Centre Number						Candidate Number				
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Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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5	
TOTAL	

Free-Standing Mathematics Qualification
Advanced Level
June 2013

Using and Applying Statistics

6990/2

Unit 10

Monday 13 May 2013 1.30 pm to 3.00 pm

For this paper you must have:
- a clean copy of the Data Sheet (enclosed)
- the booklet of formulae and statistical tables (enclosed)
- a calculator
- a protractor
- a ruler.

Time allowed
- 1 hour 30 minutes

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.
- You may **not** refer to the copy of the Data Sheet that was available prior to this examination. A clean copy is enclosed for your use.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You may use either a scientific calculator or a graphics calculator.

Advice
- You do not necessarily need to use all the space provided.

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Section A

Answer **all** questions.

Answer each question in the space provided for that question.

Use **World athletics championships** *on page 2 of the Data Sheet.*

1 (a) Use the data, given on the Data Sheet, to calculate:

(i) the mean time for the 100 metres race winners; *(1 mark)*

(ii) the standard deviation of the time for the 100 metres race winners. *(2 marks)*

(b) An outlier is any value more than two standard deviations from the mean. Identify any outliers showing calculations to support your reasoning. *(3 marks)*

(c) The cumulative frequency graph opposite shows the times taken by 23 male runners in the 100 metres race in a competition organised by a local club.

Using the graph, find:

(i) the interquartile range for the time taken by these runners. Give your answer to the nearest hundredth of a second. *(3 marks)*

(ii) the number of runners who ran slower than 12.95 seconds. *(1 mark)*

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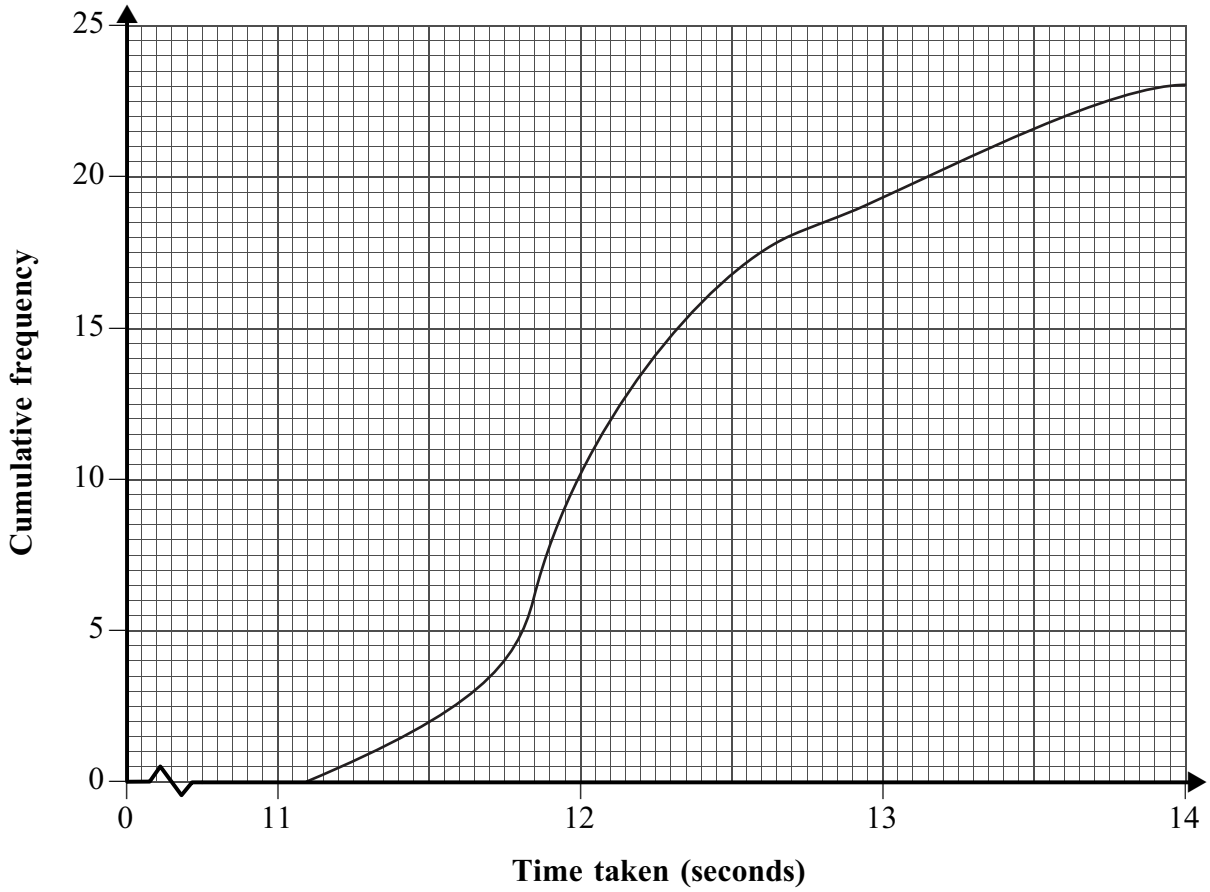

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Section B

Answer **all** questions.

Answer each question in the space provided for that question.

Use **Life expectancy at birth** *on page 3 of the Data Sheet.*

2 The World Health Organisation (WHO) collects data and estimates the average life expectancy at birth for a person born in a particular country in a particular year. The data below are for 193 countries and refer to the year 2009.

The data have been organised into a grouped frequency table, as shown below.

Life expectancy at birth (L)	Number of countries
$45 \leqslant L < 50$	12
$50 \leqslant L < 60$	24
$60 \leqslant L < 70$	44
$70 \leqslant L < 75$	53
$75 \leqslant L < 80$	32
$80 \leqslant L < 85$	28

(a) (i) On the grid opposite, draw a histogram for these data. *(4 marks)*

(ii) Using your histogram, or otherwise, estimate how many of these countries have a life expectancy at birth greater than 77 years. *(2 marks)*

(b) (i) From the data given in the table above, estimate a value for the median life expectancy. *(3 marks)*

(ii) For these data, the WHO gives the mean life expectancy at birth for someone born in 2009 as 68 years. Explain why this differs from your median value found in part **(b)(i)**. *(1 mark)*

(c) **Table 1**, on the Data Sheet, shows life expectancy at birth (years) by world region. From **1990–2009**, life expectancy at birth for **females** in **Africa** increased by 5.7%.

(i) Find the percentage increase for **female** life expectancy at birth in **South-East Asia** over the same period. *(2 marks)*

(ii) Suggest a reason why these values are different. *(1 mark)*

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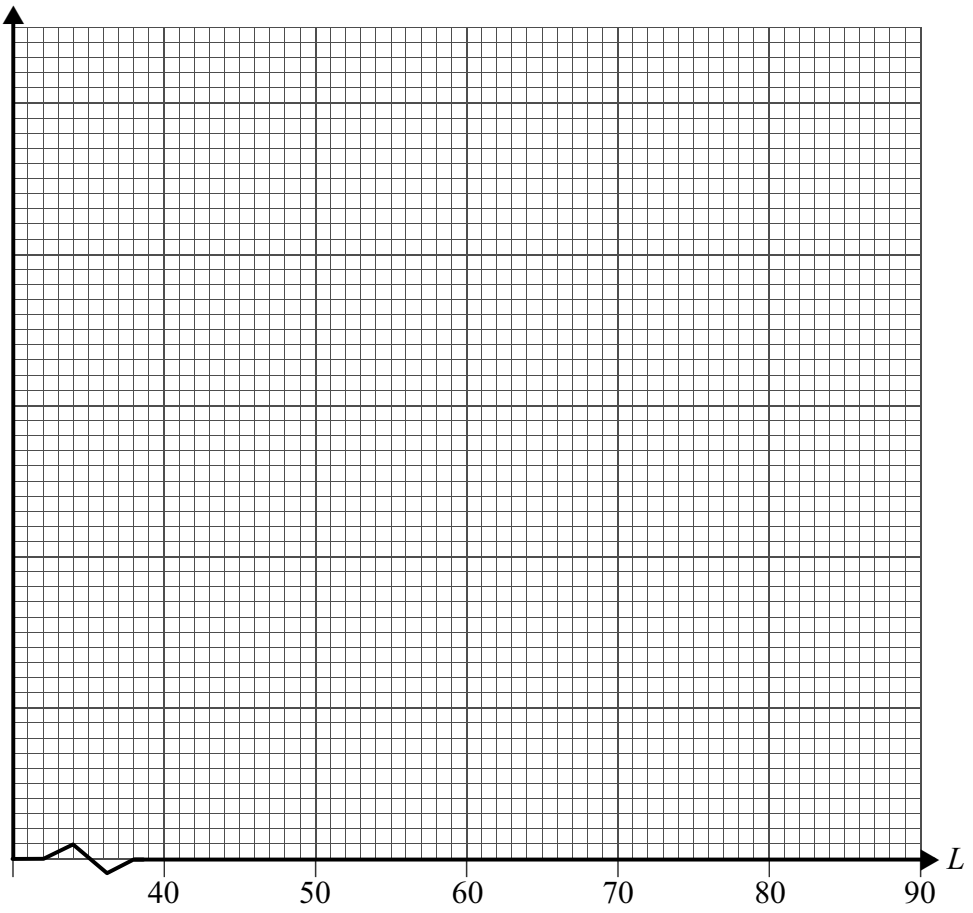

Life expectancy at birth in 2009 (years)

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3 The table below shows the data for 2009 for a random sample of ten countries taken from the original 193 countries. The data for the gross national income per capita are also given.

Country	**Gross national income per capita ($1000)**	**Life expectancy at birth (years)**
Australia	37.3	82
Belgium	35.4	80
Ecuador	7.78	75
India	2.93	65
Madagascar	1.05	65
Peru	7.95	76
Republic of Korea	27.8	80
Saudi Arabia	24.5	72
Uganda	1.14	52
Yemen	2.22	65

(a) For the above table of data, use **Gross national income per capita** (x) and **Life expectancy at birth** (y) to plot a scatter graph of these data on the grid opposite. *(2 marks)*

(b) Use your calculator to find:

(i) the mean gross national income per capita, $\overline{x}$; *(1 mark)*

(ii) the mean estimated life expectancy at birth, $\overline{y}$; *(1 mark)*

(iii) the product-moment correlation coefficient, r. *(1 mark)*

(c) Interpret your value of r, found in part **(b)**, in the context of this question. *(1 mark)*

(d) (i) Calculate the equation of the line of best fit of y on x in the form $y = ax + b$, giving the values of a and b correct to three significant figures. *(3 marks)*

(ii) Plot the line of best fit on your scatter graph. *(3 marks)*

(e) For Portugal, the gross national income per capita was $22.3 thousand and the life expectancy at birth was 79 years. Find the value for the life expectancy at birth given by the line of best fit. Comment on your answer. *(3 marks)*

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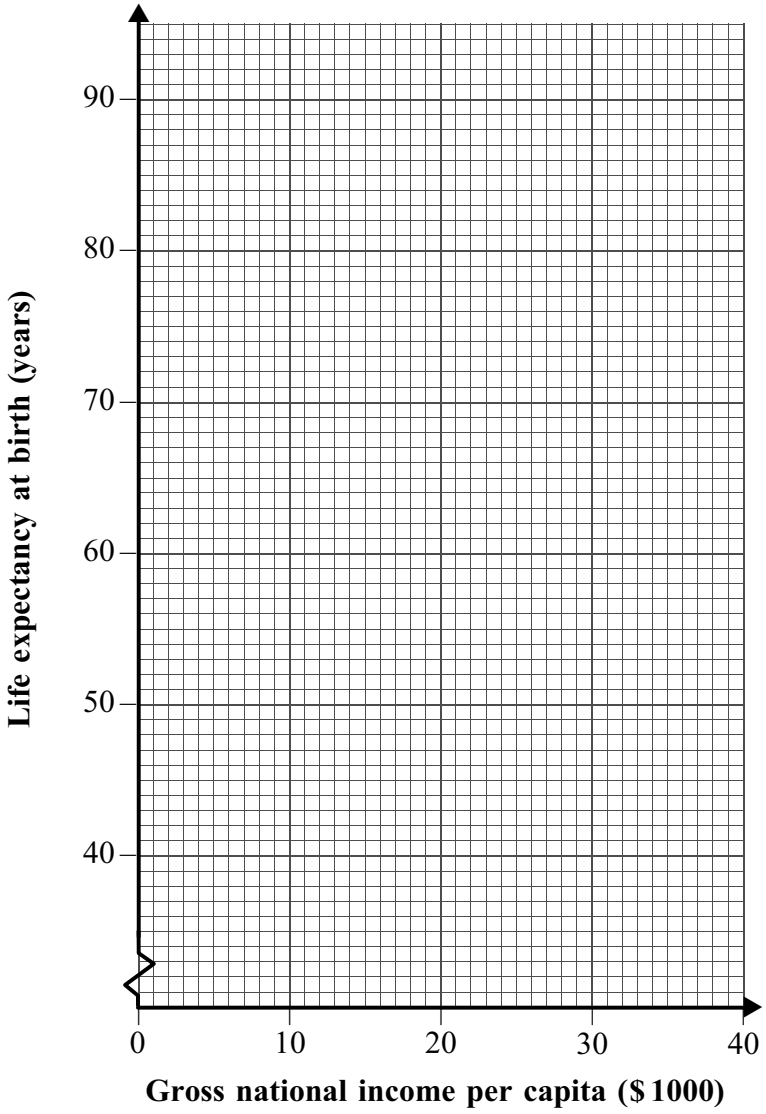

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Section C

Answer **all** questions.

Answer each question in the space provided for that question.

Use **Dairy farming** *on page 4 of the Data Sheet.*

4 The table showing the annual average milk yield per cow and the net milk price per litre is reproduced below.

	Year									
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Average milk yield per cow (litres)	5978	6347	6495	6620	6571	6749	6977	6913	6943	7084
Net milk price (pence per litre)	16.9	19.3	17.1	18.0	18.5	18.5	17.9	20.7	25.9	23.6

The grid opposite shows a line graph for the annual average milk yield per cow over the time period 2000–2009.

(a) Draw a line graph on the same grid for the net milk price per litre over the same time period of 2000–2009. You should use the right-hand side vertical axis as your scale when you plot and draw your line graph. *(3 marks)*

(b) Describe in context the trend for each of the two graphs. *(2 marks)*

(c) A typical price charged by shops for one litre of milk in 2009 was 72 p. The mark-up is the difference between the shop price and the net milk price. What was the mark-up as a percentage of the net milk price in 2009? *(3 marks)*

(d) The Data Sheet indicates that the total number of dairy cattle in the UK had decreased by 6.7 % in the five years previous to 2010. Calculate the total number of dairy cattle in the UK in 2005. *(3 marks)*

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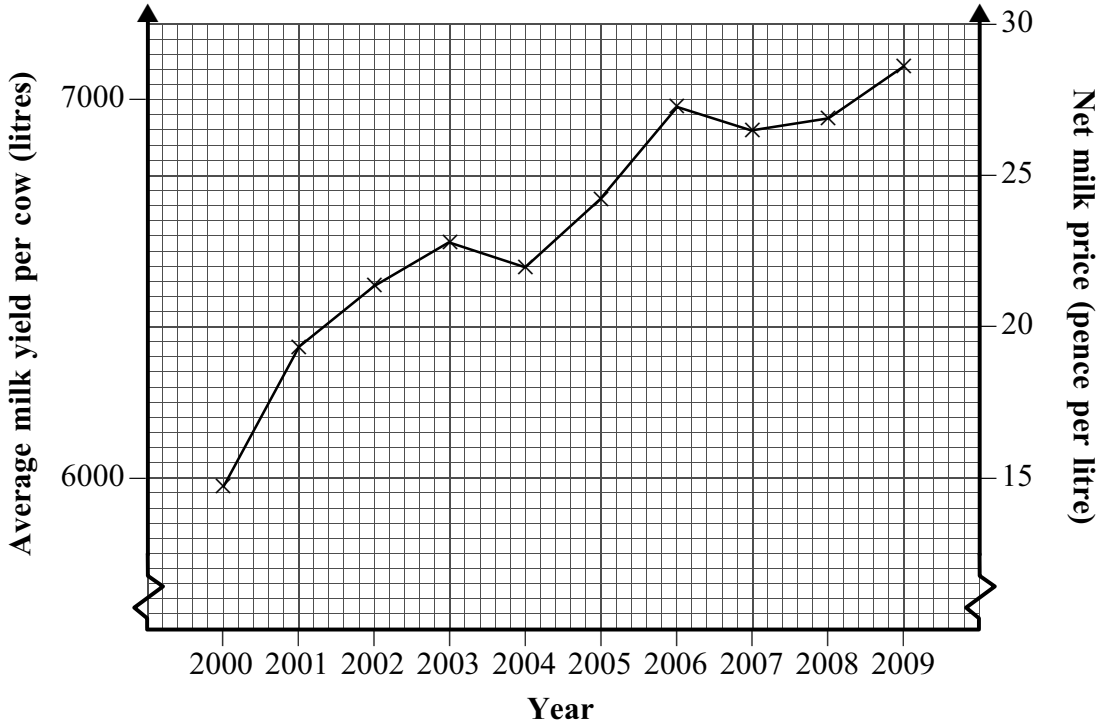

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5 Tom is an organic dairy farmer.

(a) For an organic dairy cow, shortly after calving, assume that the amount of milk produced follows a normal distribution with a mean of 27 litres of milk per day and a standard deviation of 4 litres of milk per day.

(i) Calculate the probability that an organic dairy cow will produce less than 33 litres of milk per day. *(3 marks)*

(ii) Calculate the probability that an organic dairy cow will produce between 24 litres and 33 litres of milk per day. *(4 marks)*

(b) Later in the milking cycle the amount of milk produced still follows a normal distribution. However, the mean value will decline but the standard deviation will remain the same. Calculate the new mean value for the amount of milk produced each day at this point in the milking cycle if the probability that an organic dairy cow will produce more than 16 litres of milk per day is 0.98. *(4 marks)*

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END OF QUESTIONS

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