Free-Standing Mathematics Qualification
June 2008
Advanced Level

USING AND APPLYING STATISTICS   **6990/2**
Unit 10

Thursday 15 May 2008   9.00 am to 10.30 am

For this paper you must have:
- a clean copy of the Data Sheet (enclosed)
- an answer sheet for use in Questions 2, 3, 4, 5 and 6 (enclosed)
- an 8-page answer book
- the booklet of formulae and statistical tables (enclosed)
- a scientific calculator
- a ruler.

Time allowed: 1 hour 30 minutes

Instructions
- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Write the information required on the front of your answer book **and** on the top of the answer sheet for Questions 2, 3, 4, 5 and 6.
- The *Examining Body* for this paper is AQA. The *Paper Reference* is 6990/2.
- Answer **all** questions.
- All necessary working should be shown; otherwise marks for method may be lost.
- The **final** answer to questions requiring the use of calculators or tables 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 available for your use.
- At the end of the examination, remember to hand in both your answer book **and** the answer sheet for Questions 2, 3, 4, 5 and 6.

Information
- The maximum mark for this paper is 60.
- The marks for questions are shown in brackets.

6990/2

SECTION A

Answer **all** questions.

*Use **Population change** on page 2 of the Data Sheet.*

1   (a)   Calculate the percentage change in the population of the UK from the beginning of 2001 to the beginning of 2002. *(2 marks)*

(b)   The percentage change in the population of the UK from the beginning of 1971 to the end of 2004 is 7.66 %.

Calculate the population of the UK at the beginning of 1971. *(3 marks)*

(c)   The natural change is the difference between the number of births and the number of deaths.

Write down **two** comparisons between the natural change and the net migration and other changes during the period shown on the graph. *(2 marks)*

SECTION B

Answer **all** questions.

*Use **Schoolchildren** on page 3 of the Data Sheet.*

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2 The hand spans, in centimetres, of 200 schoolchildren are summarised in the table below.

Hand span (cm)	$6 \leqslant x < 14$	$14 \leqslant x < 16$	$16 \leqslant x < 18$	$18 \leqslant x < 20$	$20 \leqslant x < 24$	$24 \leqslant x < 32$
Frequency	16	18	38	66	58	4

    (a) Draw a histogram to illustrate these hand spans using the grid given on the answer sheet. *(4 marks)*

    (b) Estimate the number of schoolchildren who had hand spans greater than 21 cm. *(2 marks)*

3 (a)   (i) Find the mean height $\bar{h}$ and the mean foot length $\bar{f}$ for the 12 boys.

      (ii) Calculate the correlation coefficient between f and h.

      (iii) Calculate the equation of the line of best fit of f on h. *(5 marks)*

    (b) Draw the line of best fit on the scatter diagram for the boys on the answer sheet. *(4 marks)*

    (c) Briefly describe the gradient of the line of best fit in terms of the foot length and the height of the boys. *(2 marks)*

    (d) By comparing the scatter diagram for the girls' foot lengths against heights with the boys' scatter diagram, explain why the correlation coefficient for the girls is smaller than that for the boys. *(2 marks)*

Turn over for the next question

4 The wrist circumferences of the boys and girls are copied from the data sheet.

Boys' wrist circumferences (mm)
200
180
150
167
170
160
146
170
180
170
170
180

Girls' wrist circumferences (mm)
145
155
140
120
180
150
110
150
69
150
150
150

(a) (i) Use a calculator to find the mean and the standard deviation of the wrist circumferences of the girls and complete the table on the answer sheet. *(3 marks)*

(ii) Compare the mean and the standard deviation of the girls' wrist circumferences with those of the boys. *(2 marks)*

(b) (i) Write down the value of the girls' wrist circumference in the above table which is suspect. *(1 mark)*

(ii) Without recalculating, what would be the effect on the mean and standard deviation of the wrist circumferences of the girls if this value were removed? *(2 marks)*

(c) The wrist circumference of girls is normally distributed with mean 170 mm and standard deviation 9.6 mm.

Calculate the probability that a girl will have a wrist circumference:

(i) smaller than 185 mm; *(3 marks)*

(ii) smaller than 146 mm. *(5 marks)*

SECTION C

Answer **all** questions.

Use **University of Florida age distribution** *on page 4 of the Data Sheet.*

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5 (a) The average age of an Eminent Scholar is 47. Which type of staff has the youngest average age? *(1 mark)*

(b) Part of the age distribution of the staff at the University of Florida in 2006 is summarised in the table below.

Staff	Age					Total
	<40	**40 – 49**	**50 – 59**	**60 – 69**	**70+**	
Professor	2	13	31	19	1	66
Senior Lecturer	2	21	23	4	0	50

The cumulative frequency curve of the age distribution for Senior Lecturer is drawn on the answer sheet.

Draw the cumulative frequency curve of the age distribution for Professor on the same grid on the answer sheet.
Take the 70+ bracket to be 70 – 74. *(3 marks)*

(c) Use the cumulative frequency curves to compare the median ages for Senior Lecturer and Professor. *(3 marks)*

Turn over for the next question

SECTION D

Answer **all** questions.

*Use **Cambridge University** on page 4 of the Data Sheet.*

6 The data relating to the genders of UTOs are repeated below, together with a total row.

	Female	**Male**	**Total**
University Lecturer	153	362	515
Senior Lecturer	57	189	246
Reader	45	193	238
Professor	42	422	464
Total	297	1166	1463

(a) (i) Calculate the proportion of female UTOs who are professors.

(ii) Calculate the proportion of male UTOs who are professors.

(iii) Write down a brief comparison of these proportions. *(3 marks)*

(b) Calculate the number of UTOs required for a sample size 100 stratified by type and gender. Complete the table given on the answer sheet. *(4 marks)*

(c) Using the figures in the tables below, give calculations to show that UTOs up to 34 years make up 8.9 % of the total UTOs. *(4 marks)*

	Female	**Male**	**Total**
University Lecturer	153	362	515
Senior Lecturer	57	189	246
Reader	45	193	238
Professor	42	422	464
Total	297	1166	1463

Age	Percentage	
	Female	**Male**
Up to 34 years	14.8	7.4
35 – 44 years	37.4	28.2
45 – 54 years	27.9	31.7
55+	19.9	32.7

END OF QUESTIONS

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USING AND APPLYING STATISTICS   **6990/2FST**
Unit 10

FORMULAE AND STATISTICAL TABLES

6990/2FST

Formulae

When asked for a correlation coefficient, it is expected that you will use the statistical function on your calculator. However, if you wish, you may use the following formulae (or others that you know).

The product-moment correlation coefficient for bivariate data: $r = \dfrac{S_{xy}}{\sqrt{S_{xx}S_{yy}}}$
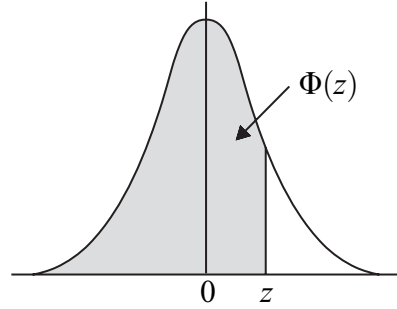
where $\qquad S_{xy} = \sum[(x_i - \bar{x})y_i]$

$\qquad\qquad S_{xx} = \sum[(x_i - \bar{x})x_i]$

$\qquad\qquad S_{yy} = \sum[(y_i - \bar{y})y_i]$

Normal Distribution

The tabulated value is $\Phi(z) = P(Z \leq z)$ where Z is the standardised normal random variable.

z	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5909	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.7	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999

END OF FORMULAE AND STATISTICAL TABLES

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Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

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USING AND APPLYING STATISTICS   **6990/2AS**
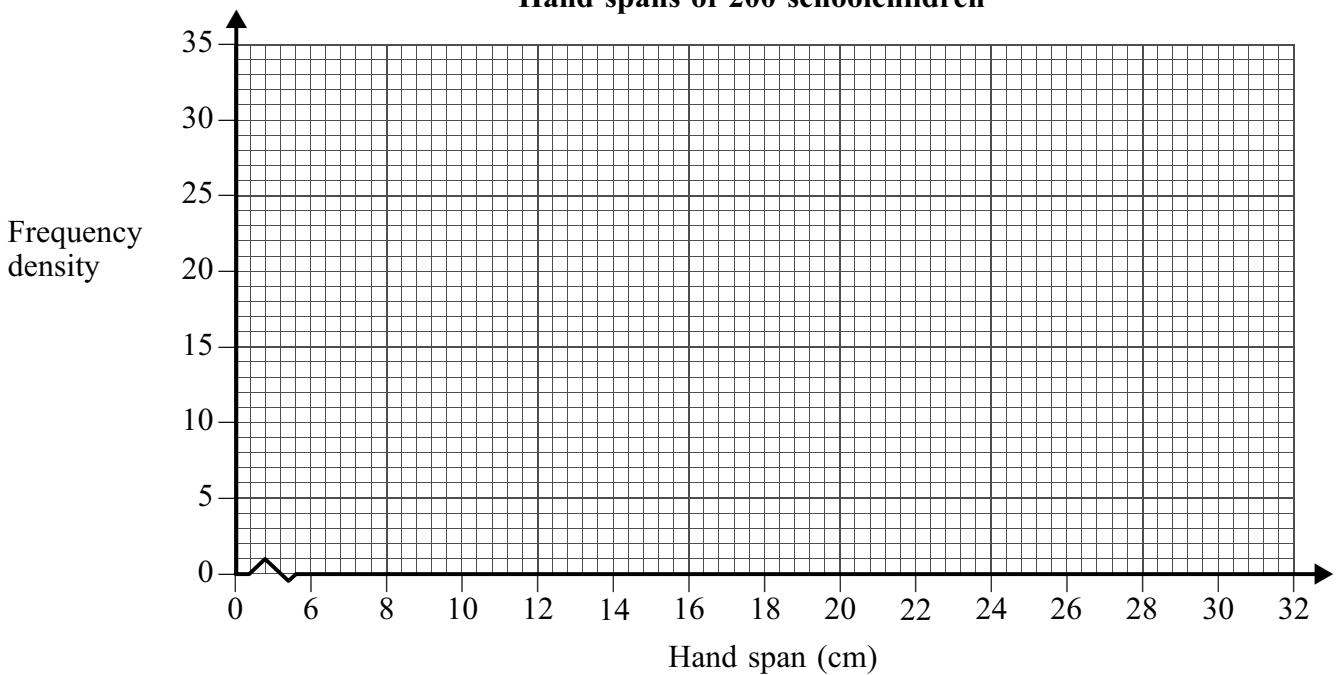**Unit 10**

AQA
ASSESSMENT and
QUALIFICATIONS
ALLIANCE

This answer sheet is to be used when answering Questions 2, 3, 4, 5 and 6 as indicated.

Fasten this sheet securely to your answer book.

This graph is to be used when answering Question 2(a)

Hand spans of 200 schoolchildren

6990/2AS

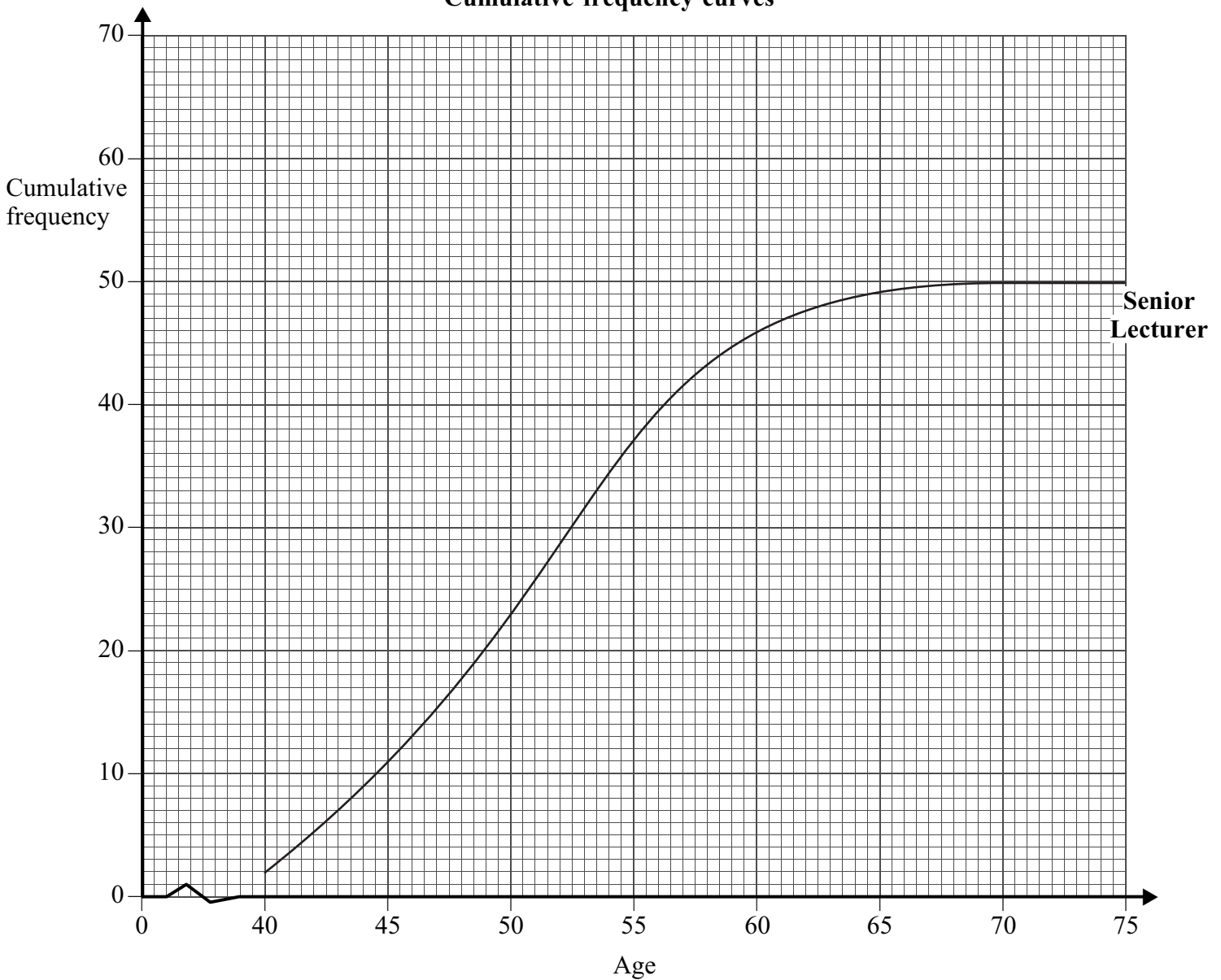**These graphs are to be used when answering Question 3 parts (b) and (d)**

Boys

Foot length (cm) vs Height (cm)

Girls

Foot length (cm) vs Height (cm)
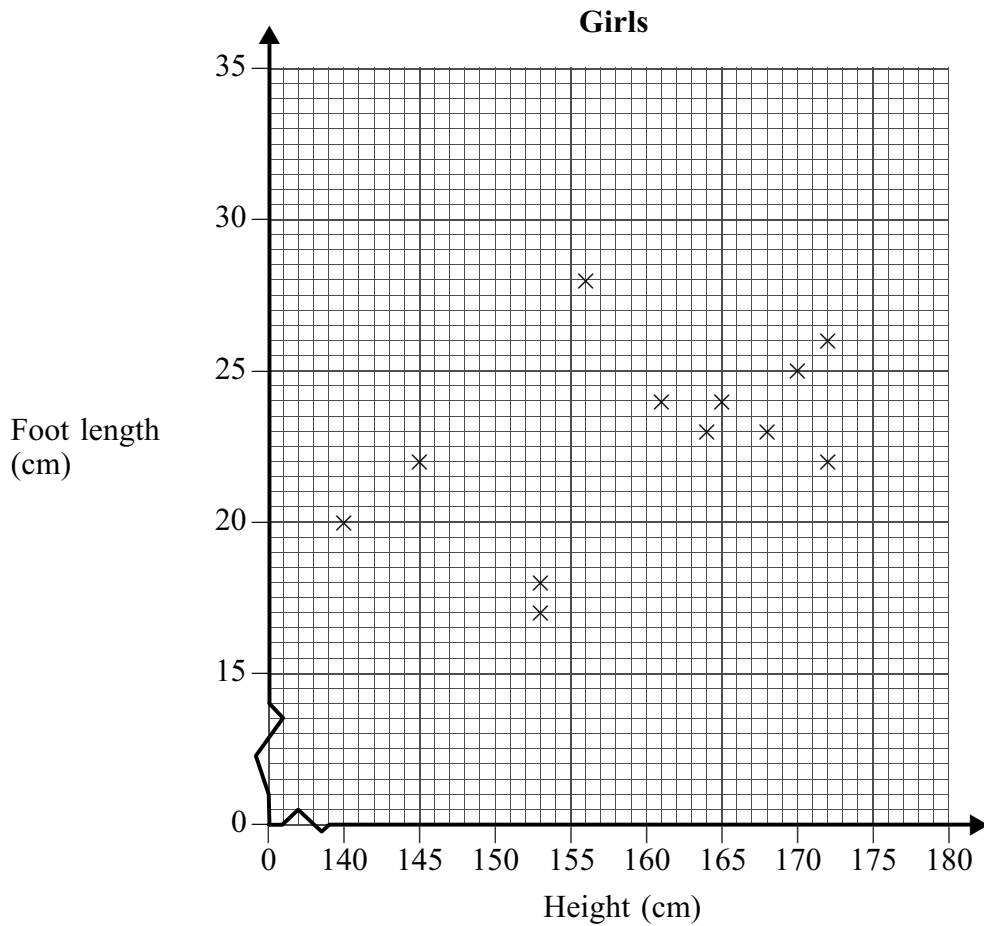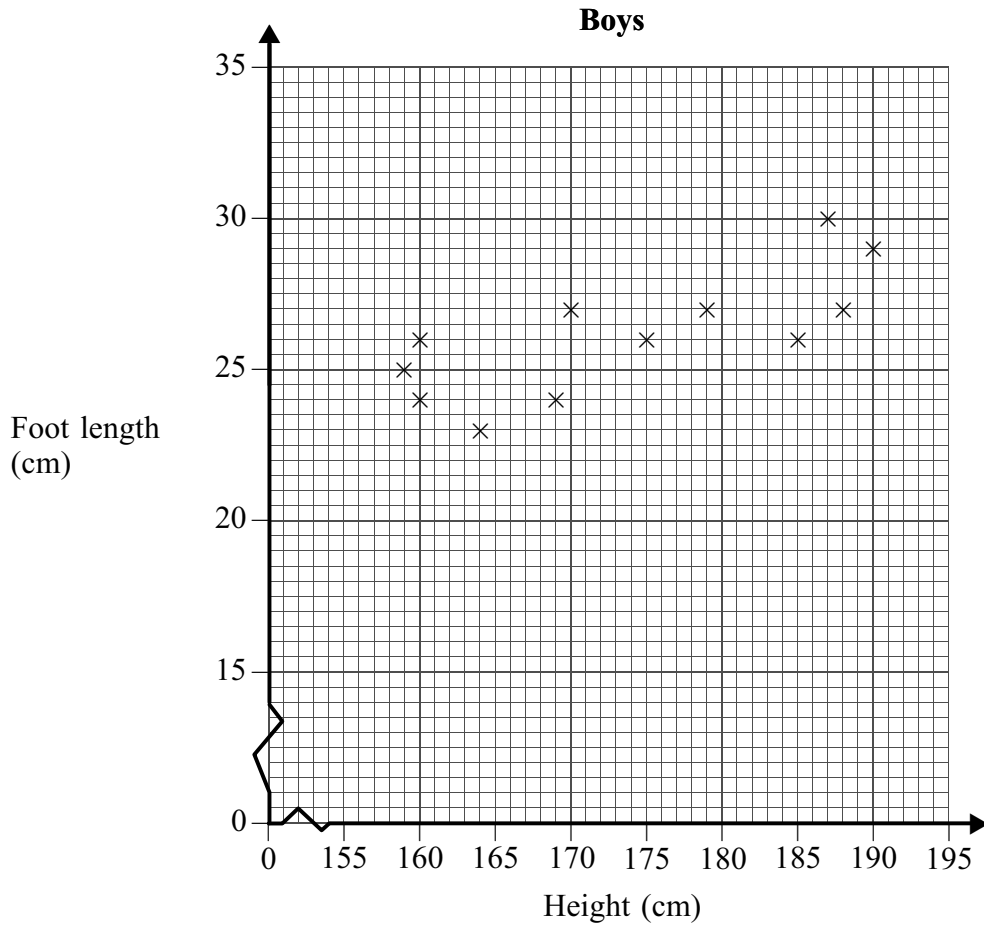
This table is to be used when answering Question 4(a)(i)

Wrist circumference	Mean	Standard deviation
Boys	170.25	13.8
Girls		

This graph is to be used when answering Question 5, parts (b) and (c)

Cumulative frequency curves

Turn over

Turn over ▶

This table is to be used when answering Question 6(b)

Stratified sample size 100

	Female	**Male**
University Lecturer		
Senior Lecturer		
Reader		
Professor		

END OF ANSWER SHEET