Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/61**

Paper 6 (Extended) **May/June 2019**

MARK SCHEME

Maximum Mark: 40

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2019 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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MARK SCHEME NOTES

The following notes are intended to aid interpretation of mark schemes in general, but individual mark schemes may include marks awarded for specific reasons outside the scope of these notes.

Types of mark

M Method marks, awarded for a valid method applied to the problem.

A Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. For accuracy marks to be given, the associated Method mark must be earned or implied.

B Mark for a correct result or statement independent of Method marks.

When a part of a question has two or more 'method' steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. The notation '**dep**' is used to indicate that a particular M or B mark is dependent on an earlier mark in the scheme.

Abbreviations

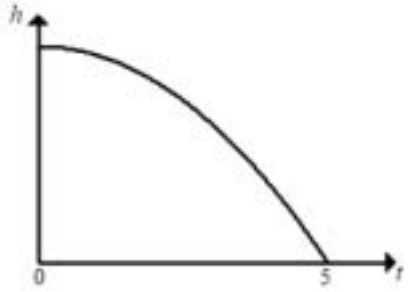
awrt	answers which round to
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
nfww	not from wrong working
oe	or equivalent
rot	rounded or truncated
SC	Special Case
soi	seen or implied

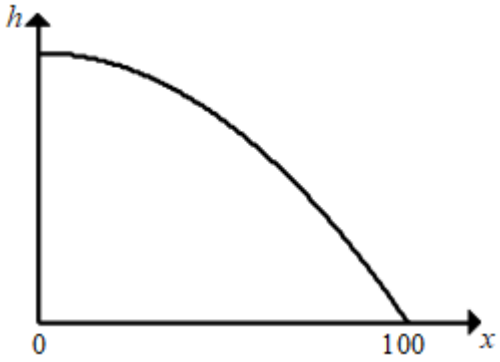
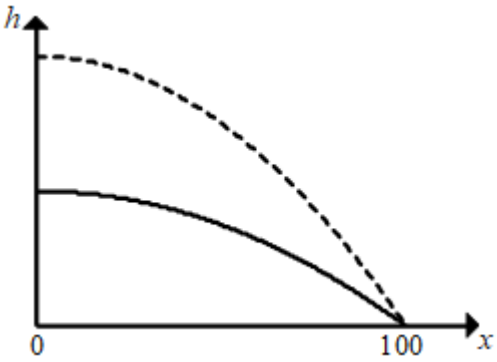
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Question	Answer	Marks	Partial Marks
A	INVESTIGATION GAMES IN A COMPETITION		
1(a)(i)	8	**1**	
1(a)(ii)	5	**1**	**C** opportunity
1(a)(iii)	128	**1**	**C** opportunity
1(b)	r: 1 2 3 4 5 6 7 8 t: 2 4 8 16 32 64 128 256	**1**	
1(c)(i)	$[t =]\ 2^r$ oe	**1**	**C** opportunities
1(c)(ii)	32 768	**1**	**FT** *their* **(c)(i)** provided it is a power of 2
2(a)(i)	5	**1**	**C** opportunity
2(a)(ii)	24	**2**	**B1** for 1st round = 9 games oe soi **C** opportunity
2(b)	35	**1**	**C** opportunity
2(c)	Number of games = number of teams – 1 oe	**1**	
3(a)	n: 2 3 4 5 6 7 8 g: 1 3 6 10 15 21 28	**1**	**C** opportunity
3(b)	$g = \frac{1}{2}n^2 - \frac{1}{2}n$ oe	**2**	**B1** for $\frac{1}{2}n^2$ or for $-\frac{1}{2}n$ or for both $a = \frac{1}{2}$ and $b = -\frac{1}{2}$ **C** opportunity
3(c)	$\frac{1}{2}\times 8^2 - \frac{1}{2}\times 8 = 28$ seen	**1**	
4	Correct completion of table	**2**	**B1** for EF and correct week 2 **B1** for correct week 3
5(a)	Correct values	**1**	
5(b)	[Teams =] 4 [*Knock-Out* games =] 3 [*League* games =] 6	**1**	**C** opportunity

Question	Answer	Marks	Partial Marks
Communication: seen in five of the following questions		**1**	
1(a)(ii)	32 16 8 4 2 oe or $\log_2 32$ or 2^5 seen or a diagram e.g. a tree showing the game and rounds seen		
1(a)(iii)	32 64 128 seen or for 2^7 seen		
1(c)(i)	For showing 2^r satisfies at least two (r, t) pairs or for stating it is geometric with ratio 2 and first term 2		
1(c)(i)	t = some function of r seen		
2(a)(i) or 2(a)(ii)	25 16 8 4 2 or 18 16 8 4 2 or 4 + 1 or a diagram, e.g. a tree showing the games and rounds or 9 8 4 2 1 or $\frac{18}{2}$ $\frac{16}{2}$ $\frac{8}{2}$ $\frac{4}{2}$ $\frac{2}{2}$ seen		
2(b)	Any relevant list to find the 35 (teams) 36 32 16 8 4 2 or 8 32 16 8 4 2 seen or (games) 4 16 8 4 2 1 or 18 9 1 4 2 1 seen or a diagram e.g. a tree showing the games and rounds		
3(a)	Either three first differences in the sequence: 2, 3, 4, 5, 6, 7 or description of how the sequence increases in words or at least 3 calculations or a list for 4, 5, 6 or 7 teams (order does not matter) or a connected diagram with arcs and vertices appropriate labelling of vertices that clearly shows all possible connected pairs for e.g. 4 (or more) teams or a list of letters with appropriate and clear connections that clearly shows all possible connections between pairs of letters for e.g. 4 (or more) teams		
3(b)	Two correct equations in a and b or two rows of differences to obtain 1s and the sequence $-0.5, -1, -1.5, -2...$ found with differences of -0.5 or two rows of differences to obtain 1s and an equation for b		
5(b)	Correct quadratic equation or table of values with at least 2 columns		

THROWING STONES

Question	Answer	Marks	Partial Marks
B	MODELLING THROWING STONES		
6(a)	$h = 122.5 - 4.9t^2$ mark final answer	**1**	
6(b)	Correct sketch 	**1**	**C** opportunity
6(c)	5	**1**	
6(d)(i)	m/s oe	**1**	
6(d)(ii)	100	**1**	**FT** 20 × *their* 5
6(e)(i)	$h = 122.5 - 4.9\left(\frac{x}{20}\right)^2$ and correct completion to given answer or substitution of $t = \frac{x}{v}$ and rearrangement to $hv^2 = 122.5v^2 - 4.9x^2$ and correct completion to given answer or $400h = 49\,000 - 4.9(20^2 t^2)$ and correct completion to $h = 122.5 - 4.9t^2$ or for example, substitutes $t = \frac{x}{20}$ to obtain e.g. $h = 122.5 - 4.9\left(\frac{x}{20}\right)^2$ and shows that e.g. $h = \frac{49000}{400} - \frac{4.9x^2}{400} = 122.5 - 4.9\left(\frac{x}{20}\right)^2$	**2**	**B1** for $t = \frac{x}{20}$ soi or $x^2 = (20t)^2$ soi or substitution of $t = \frac{x}{v}$ and rearrangement to $hv^2 = 122.5v^2 - 4.9x^2$

Question	Answer	Marks	Partial Marks
6(e)(ii)	Correct sketch  	**1**	**C** opportunity
7(a)	61.25	**1**	**C** opportunity
7(b)	Correct sketch  	**1**	**FT** *their* x-intercept from **6(e)(ii)**
7(c)	3.5 to 3.534	**1**	**C** opportunity
8(a)	1.6 oe	**2**	**B1** for substitution of $h = 0$ and $x = 50$ in $h = 122.5 - 4.9\left(\frac{kx}{16}\right)^2$ at some stage **C** opportunity
8(b)	37.7 to 38	**2**	**FT** $\frac{100}{\sqrt{3.125(their\,k)^2 - 1}}$ for $k > 0.565685\ldots$ **B1 FT** for sketch or models equated, **FT** *their* k **C** opportunities

Question	Answer	Marks	Partial Marks
8(c)	45.8 to 46 mark final answer	**3**	**B2** for 15 to 15.5 as final answer or **M2** for 61.25 – 15.3125 oe or **B1** for use of $h = 0$ and $x = 50$ or $h = 61.25 - \frac{4.9(50)^2}{800}$ or sketch with 61.25 and 50 indicated **C** opportunity
8(d)	14.1 to 14.14214 mark final answer	**1**	
Communication: seen in three of the following questions		**1**	
6(b) or 6(e)(ii)	h-intercept at 122.5 seen or implied by scale or vertical axis labelled as 400h and h-intercept at 49 000 seen or implied by scale		
7(a)	correct units		
7(c)	correct units		
8(a)	Further correct or correct FT working after substitution of $h = 0$ and $x = 50$ or a correct rearrangement of the given model: $h = 122.5 - 4.9\left(\frac{kx}{16}\right)^2$; may have substituted $x = 50$ or $h = 0$		
8(b)	Sketch with x-coordinate of the crossing point identified as being the point from which the solution is obtained or correct next working step after models equated		