

General Certificate of Education  
June 2008  
Advanced Subsidiary Examination



**MATHEMATICS**  
**Unit Statistics 1B**

**MS/SS1B**

**STATISTICS**  
**Unit Statistics 1B**

Wednesday 21 May 2008 1.30 pm to 3.00 pm

**For this paper you must have:**

- an 8-page answer book
- the blue AQA booklet of formulae and statistical tables
- an insert for use in Question 3 (enclosed).

You may use a graphics calculator.

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. The *Examining Body* for this paper is AQA. The *Paper Reference* is MS/SS1B.
- Answer **all** questions.
- Show all necessary working; otherwise marks for method may be lost.
- The **final** answer to questions requiring the use of tables or calculators should normally be given to three significant figures.
- Fill in the boxes at the top of the insert.

**Information**

- The maximum mark for this paper is 75.
- The marks for questions are shown in brackets.
- Unit Statistics 1B has a **written paper only**.

**Advice**

- Unless stated otherwise, you may quote formulae, without proof, from the booklet.

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Answer **all** questions.

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- 1 The table shows the times taken,  $y$  minutes, for a wood glue to dry at different air temperatures,  $x$  °C.

$x$	10	12	15	18	20	22	25	28	30
$y$	42.9	40.6	38.5	35.4	33.0	30.7	28.0	25.3	22.6

- (a) Calculate the equation of the least squares regression line  $y = a + bx$ . (4 marks)
- (b) Estimate the time taken for the glue to dry when the air temperature is 21 °C. (2 marks)
- 2 A basket in a stationery store contains a total of 400 marker and highlighter pens. Of the marker pens, some are permanent and the rest are non-permanent. The colours and types of pen are shown in the table.

Type	Colour			
	Black	Blue	Red	Green
<b>Permanent marker</b>	44	66	32	18
<b>Non-permanent marker</b>	36	53	21	10
<b>Highlighter</b>	0	41	37	42

A pen is selected at random from the basket. Calculate the probability that it is:

- (a) a blue pen; (1 mark)
- (b) a marker pen; (2 marks)
- (c) a blue pen or a marker pen; (2 marks)
- (d) a green pen, given that it is a highlighter pen; (2 marks)
- (e) a non-permanent marker pen, given that it is a red pen. (2 marks)

3 [Figure 1, printed on the insert, is provided for use in this question.]

The table shows, for each of a sample of 12 handmade decorative ceramic plaques, the length,  $x$  millimetres, and the width,  $y$  millimetres.

Plaque	$x$	$y$
A	232	109
B	235	112
C	236	114
D	234	118
E	230	117
F	230	113
G	246	121
H	240	125
I	244	128
J	241	122
K	246	126
L	245	123

- (a) Calculate the value of the product moment correlation coefficient between  $x$  and  $y$ .  
(3 marks)
- (b) Interpret your value in the context of this question.  
(2 marks)
- (c) On **Figure 1**, complete the scatter diagram for these data.  
(3 marks)
- (d) In fact, the 6 plaques A, B, ..., F are from a different source to the 6 plaques G, H, ..., L.

With reference to your scatter diagram, **but without further calculations**, estimate the value of the product moment correlation coefficient between  $x$  and  $y$  for **each** source of plaque.  
(2 marks)

4 The runs scored by a cricketer in 11 innings during the 2006 season were as follows.

47 63 0 28 40 51  $a$  77 0 13 35

The exact value of  $a$  was unknown but it was greater than 100.

- (a) Calculate the median and the interquartile range of these 11 values. (4 marks)
- (b) Give a reason why, for these 11 values:
- (i) the mode is **not** an appropriate measure of average;
  - (ii) the range is **not** an appropriate measure of spread. (2 marks)

5 When a particular make of tennis ball is dropped from a vertical distance of 250 cm on to concrete, the height,  $X$  centimetres, to which it first bounces may be assumed to be normally distributed with a mean of 140 and a standard deviation of 2.5.

- (a) Determine:
- (i)  $P(X < 145)$ ; (3 marks)
  - (ii)  $P(138 < X < 142)$ . (4 marks)
- (b) Determine, to one decimal place, the maximum height exceeded by 85% of first bounces. (4 marks)
- (c) Determine the probability that, for a random sample of 4 first bounces, the mean height is greater than 139 cm. (4 marks)

6 For the adult population of the UK, 35 per cent of men and 29 per cent of women do not wear glasses or contact lenses.

- (a) Determine the probability that, in a random sample of 40 men:
- (i) at most 15 do not wear glasses or contact lenses; (3 marks)
  - (ii) more than 10 but fewer than 20 do not wear glasses or contact lenses. (3 marks)
- (b) Calculate the probability that, in a random sample of 10 women, exactly 3 do not wear glasses or contact lenses. (3 marks)
- (c) (i) Calculate the mean and the variance for the number who **do** wear glasses or contact lenses in a random sample of 20 women. (3 marks)
- (ii) The numbers wearing glasses or contact lenses in 10 groups, each of 20 women, had a mean of 16.5 and a variance of 2.50.

Comment on the claim that these 10 groups were **not** random samples. (3 marks)

7 Vernon, a service engineer, is expected to carry out a boiler service in one hour.

One hour is subtracted from each of his actual times, and the resulting differences,  $x$  minutes, for a random sample of 100 boiler services are summarised in the table.

Difference	Frequency
$-6 \leq x < -4$	4
$-4 \leq x < -2$	9
$-2 \leq x < 0$	13
$0 \leq x < 2$	27
$2 \leq x < 4$	21
$4 \leq x < 6$	15
$6 \leq x < 8$	7
$8 \leq x \leq 10$	4
<b>Total</b>	<b>100</b>

- (a) (i) Calculate estimates of the mean and the standard deviation of these differences. *(4 marks)*
- (ii) Hence deduce, in minutes, estimates of the mean and the standard deviation of Vernon's actual service times for this sample. *(3 marks)*
- (b) (i) Construct an approximate 98% confidence interval for the mean time taken by Vernon to carry out a boiler service. *(4 marks)*
- (ii) Give a reason why this confidence interval is approximate rather than exact. *(1 mark)*
- (c) Vernon claims that, more often than not, a boiler service takes more than an hour and that, on average, a boiler service takes much longer than an hour.
- Comment, with a justification, on **each** of these claims. *(2 marks)*

**END OF QUESTIONS**

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Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

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# Insert

Insert for use in **Question 3**.

Fill in the boxes at the top of this page.

Fasten this insert securely to your answer book.

**Turn over for Figure 1**

**Turn over ►**

Figure 1 (for use in Question 3)

## Decorative Plaques

