INTERNATIONAL BACCALAUREATE
BACCALAURÉAT INTERNATIONAL
BACHILLERATO INTERNACIONAL

MARKSCHEME

May 2000

MATHEMATICAL STUDIES

Standard Level

Paper 1

11 pages

Paper 1 Markscheme

Instructions to Examiners

1 Method of Marking

(a) All marking must be done using a **red** pen.

(b) In this paper, the maximum mark is awarded for a **correct answer**, irrespective of the method used. Thus, if the correct answer appears in the answer box, award the maximum mark and move onto the next question; in this case there is no need to check the method.

(c) If an **answer is wrong**, then marks should be awarded for the method according to the markscheme. (A correct answer incorrectly transferred to the answer box is awarded the maximum mark.)

2 Abbreviations

The markscheme may make use of the following abbreviations:

M Marks awarded for **Method**

A Marks awarded for an **Answer** or for **Accuracy**

C Marks awarded for **Correct** answers (irrespective of working shown)

R Marks awarded for clear **Reasoning**

AG **Answer Given** in the question and consequently marks are **not** awarded

3 Follow Through (ft) Marks

Errors made at any step of a solution can affect all working that follows. To limit the severity of the penalty, **follow through (ft)** marks should be awarded. The procedures for awarding these marks require that all examiners:

(i) penalise the error when it **first occurs**;

(ii) **accept the incorrect answer** as the appropriate value or quantity to be used in all subsequent working;

(iii) award ***M*** marks for a correct method and ***A*(ft)** marks if the subsequent working contains no further errors.

Follow through procedures may be applied repeatedly throughout the same problem.

The errors made by a candidate may be: arithmetical errors; errors in algebraic manipulation; errors in geometrical representation; use of an incorrect formula; errors in conceptual understanding.

The following illustrates a use of the **follow through** procedure.

Markscheme		Candidate's Script	Marking	
\$ 600 × 1.02	***M1***	Amount earned = \$ 600 × 1.02	8	***M1***
= \$ 612	***A1***	= \$ 602	×	***A0***
\$ (306 × 1.02) + (306 × 1.04)	***M1***	Amount = 301 × 1.02 + 301 × 1.04	8	***M1***
= \$ 630.36	***A1***	= \$ 620.06	8	***A1*(ft)**

Note that the candidate made an arithmetical error at line 2; the candidate used a correct method at lines 3, 4; the candidate's working at lines 3, 4 is correct.

However, if a question is transformed by an error into a **different, much simpler question** then:

(i) **fewer** marks should be awarded at the discretion of the Examiner;

(ii) marks awarded should be followed by '**(d)**' (to indicate that these marks have been awarded at the **discretion** of the Examiner);

(iii) a brief **note** should be written on the script explaining **how** these marks have been awarded.

4 Using the Markscheme

(a) This markscheme presents a particular way in which each question may be worked and how it should be marked. **Alternative methods** have not always been included. Where alternative methods are included, they often refer to graphic display calculator solutions, and they are indicated by **OR**, *e.g.*

Mean = 59 ***(G2)***

OR

Mean = 7820/134 ***(M1)***
= 59 ***(A1)***

Thus, if an answer is wrong then the working must be carefully analysed in order that marks are awarded for a different method in a manner which is consistent with the markscheme.

In this case:

(i) a mark should be awarded followed by '**(d)**' (to indicate that the marks have been awarded at the **discretion** of the Examiner);

(ii) a brief **note** should be written on the script explaining **how** these marks have been awarded.

(b) Unless the question specifies otherwise, accept **equivalent forms**. For example: $\frac{\sin\theta}{\cos\theta}$ for $\tan\theta$.

(c) As this is an international examination, all **alternative forms of notation** should be accepted. For example: 1.7 , 1·7 , 1,7 ; different forms of vector notation such as $\vec{u}$, $\bar{u}$, $\underline{u}$; $\tan^{-1}x$ for arctan *x*.

5 Accuracy of Answers

(a) In the case when the accuracy of the answer is **specified in the question** (for example: "find the size of angle *A* to the nearest degree") the maximum mark is awarded **only if** the correct answer is given to the accuracy required.

(b) When the accuracy is **not** specified in the question, then the general rule applies:

> *Unless otherwise stated in the question, all numerical answers must be given exactly or to three significant figures as appropriate.*

In this case, the candidate is **penalised once only IN THE PAPER** for giving a correct answer to the wrong degree of accuracy. Hence, on the **first** occasion in the paper when a correct answer is given to the wrong degree of accuracy maximum marks are **not** awarded, but on **all subsequent occasions** when correct answers are given to the wrong degree of accuracy then maximum marks **are** awarded.

6 Graphic Display Calculators

Many candidates will be obtaining solutions directly from their calculators, often without showing any working. They have been advised that they must use mathematical notation, not calculator commands when explaining what they are doing. Incorrect answers without working will receive no marks. However, if there is written evidence of using a graphic display calculator correctly, method marks may be awarded. Where possible, examples will be provided to guide examiners in awarding these method marks.

1. (a) $mn = 6.0 \times 2.4 \times 10^{-2}$ ***(M1)***

$= 14.4 \times 10^{-2}$

$= (1.44 \times 10^{1}) \times 10^{-2}$

$= 1.44 \times 10^{-1}$ ***(A1)***

(b) $\frac{m}{n} = \frac{6.0}{2.4} \times 10^{8}$ ***(M1)***

$= 2.5 \times 10^{8}$ ***(A1)***

Total [4 marks]

2. (a) $(x+2)(x-4)$ ***(A1)***

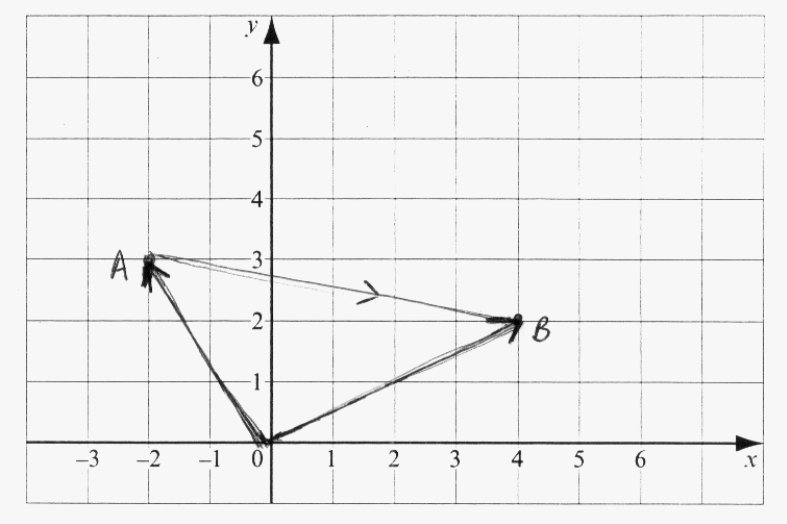
(b) (i) $(-2, 0)$ ***(A1)***

(ii) $(1, -9)$ ***(A1)(A1)***

Total [4 marks]

3. (a) (i) ***(A1)(A1)***

(ii) ***(A1)***



Note:	Award ***(A1)*** for each **directed** vector.

(b) $\begin{bmatrix} 6 \\ -1 \end{bmatrix}$ ***(A1)***

Total [4 marks]

4. (a) Award **(A1)** each for any two of the following:

Good music students go to good universities.
Good mathematics students get good jobs.
Good music students get good jobs. ***(A2)***

(b) (i) There is a good music student who is not a good mathematics student. ***(A1)***

(ii) Good mathematics students go to good universities and students who go to good universities get good jobs. ***(A1)***
OR
Good mathematics students get good jobs. ***(A1)***

Total [4 marks]

5. (a) $y = -x + 2$ or $x + y = 2$ or $x + y - 2 = 0$ ***(A1)***

(b) Midpoint M: $\left(\frac{0+2}{2}, \frac{2+0}{2}\right) = (1, 1)$ ***(M1)***

gradient $= 1$ ***(A1)***

$1 = 1(1) + (b) \Rightarrow b = 0$

$y = x$ ***(A1)***

Total [4 marks]

6. (a) $c = 0.10k + 1.40$ ***(A1)***

(b) (i) $c = 0.10(7) + 1.40$ (allow follow through from part (a))
$= 0.70 + 1.40$ ***(A1)***
$= 2.10\ \$$

(ii) $2.40 = 0.10k + 1.40$ (allow follow through from part (a))
$1.00 = 0.10k$ ***(M1)***
$10 = k$
10 km ***(A1)***

Total [4 marks]

7. (a) Let the population at the end of 1999 be x.

$$\frac{44100}{x} = \frac{x}{40000}$$

$x = 42000$ ***(A1)***

(b) $r = \frac{44100}{42000}$ ***(M1)***

$r = 1.05$

$u_n = u_1 r^{n-1}$ ***(M1)***

$44100 = u_1 (1.05)^6$

$u_1 = 32908$ (or 32900 to 3 s.f.) ***(A1)***

Total [4 marks]

8. (a) $l = \sqrt{8^2 + 8^2}$ ***(M1)***

$= \sqrt{128}$

$= 11.3$ (3 s.f.) ***(A1)***

(b) $L = \sqrt{\sqrt{128^2} + 8^2}$ **OR** $L = \sqrt{11.3^2 + 8^2}$ (allow ft from (a)) ***(M1)***

$= \sqrt{128 + 64}$ **OR** $= \sqrt{127.69} + 64$

$= 13.9$ (3 s.f.) **OR** $= 13.8$ (3 s.f.) ***(A1)***

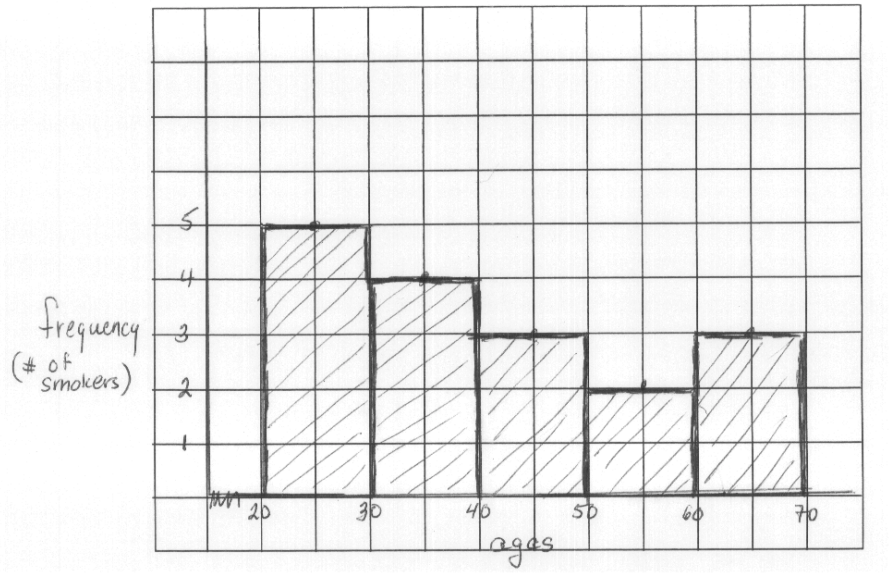
Total [4 marks]

9. (a) $\text{mean} = \dfrac{(25)5+(35)4+(45)3+(55)2+(65)3}{17}$ ***(M1)***

Note: Award ***(M1)*** for using mid-interval values.

$\text{mean} = 41.5$ ***(A1)***

(b)



(A2)

Note: Award ***(A1)*** for correct intervals, ***(A1)*** for correct bar lengths

Total [4 marks]

10. (a) $\dfrac{40\times 6}{360} = \dfrac{240}{360}$ or $\dfrac{2}{3}$ or 0.667 (3 s.f.) ***(A1)***

(b) $\dfrac{2\times 20}{360} = \dfrac{40}{360}$ or $\dfrac{1}{9}$ or 0.111 (3 s.f.) ***(A1)***

(c) $\dfrac{3\times 20}{120} = \dfrac{60}{120}$ or $\dfrac{1}{2}$ or 0.5 ***(A1)***

(d) $\dfrac{100}{360} = \dfrac{5}{18}$ or 0.278 (3 s.f.) ***(A1)***

Total [4 marks]

11. (a) III ***(A1)***

(b) I ***(A1)***

(c) II ***(A1)***

(d) IV ***(A1)***

Total [4 marks]

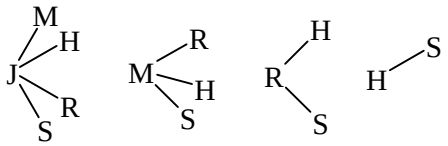
12. (a) $I = \frac{10000 \times 5 \times 28}{100}$ ***(M1)***

$= 14000$ CHF ***(A1)***

(b) $I = 10000(1.05)^{28} - 10000$ ***(M1)***

$= 29201.29$ CHF (or 29200 CHF to 3 s.f.) ***(A1)***

[Total 4 marks]

13. (a)  ***(M1)***

Note:	Award ***(M1)*** for any reasonable counting method.

10 combinations ***(A1)***

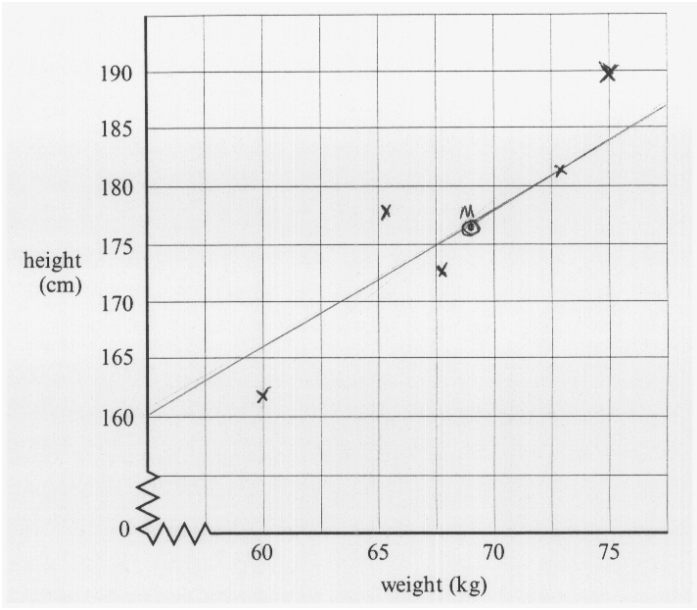
(b) $\frac{1}{10}$ (allow follow through from part (a)) ***(A2)***

Total [4 marks]

14. (a) (i) $\frac{182+173+162+178+190}{5} = 177 \text{ cm}$ ***(A1)***

(ii) $\frac{73+68+60+66+75}{5} = 68.4 \text{ kg}$ ***(A1)***

(b)



(A1)(A1)

Note: Award ***(A1)*** for at least 3 points plotted correctly;
(A1) for a line of best fit through $(68.4, 177)$

Total [4 marks]

15. (a) (i) 0.5 ***(A1)***

(ii) 720° ***(A1)***

(b)

x	y
90°	-1
180°	2

(A1)

(A1)

Total [4 marks]