General Certificate of Education (A-level)
June 2013

Use of Mathematics (Pilot)   **USE1**

(Specification 9361)

Algebra

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Key to mark scheme abbreviations

M	mark is for method
m or dM	mark is dependent on one or more M marks and is for method
A	mark is dependent on M or m marks and is for accuracy
B	mark is independent of M or m marks and is for method and accuracy
E	mark is for explanation
√or ft or F	follow through from previous incorrect result
CAO	correct answer only
CSO	correct solution only
AWFW	anything which falls within
AWRT	anything which rounds to
ACF	any correct form
AG	answer given
SC	special case
OE	or equivalent
A2,1	2 or 1 (or 0) accuracy marks
$-x$ EE	deduct x marks for each error
NMS	no method shown
PI	possibly implied
SCA	substantially correct approach
c	candidate
sf	significant figure(s)
dp	decimal place(s)

No Method Shown

Where the question specifically requires a particular method to be used, we must usually see evidence of use of this method for any marks to be awarded.

Where the answer can be reasonably obtained without showing working and it is very unlikely that the correct answer can be obtained by using an incorrect method, we must award **full marks**. However, the obvious penalty to candidates showing no working is that incorrect answers, however close, earn **no marks**.

Where a question asks the candidate to state or write down a result, no method need be shown for full marks.

Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

Otherwise we require evidence of a correct method for any marks to be awarded.

Question	Solution	Marks	Total	Comments
1(a)	64, 144, 256, 400	B1	1	
(b)(i)	3 points correct and line	B1		1 ruled line up to 1mm thick
	all correct ± 2 mm	B1	2	At least from T^2=0 to 400
(b)(ii)	b = 1.2 to 1.5 (= graph intercept)	B1		Allow substitution to find a if a point <u>on the line</u> is used.
	evidence of measurements of " Δx and Δy"	M1		If a and b are transposed or not assigned B0M1A0 max.
	a = 0.018 to 0.025	A1	3	NMS: If b matches the graph and a is in the range B1M1A1but if b does not match graph B0M0A0
(c)	$M = 0.021(32^2) + 1.3$	M1		Allow use of 'their' a and b if working is seen <u>or</u> if their a and b are both in the acceptable range
	22.8	A1 ft	2	Only FT if M is less than or equal to 100
(d)	Percentage share cannot exceed 100	B1	1	"It would probably stop increasing after a while" B0
				General comment on extrapolation B0
	Total		**9**	
2(a)	Increasing, curved the right way.	B1		Ignore anything drawn for $x < 0$. Condone a flattish bit near the y-axis but must be strictly non-decreasing, must be a function.
	y-intercept = 4000	B1	2	
(b)(i)	$4000 \times e^{(0.034 \times 6)}$	M1		0.204 seen and a <u>power</u> of e seen: M1
	4910	A1	2	Accept any integer in the range [4900,4910] for M1A1 but any decimal in same range M1A0
(b)(ii)	$\left(8000 = 4000 \times e^{0.034t}\right)$			
	$2 = e^{0.034t}$	M1		For taking logs correctly
	$0.034t = \ln 2$	M1		
	20.4 (hours) AWRT	A1	3	Accept 20, 20.3 or 21 with working.
				Trial and improvement methods give 3 marks for 20.4, or 2 marks for 20 or 21.
				NMS AWRT 20.4, 20hours 24mins,20 hours,23mins score M1M1A1 but anything else scores zero.
	Total		**7**	

Question	Solution	Marks	Total	Comments
3(a)(i)	1.89, 1.92, 1.65, 1.08, 0.21, -0.96	B1 B1	 2	4 or 5 values all values correct
(a)(ii)	Inverted quadratic shape Completely correct, including scale and curve.	B1 B1	 2	 ± 2 mm ft from (i) if correct shape
(a)(iii)	A value from 3.7 to 3.9	B1	1	consistent with their graph
(b)(i)	1.944 (m)(or 1.94)	B1	1	From graph or symmetry Accept 1.9 to 2.0
(b)(ii)	1.8	B1	1	cao
(c)	$p = 1.8$ q = max. value of y = 1.944 (or 1.94)	B1 ft M1 A1cao	 3	Alternative method $q-0.6(p-x)^2 \equiv 0.6x(3.6-x)$ $q-0.6(p^2-2px+x^2) \equiv 2.16x-0.6x^2$ M1 $1.2px=2.16x \Rightarrow p=1.8$ A1 $q-0.6p^2=0 \Rightarrow q=1.944$ A1 Attempt to complete square with answers p=1.8 and q=3.24 scores B1M1A0
(d)	a=2.4 2.7=k(1.2)(1.2) k=1.875 or 1.8	B1 B1	 2	 2.7=k(1.2)(a-1.2) does not in itself gain any marks
	Total		**12**	
4(a)	102.6, 99.6, 97.7, 97(.0)	B1	1	Condone 97
(b)	Correct graph(FT from (a))	B2	2	± 2 mm 1 or 2 errors B1 No curve drawn or straight line drawn counts as one error
(c)(i)	Drawing a tangent (anywhere) -18	M1 A1	 2	 allow -15 to -25 positive gradient; max M1A0 NMS: M1A1 if answer in range, M0A0 if answer not in range
(c)(ii)	Billions (of pounds) per year	B1	1	
(c)(iii)	decreasing by this amount per year	B1	1	Mention of decreasing/reducing etc. needed
(d)	Translation	B1		Not shift, slide etc.
	$\begin{pmatrix} 0 \\ 106 \end{pmatrix}$	B1	2	Must use vector Extra transformation B1B0
(e)(i)	107	B1	1	
(e)(ii)	Max occurs when $\dfrac{180(t-1.6)}{1.2}=180$ $t = 2.8$	 B1 B1	 2	Correct answer gives full marks, however found. Answers transposed B0B1B1
	Total		**12**	
	Total for paper		**40**	