General Certificate of Education
November 2004
Advanced Subsidiary Examination

MATHEMATICS (SPECIFICATION A)   **MAME**
Unit Methods

AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

Tuesday 2 November 2004   Morning Session

In addition to this paper you will require:
- an 8-page answer book;
- one sheet of graph paper for use in Question 4;
- a ruler;
- the AQA booklet of formulae and statistical tables.

You may use a standard scientific calculator **only**.

Time allowed: 1 hour 20 minutes

Instructions
- Use blue or black ink or 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 MAME.
- 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 tables or calculators should normally be given to three significant figures.
- Tie loosely any additional sheets you have used to the back of your answer book before handing it to the invigilator.

Information
- The maximum mark for this paper is 60.
- Mark allocations are shown in brackets.
- Additional sheets of graph paper are available on request.

Advice
- Unless stated otherwise, formulae may be quoted, without proof, from the booklet.

MAME

Answer **all** questions.

1   A straight line L has equation

$$3x - 4y = 12.$$

(a)   (i)   Write the equation of L in the form $y = mx + c$. *(1 mark)*

(ii)   Hence write down the gradient of the line L. *(1 mark)*

(b)   Find the equation of the straight line which passes through the origin and is perpendicular to the line L. *(2 marks)*

2   The probability distribution of a random variable X is given in the table below.

x	2	4	6	8
P(X=x)	0.25	0.35	0.25	0.15

Calculate the mean and variance of X. *(4 marks)*

3   Write each of the following as a power of 4:

(a)   64; *(1 mark)*

(b) $\dfrac{1}{64}$; *(1 mark)*

(c)   128; *(1 mark)*

(d) $\sqrt{2}$. *(1 mark)*

4   [A sheet of 2 mm graph paper is provided for use in answering this question.]

A survey of the weights of 100 babies born in a hospital gave the following results.

Weight (pounds)	$0-2$	$2-4$	$4-5$	$5-6$	$6-7$	$7-12$	$12-$
Frequency	0	8	18	24	20	30	0

(a)   Draw, on the graph paper, a histogram to illustrate this distribution. *(3 marks)*

(b)   Calculate estimates of the mean and the variance of the weights of the babies. *(5 marks)*

5 Jane is an athlete in training for a major event.

Every evening she does either a 5-mile run or a 10-mile run.

On a given day Jane does a full day's work with probability $\frac{2}{3}$.

When she has done a full day's work, the probability that she does a 10-mile run is $\frac{2}{5}$.

When she has **not** done a full day's work, the probability that she does a 10-mile run is $\frac{4}{5}$.

(a) For a random day, calculate the probability that:

  (i) she does a full day's work and a 10-mile run;   *(2 marks)*

  (ii) she does **not** do a full day's work but she does a 10-mile run;   *(2 marks)*

  (iii) she does a 10-mile run.   *(1 mark)*

(b) Given that she does a 10-mile run, find the conditional probability that she has done a full day's work.   *(2 marks)*

6 (a) Write the expression

$$x^2 - 12x + 40$$

in the form

$$(x + A)^2 + B.$$ *(2 marks)*

(b) Hence, or otherwise, write the expression

$$2x^2 - 24x + 81$$

in the form

$$2(x + A)^2 + C.$$ *(2 marks)*

(c) Explain briefly why

$$2x^2 - 24x + 81 > 0$$

for all values of x.   *(2 marks)*

Turn over ▶

7 A trader buys 200 items and sells them at a profit.

He pays £10 for each item, but varies the price at which he sells the items.

His selling prices, £x per item, are such that

$$\sum x = 2220, \quad \sum x^2 = 24\,660\,.$$

(a) (i) Calculate the mean selling price of the 200 items. *(2 marks)*

(ii) Show that the standard deviation of these selling prices is £0.30. *(3 marks)*

(b) Hence find the mean and the standard deviation of the trader's profit per item.

(2 marks)

(c) The trader buys 10 further items for £10 each, but is unable to sell them and has to destroy them.

Show that the standard deviation of the trader's profit on the 210 items is approximately £2.38 per item. *(3 marks)*

8 The diagram shows the graph of $y = f(x)$, where

$$f(x) = x^3 - 4x^2 + x + 6.$$
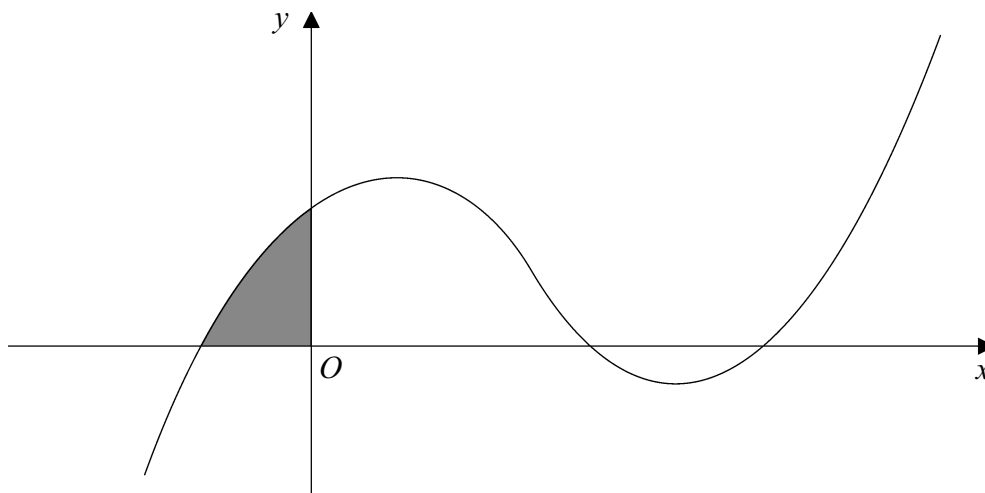
(a) (i) Show that $f(-1) = 0$. *(1 mark)*

(ii) Hence write down a factor of $f(x)$. *(1 mark)*

(iii) Express $f(x)$ as a product of three linear factors. *(4 marks)*

(b) (i) Find $\int (x^3 - 4x^2 + x + 6)\,dx$. *(3 marks)*

(ii) Hence calculate the area of the shaded region on the diagram above. *(3 marks)*

(c) (i) Differentiate $f(x)$ to obtain $f'(x)$. *(2 marks)*

(ii) Hence find the x-coordinates of the two stationary points on the graph of $y = f(x)$. Give your answers in the form $a + b\sqrt{13}$. *(3 marks)*

END OF QUESTIONS