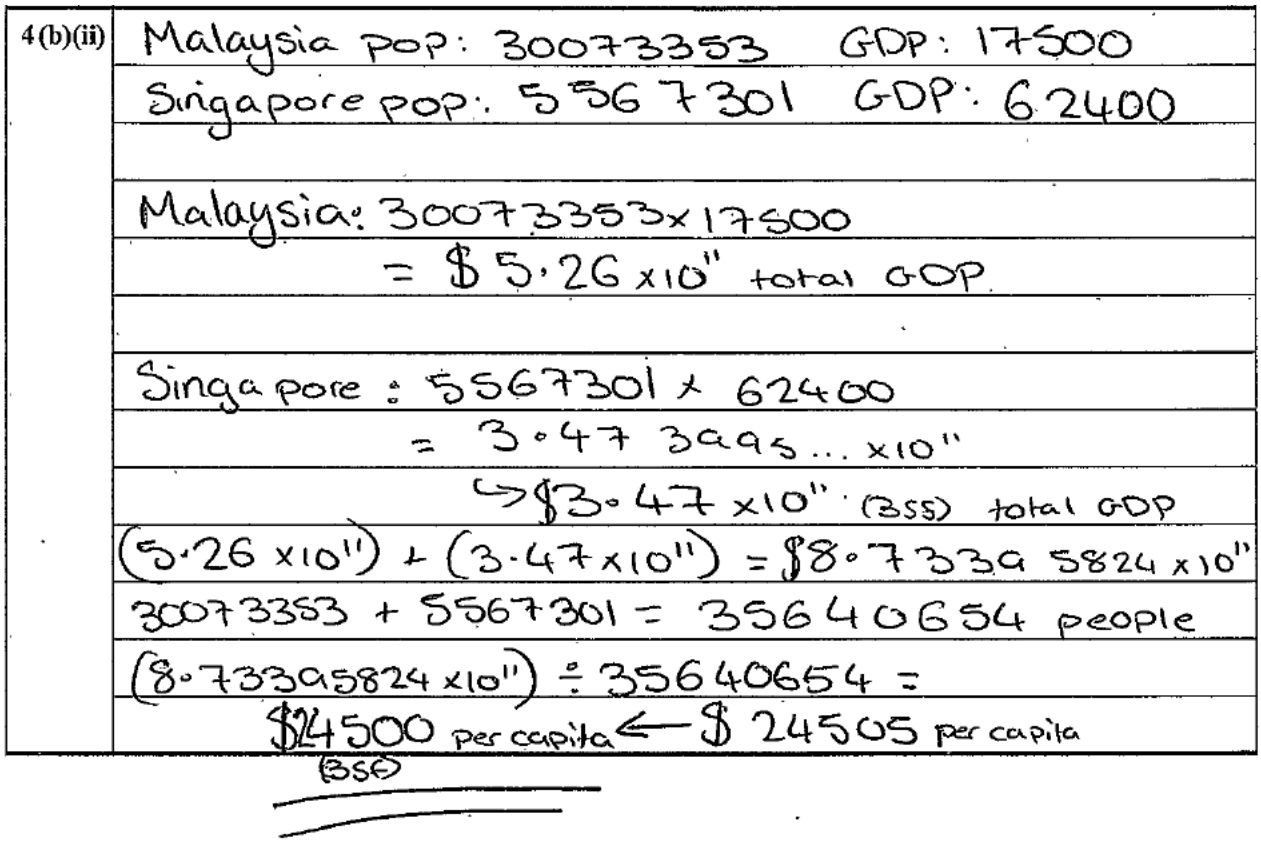
This question also was well answered.

## Question 4 (b) (ii)

**(ii)** Find the mean GDP per capita of the combined population of Malaysia and Singapore. **[4]**

This was found more challenging than the rest of Question 4. Many candidates did not realise that they needed to find the total GDP for Singapore, as they had done for Malaysia in the previous part. There were, however, plenty of fully correct responses, like that shown below.

### Exemplar 9



# Question 5 (i)

**5** Solveig is a student in Norway. She is interested in the relationship between GDP per capita and life expectancy. She carries out a pilot investigation using the Nordic countries as a sample. She carries out a Spearman's rank correlation test on her data, using a 5% significance level.

**(i)** Complete the missing cells in Table 5.1.

State suitable null and alternative hypotheses, carry out the test and state the conclusion. **[7]**

**5 (i)**

| Country | GDP per capita | GDP rank, $x$ | LE | LE rank, $y$ | $d = x - y$ | $d^2$ |
|---|---|---|---|---|---|---|
| **Denmark** | 37 800 | 4 | 79.09 | 6 | −2 | 4 |
| **Estonia** | 22 400 | 8 | 74.07 | 8 | 0 | 0 |
| **Faroe Islands** | 30 500 | 6 | 80.11 | 4 | | |
| **Finland** | 35 900 | 5 | 79.69 | 5 | | |
| **Iceland** | 40 700 | | 81.22 | | | |
| **Latvia** | 19 100 | | 73.44 | | | |
| **Lithuania** | 22 600 | 7 | 75.98 | 7 | | |
| **Norway** | 55 400 | 1 | 81.60 | 2 | −1 | 1 |
| **Sweden** | 40 900 | 2 | 81.89 | 1 | 1 | 1 |
| | | | | **Total** | | |

**Table 5.1**

This part was well answered with many candidates obtaining all 7 marks.

A few lost 1 mark on the table by failing to fill in the cell for the Total of $d$; the zero here is valuable as it provides a check.

A few candidates made statements to the effect that the conclusion of the hypothesis test is that there is a high level of association between GDP per capita and Life Expectancy in Scandinavian countries. They missed the important point that the sample was being used to test the hypothesis for all countries.

In Exemplar 10 the candidate's alternative hypothesis would set up a 2-tail test but the critical value given is for a 1-tail test. So, one mark is lost. However, since the candidate has followed a correct structure throughout, the final mark for the outcome of the test is allowed on follow through.

## Exemplar 10

5(i)

| Country | GDP per capita | GDP rank, $x$ | LE | LE rank, $y$ | $d=x-y$ | $d^2$ |
|---|---|---|---|---|---|---|
| Denmark | 37800 | 4 | 79.09 | 6 | −2 | 4 |
| Estonia | 22400 | 8 | 74.07 | 8 | 0 | 0 |
| Faroe Islands | 30500 | 6 | 80.11 | 4 | 2 | 4 |
| Finland | 35900 | 5 | 79.69 | 5 | 0 | 0 |
| Iceland | 40700 | 3 | 81.22 | 3 | 0 | 0 |
| Latvia | 19100 | 9 | 73.44 | 9 | 0 | 0 |
| Lithuania | 22600 | 7 | 75.98 | 7 | 0 | 0 |
| Norway | 55400 | 1 | 81.60 | 2 | −1 | 1 |
| Sweden | 40900 | 2 | 81.89 | 1 | 1 | 1 |
| | | | | Total | 0 | 10 |

$n=9$

Table 5.1

$H_0$ - there is no association between GDP per capita and life expectancy.

$H_1$ - there is an association between GDP per capita and life expectancy.

$r_s = 1-\left(\frac{6\times 10}{9(9^2-1)}\right) = 0.916$

1-tail test in booklet $= 0.6000$

$0.916 > 0.6000$

So reject $H_0$; there is evidence of an association between GDP per capita and life expectancy.

## Question 5 (ii)

Solveig draws the scatter diagram for all the countries in the world. It is shown in Fig. 5.2.

**(ii)** Circle the point on the scatter diagram corresponding to Equatorial Guinea. **[1]**

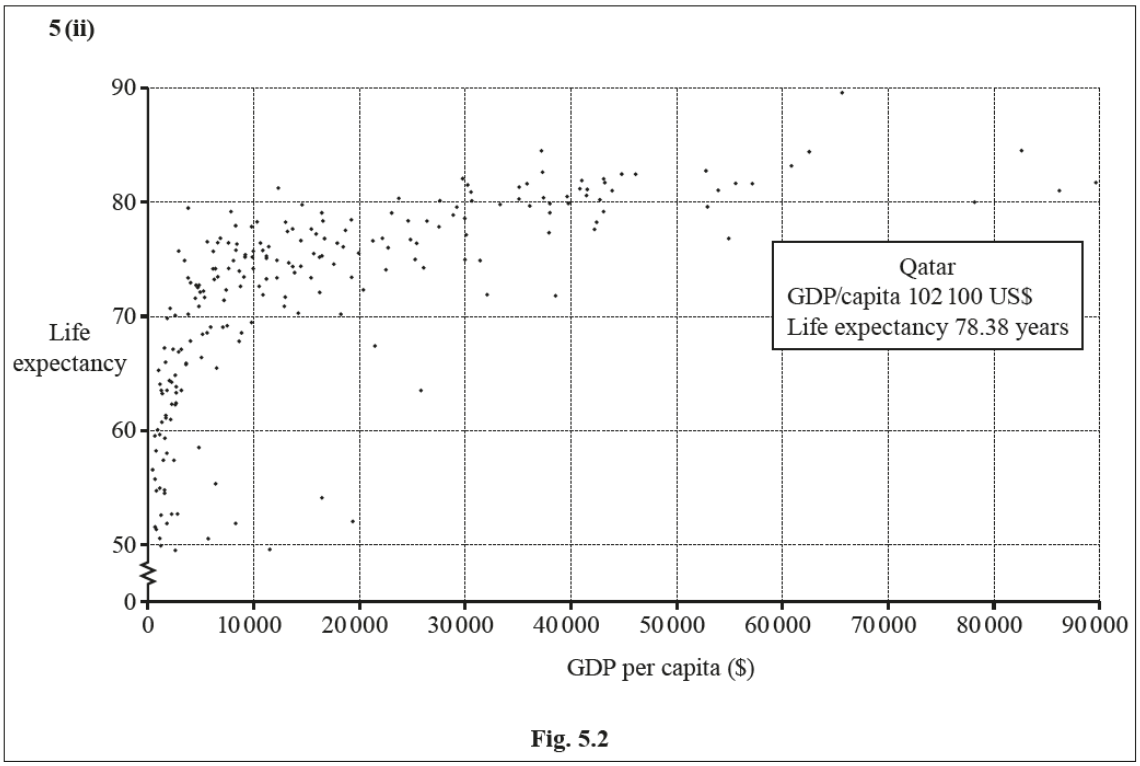



**Fig. 5.2**

Almost all candidates ringed the correct point. To do this they had to find the relevant figures for Equatorial Guinea from the data set.

## Question 5 (iii)

**(iii)** Make two comments on what the scatter diagram shows. **[2]**

Possible answers include weak, positive association (or correlation), and the fact that there appear to be two different relationships, one for GDP up to about US$10,000 and another for greater values. Most candidates made at least one sensible comment .

# Question 6 (i)

**6** This question is about modelling the size of the world population. Its rapid growth in recent years is a cause of concern over the future of the planet.

Table 6.1 gives the years in which the population is estimated to have reached whole numbers of billions. It also gives the lengths of the intervals involved, their mid-points and average year-on-year percentage increases over the intervals.

| Size (billions) | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Year | 1804 | 1927 | 1960 | 1974 | 1987 | 1999 | 2011 |
| Interval (years) | 123 | 33 | 14 | 13 | 12 | 12 | |
| Mid-point of interval | 1865.5 | 1943.5 | 1967 | 1980.5 | 1993 | 2005 | |
| % increase per year | 0.565 | 1.236 | 2.076 | 1.731 | 1.531 | 1.293 | |

**Table 6.1**

**(i)** Using your calculator, show that, to 3 significant figures, the value of $1.00565^{123}$ is 2.00.

Explain briefly how this relates to the information in Table 6.1. **[2]**

There were two parts to this question. In the first, candidates were asked to use their calculators to show a certain rounded result. This required them to write some or all of their calculator display down in unrounded form, for example "1.999 693 ..." and then give the required rounded answer of "2.00". Those who missed out the unrounded form were not given the mark.

The second part required candidates to state that this related to the time it took the world population to increase from 1 billion people to 2 billion. Not all candidates made this connection.

# Question 6 (ii)

**(ii)** The last row of Table 6.1 shows that the percentage rates of increase are going down. Fig. 6.2 shows the four most recent values from Table 6.1. (They are plotted at the mid-points of their intervals.)

By drawing a suitable line on this graph, estimate the year when the world population may stop increasing.

State one reason why this estimate should be treated with caution. **[3]**

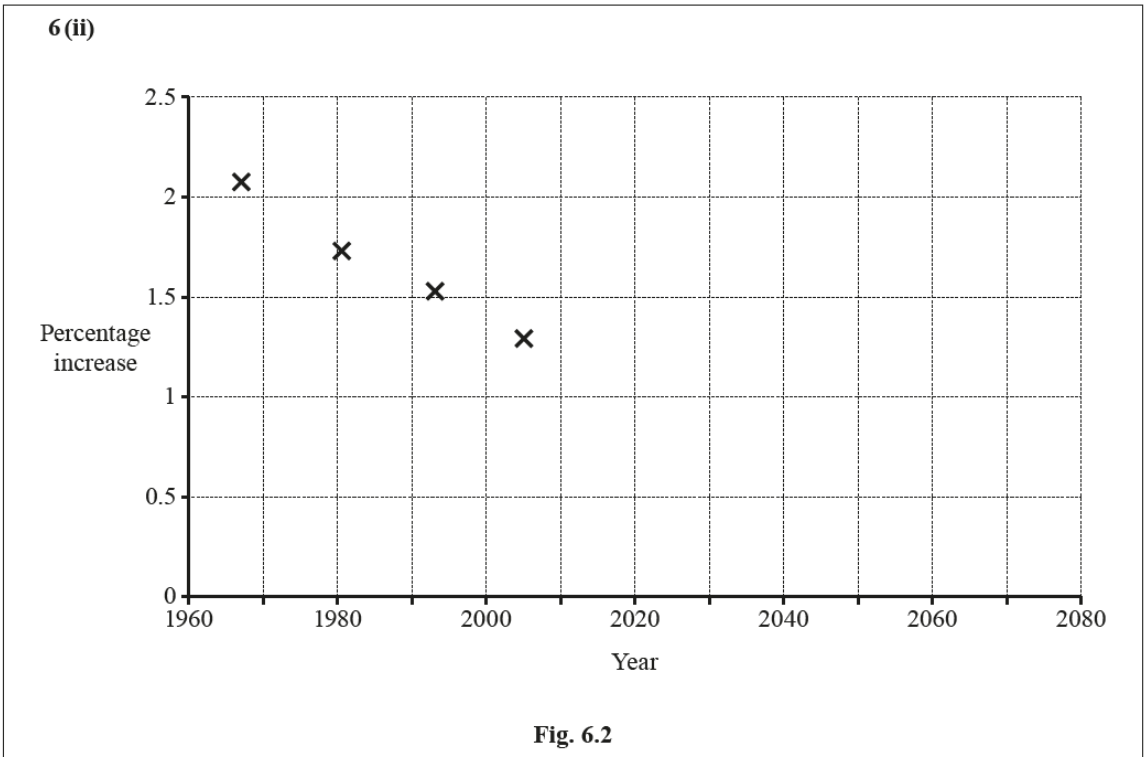



**Fig. 6.2**

This part was well answered. Most candidates drew a straight line through the data points, crossing the axis between about 2060 and 2070.

Candidates were then asked why their previous answer should be treated with caution. Some correctly stated that it was based on extrapolation and others wrote, sometimes at considerable length, about the uncertainty of what lay ahead which was fine; they were making essentially the same point. However, quite a few answers were irrelevant and so were not given this mark.

The response below received all 3 marks.

## Exemplar 11

**6 (ii)**

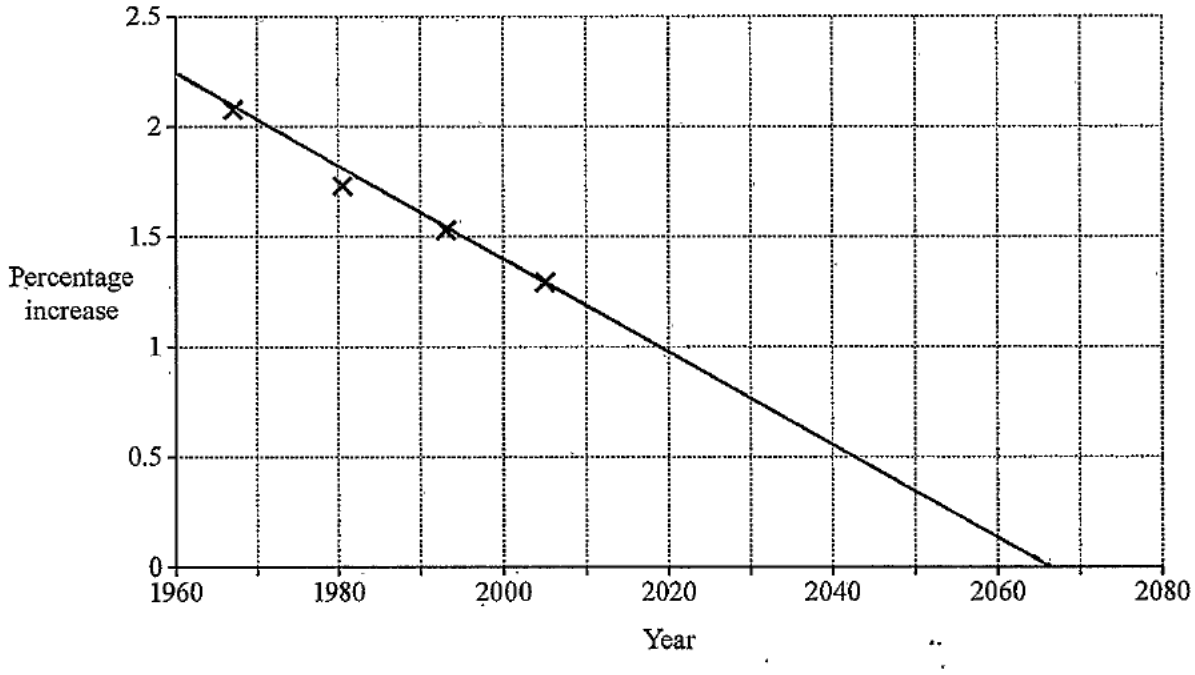



**Fig. 6.2**

| | |
|---|---|
| **Year** | 2068 |
| | |
| **Reason** | This is created by only following the trends of the 45 years, world behaviour will change so cannot be an accurate prediction |

## Question 6 (iii)

**6 cont** The next two parts of this question involve a birth rate of 12.5. This is the theoretical birth rate of a country with a stable population and a life expectancy of 80 years.

The frequency chart in Fig. 6.3 shows the distribution of the birth rates of all the countries in the world.

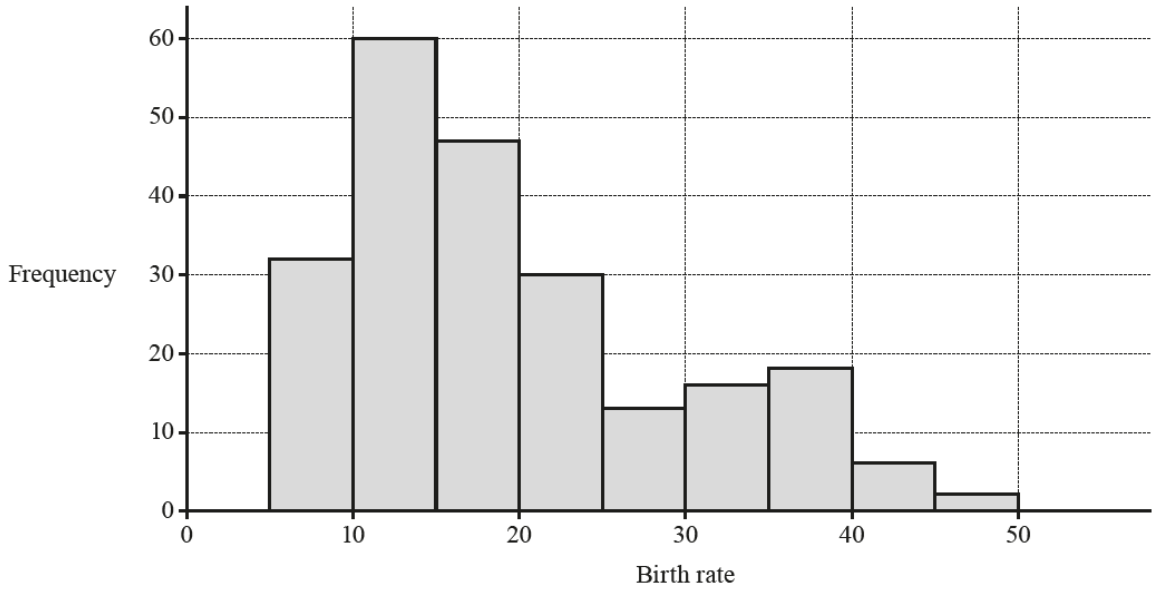



**Fig. 6.3**

**(iii)** Use Fig. 6.3 to estimate the number of countries with birth rates less than 12.5. **[2]**

Most candidates carried out the correct procedure to estimate the required frequency from the chart and obtained these 2 marks.

## Question 6 (iv)

**(iv)** The pre-release data includes the birth rates of 32 countries in Western Europe. For how many of these countries is the birth rate more than 12.5? **[1]**

Nearly all candidates answered this correctly. Some gave the number of countries in Western Europe with birth rates less than 12.5, instead of more than 12.5.

## Question 6 (v)

Table 6.4 gives the birth rates for the UK for the 100 years from 1901 to 2001. (Data were not collected in 1941 when the country was at war). The overall pattern is typical of countries in Europe and many other parts of the world.

| Year | 1901 | 1911 | 1921 | 1931 | 1951 | 1961 | 1971 | 1981 | 1991 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|
| Birth rate | 28.5 | 23.2 | 18.7 | 17.2 | 16.7 | 18.2 | 13.2 | 13.4 | 12.7 | 12.2 |

**Table 6.4**

**(v)** Give two comments on your answer to part **(ii)** considering the data in Table 6.4 and the rest of the question. **[2]**

Many of the answers to this question were not expressed clearly.

The data provide one example, the UK, of the world-wide trend of falling birth rates and so makes the prediction in part (ii) of the world population ceasing to grow in the second half of this century a reasonable one.

Many responses did not make it clear whether they were referring to the population of the UK or the world. Another cause of confusion was the difference between birth rate and rate of population increase.

Marks were only given to clear responses that made valid points. An example of such a response is given below.

### Exemplar 12

**6 (v) Comment 1**

The majority of countries ~~x~~ with a birth rate of more than 12.5 are not in Western Europe.

The birth rate has decreased overall in the UK in the last 100 years.

**Comment 2**

The majority of worldwide population growth is happening outside of ~~Europe~~ Europe.

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