General Certificate of Education (A-level)
June 2013

Use of Mathematics (Pilot)   **USE3**

(Specification 9362)

Mathematical Comprehension

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.

Free-Standing Mathematics Qualification
Mathematical Comprehension: Pilot USE 3 – Answers and Marking Scheme
June 2013

Q	Solution	Marks	Total	Comments
1	The area under the line of equality	B2	2	B1 for mention of area, B1 under straight line
	Total		**2**	
2(a)	$A = \frac{1}{2} \times h\left[(y_o + y_5) + 2(y_1 + y_2 + y_3 + y_4)\right]$	M1		
	$A = \frac{1}{2} \times 0.2$			
	$\left[(0+1) + 2(0.08 + 0.19 + 0.34 + 0.55)\right]$	A1		
	$= 0.332$	A1		
	$G = 1 - (2 \times 0.332)$	M1		
	$= 0.336$	A1ft	5	
(b)	This means that wealth is distributed more equally in India than in the UK	B1ft	1	
	Total		**6**	
3	$A = \int_0^1 (1.04x^3 - 0.38x^2 + 0.34x)\mathrm{d}x$	B1		
	$= \left[\frac{1.04x^4}{4} - \frac{0.38x^3}{3} + \frac{0.34x^2}{2}\right]_0^1$	M1 A1		
	$= \frac{1.04}{4} - \frac{0.38}{3} + \frac{0.34}{2}$			
	$= 0.303$	A1		
	$G = 1 - 2 \times 0.303$	M1		
	$= 0.393$	A1	6	
	Total		**6**	
4	This point represents where the total wealth of the society is owned by the total membership of the society	B2	2	B1 for mention of total or total population without the other.
	Total		**2**	
5(a)	[Lorenz curve diagram]	B2	2	B1 for correct lines indicated and B1 for correct shading
(b)	Almost all of the wealth of the country is owned by very few people (alternatively almost everyone has none of the wealth)	B2	2	B1 for all people or all wealth but not the other
	Total		**4**	
6(a)	$0.5 - 0.25 = 0.25 = 25\%$	M1 A1	2	Accept 0.24 -0.26
(b)	Gradient = 1 So increase in proportion of wealth = increase in proportion of population	B1 B1	2	
	Total		**4**	

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Q	Solution	Marks	Total	Comments
7(a)	$p'(x) = 5.58x^2 - 2.68x + 0.48$ $q'(x) = 1.38x^2 + 0.54$	M1 A1 A1	3	For either
(b)	$p'(0) = 0.48$ $q'(0) = 0.54$	A1 ft	1	
(c)	The distribution of wealth is more unequal in Brazil.	B2 ft	2	
	Total		**6**	
8(a)	-0.008: the world record is decreasing at a rate of 0.008 seconds per year. 10.6: the value of the world record predicted by the model in 1900 (when $n = 0$)	B1 B1	2	Condone initial value of record.
(b)	Using $n = 120$, $T = -0.008 \times 120 + 10.6 = 9.64$	M1 A1	2	Or similar
	Total		**4**	
9(a)	10.6 seconds	B1	1	
(b)	$9.58 = 10.6e^{-0.0008n}$ $\dfrac{9.58}{10.6} = 0.9038 = e^{-0.0008n}$ $\ln 0.9038 = -0.0008\,n$ $n = \dfrac{-1}{0.0008}\ln 0.9038 = \dfrac{0.101177}{0.0008} = 126 \text{ or } 127$ i.e. in year 1900+126=2026 or 2027	M1 M1 A1 A1 ft	4	
	Total		**5**	
10	Question 8 model record becomes negative. Question 9 model record tends to zero. Question 9 model is appropriate for longer than question 8 model or both models lead to improbably short times	B1 B1 B1	3	SC1 for substituting large number $n \geq 1000$ B1 for interpretation of either value B1 for interpretation of other
	Total		**3**	
11(a)	$T = 10.6e^{-0.0008n}$ $\dfrac{dT}{dn} = -0.00848e^{-0.0008n}$ when $n = 0$ $\dfrac{dT}{dn} = -0.00848$	M1 A1	2	
(b)	The rate of change of the world record in 1900 was -0.00848 seconds per year.	B1	1	
	Total		**3**	
	TOTAL		**45**	