

Centre Number						Candidate Number				
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For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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7	
TOTAL	



General Certificate of Education  
Advanced Level Examination  
June 2015

# Mathematics

# MS2B

## Unit Statistics 2B

Friday 12 June 2015 9.00 am to 10.30 am

**For this paper you must have:**

- the blue AQA booklet of formulae and statistical tables.

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.
- 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.

### 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 5 M S 2 B 0 1

Answer **all** questions.

Answer each question in the space provided for that question.

**1** In a survey of the tideline along a beach, plastic bottles were found at a constant average rate of 280 per kilometre, and drinks cans were found at a constant average rate of 220 per kilometre. It may be assumed that these objects were distributed randomly and independently.

Calculate the probability that:

- (a) a 10 m length of tideline along this beach contains no more than 5 plastic bottles; **[2 marks]**
- (b) a 20 m length of tideline along this beach contains exactly 2 drinks cans; **[3 marks]**
- (c) a 30 m length of tideline along this beach contains a **total** of at least 12 but fewer than 18 of these two types of object. **[4 marks]**

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QUESTION  
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2 The continuous random variable  $X$  has probability density function defined by

$$f(x) = \begin{cases} \frac{1}{k} & a \leq x \leq b \\ 0 & \text{otherwise} \end{cases}$$

(a) Write down, in terms of  $a$  and  $b$ , the value of  $k$ .

[1 mark]

(b) (i) Given that  $E(X) = 1$  and  $\text{Var}(X) = 3$ , find the values of  $a$  and  $b$ .

[4 marks]

(ii) Four independent values of  $X$  are taken. Find the probability that exactly one of these four values is negative.

[3 marks]

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QUESTION  
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**3** A machine fills bags with frozen peas. Measurements taken over several weeks have shown that the standard deviation of the weights of the filled bags of peas has been 2.2 grams.

Following maintenance on the machine, a quality control inspector selected 8 bags of peas. The weights, in grams, of the bags were

910.4 908.7 907.2 913.2 905.6 911.1 909.5 907.9

It may be assumed that the bags constitute a random sample from a normal distribution.

**(a)** Giving the limits to **four** significant figures, calculate a 95% confidence interval for the mean weight of a bag of frozen peas filled by the machine following the maintenance:

**(i)** assuming that the standard deviation of the weights of the bags of peas is known to be 2.2 grams;

**[4 marks]**

**(ii)** assuming that the standard deviation of the weights of the bags of peas may no longer be 2.2 grams.

**[4 marks]**

**(b)** The weight printed on the bags of peas is 907 grams. One of the inspector's concerns is that bags should not be underweight.

Make **two** comments about this concern with regard to the data and your calculated confidence intervals.

**[2 marks]**

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**6** The continuous random variable  $X$  has the cumulative distribution function

$$F(x) = \begin{cases} 0 & x < 0 \\ \frac{1}{2}x - \frac{1}{16}x^2 & 0 \leq x \leq 4 \\ 1 & x > 4 \end{cases}$$

**(a)** Find the probability that  $X$  lies between 0.4 and 0.8 .

**[2 marks]**

**(b)** Show that the probability density function,  $f(x)$ , of  $X$  is given by

$$f(x) = \begin{cases} \frac{1}{2} - \frac{1}{8}x & 0 \leq x \leq 4 \\ 0 & \text{otherwise} \end{cases}$$

**[1 mark]**

**(c) (i)** Find the value of  $E(X)$  .

**[3 marks]**

**(ii)** Show that  $\text{Var}(X) = \frac{8}{9}$ .

**[4 marks]**

**(d)** The continuous random variable  $Y$  is defined by

$$Y = 3X - 2$$

Find the values of  $E(Y)$  and  $\text{Var}(Y)$  .

**[2 marks]**

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**END OF QUESTIONS**



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