

VERSION A



**3849-301 Level 3 Certificate in Using and Applying
Mathematics**

Final mark scheme

Paper 1 – Modelling

Paper 2 – Comprehension and Communication

Paper 1: Modelling

Marks	Formulating (A02)	Model development (A01)	Evaluation & interpretation (A03)
0			
1	Formulates a simplification of the situation that does not adequately capture all of the most important aspects and/or which does not allow mathematical work to proceed.	Develops a mathematical model that <ul style="list-style-type: none"> is dealt with using limited mathematics contains errors in use of standard conventions and notation. 	Gives only limited evidence of <ul style="list-style-type: none"> checking the validity of their work understanding of how their mathematical work relates to the situation they are investigating.
2			
3			
4	Formulates at least one simplification of the situation that	Develops a mathematical model that <ul style="list-style-type: none"> is dealt with effectively using appropriate mathematics contains only minor errors contains only few slips in use of standard conventions and notation. 	Provides evidence of having considered the validity of their model. Demonstrates some awareness of the implications of their mathematical work in terms of the situation it represents.
5	<ul style="list-style-type: none"> adequately deals with important factors makes reasonable assumptions 		
6	<ul style="list-style-type: none"> allows mathematical analysis to proceed. 		
7	Formulates a model(s) that demonstrates <ul style="list-style-type: none"> understanding of how to deal with factors in the situation so that they might be dealt with effectively using mathematics evidence of understanding of how to modify/adapt/improve this. 	Develops a mathematical model that <ul style="list-style-type: none"> is dealt with effectively using appropriate mathematics is almost entirely without error, demonstrates efficiency and rigour uses standard conventions and notation correctly throughout. 	Provides evidence of having considered the validity of their model. Demonstrates clearly of how outcomes of their mathematical work relate to the real situation and awareness of the implications for the situation/context.
8			
9			
10	<i>and</i> demonstrates how mathematical work provides insight into increasing sophistication in model formulation.	<i>and</i> demonstrates clear and rationally explained improvement.	<i>and</i> explains how the mathematical structure of their models are related to the real situation/context.
Mark			
Scaling factor	2.5	1	1
Scaled mark			
TOTAL MARKS FOR PAPER 1			/45

Paper 2: Part 1 - Comprehension

AO1 Select, use and apply mathematical techniques effectively when solving problems and communicating with mathematics.

AO2 Represent authentic situations mathematically and analyse these using mathematics to provide insight and solve associated problems.

A03 Critically make sense of mathematical reasoning, and solutions to problems and communicate mathematical working effectively and with clarity.

				Mark allocations		
1				AO1	AO2	AO3
(i)	As the price falls the quantity demanded (sold) increases	B2	Allow B1 for negative (correlation)			2
(ii)	As the price rises the seller increases the number they are prepared to supply	B2	Allow B1 for positive (correlation)			2
	TOTAL	4				4
2						
	A at price $\text{£}p_1$ the seller is prepared to supply quantity q_2 At B when quantity q_2 are available the price buyers will pay is $\text{£}p_2$ At C when price of goods is $\text{£}p_2$ the seller is prepared to supply quantity q_3	B2 B2 B2	Or similar B1 each if no mention of context and only in terms of p and q		1 1 1	1 1 1
	TOTAL	6			3	3
3						
	Demand 2000	B2			1	1
	Supply 1250	B2			1	1
	TOTAL	4			2	2

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				A01	A02	A03
4						
	£2.25	B2			2	
	TOTAL	2			2	
5						
a	<div> <div>Price, £</div> <div>quantity per month</div> </div>	B3		3		
b(i)	£1.75	B1		1		
b(ii)	£1.35 to £1.40	B1		1		
	TOTAL	5		5		
6						
a	$p = 0.5/500 Q$	M1		2		
(i)	$p = 0.001Q$	A1				
a	$p = (-0.5/1000)Q + 2.25$	M1, M1		3		
(ii)	$p = -0.0005Q + 2.25$	A1				
b	$p = 0.001Q = -0.0005Q + 2.25$ $0.0015Q = 2.25$ $Q = 1500$ $p = 0.001Q = 1.5$	M1 A1 A1		3		
	TOTAL	8		8		
7						
	Statement: would not settle to equilibrium point Sketch: correct supply and demand curves correct cobwebbing	B1 B1 B2	Lines that would lead to correct result Clearly indicated with correct arrows			4
	TOTAL	4				4
8						
a	23	B1				1
b	$282 - 215 = 67$	B1		1		
	TOTAL	2		1		1

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				A01	A02	A03																		
9																								
	(60x59x58x57x56x55)/(6x5x4x3x2x1) = 50,063,860 1 in 50,063,860	M1 A1 A1 ft		3																				
	TOTAL	3		3																				
10																								
a	<table><tr><td>1st ball</td><td>2nd ball</td></tr><tr><td rowspan="3">4</td><td>3</td></tr><tr><td>2</td></tr><tr><td>1</td></tr><tr><td rowspan="3">3</td><td>2</td></tr><tr><td>1</td></tr><tr><td>4</td></tr><tr><td rowspan="3">2</td><td>1</td></tr><tr><td>4</td></tr><tr><td>3</td></tr><tr><td rowspan="3">1</td><td>4</td></tr><tr><td>3</td></tr><tr><td>2</td></tr></table>	1 st ball	2 nd ball	4	3	2	1	3	2	1	4	2	1	4	3	1	4	3	2	M1 M1 A1	All first balls Systematic attempt at second balls		3	
1 st ball	2 nd ball																							
4	3																							
	2																							
	1																							
3	2																							
	1																							
	4																							
2	1																							
	4																							
	3																							
1	4																							
	3																							
	2																							
b	4 x 3 / 2 = 6	M1 A1		2																				
	TOTAL	5		2	3																			
11																								
	When using the grouped frequency data assume that all values take the value at the middle of the range	B2				2																		
	TOTAL	2				2																		
12																								
	The area of the histogram bar gives the frequency, so the height = 3/10 = 0.3 (where 10 is the class width)	B1 B1				2																		
	TOTAL	2				2																		

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				A01	A02	A03
13						
	Because each whole number (n) on the continuous axis is centered on $n \pm 1/2$	B2	Reference to no gaps B1			2
	TOTAL	2				2
14						
a	Total area = 49 This is the total number of balls in the lottery	B1 B1		1		1
b	Median at 25 th ball i.e. 12/14 of the group 245-254 $244.5 + (12/1.4) = 244.5 + 8.57$ $= 253.(07)$	B1 M1 M1 A1	Mention of group attempt using 12/14	4		
	TOTAL	6		5		1
15						
	$p(X \leq 280)$ (with mean 253, st. dev. 16.11) = 0.953 $p(X \geq 280) = 1 - 0.953 = 0.047$ $49 \times 0.047 = 2.3$ i.e. 2 balls	M1 A1 ft M1 A1 A1		5		
	TOTAL	5		5		
TOTAL MAX MARKS FOR PAPER 2 PART 1			/60	29	10	21
Scaling factor			0.5			
TOTAL SCALED MAX MARKS FOR PAPER 2 PART 1			/30	14.5	5	10.5

Paper 2: Part 2 - Communication

Marks	Identifying and selecting data (A02)	Analysing and reasoning (A01)	Reasoning and presenting (A03)
0			
1	Identifies and selects data that in some cases is not entirely appropriate for analysis to allow the development of a well-reasoned case. The selection of data and methods of analysis do not always demonstrate awareness of the intended audience of the work and its purpose.	Mathematical analysis, is in the main, carried out accurately and using appropriate mathematics. There are some errors in working and standard conventions and notation are not always used correctly.	Mathematical reasoning, statements and diagrams lack clarity and in places are difficult to follow. Interpretation, arguments and conclusions are not always appropriate, may contain errors and do not sufficiently, take account of their intended <ul style="list-style-type: none"> audience purpose.
2			
3			
4	Identifies and selects appropriate data that can be analysed using mathematics to develop a well-reasoned case. The selection of data and methods of analysis demonstrate awareness of the intended audience of the work and its purpose.	Mathematical analysis is carried out effectively using appropriate mathematics. Mathematical work contains only minor errors and contains only few slips in use of standard conventions and notation.	Mathematical reasoning, statements and diagrams can, with few exceptions, be clearly followed. Interpretation and arguments developed are almost entirely correct, appropriate, take account of and apply in light of the intended: <ul style="list-style-type: none"> audience purpose
5			
6			
7	Identifies and selects data judiciously so that it can be analysed using mathematics to develop a thoughtfully reasoned case. The selection of data and methods of analysis clearly demonstrate awareness of the intended audience of the work and its purpose.	Mathematical analysis is carried out effectively using appropriate mathematics almost entirely without errors and with efficiency and rigour. Standard conventions and notation are correctly used throughout.	Throughout mathematical reasoning, statements and diagrams can be clearly followed. Interpretation and arguments developed are correct, appropriate and in the main take account of and apply, in light of the intended: <ul style="list-style-type: none"> audience purpose.
8			
9			
10	<i>and allows exploration and communication of alternatives by selection of data.</i>	<i>and a range of different mathematical methods and measures are explored.</i>	<i>and alternatives are clearly presented and critiqued.</i>
Mark			
Scaling factor	1	0.5	1.5
Scaled mark			
TOTAL MARKS FOR PAPER 2: PART 2			/30

Mark allocations to Assessment Objectives

Maximum marks available

Paper 1: Modelling

Strand	Formulating	Model development	Evaluation and interpretation
Assessment objective	AO2	AO1	AO3
Max. raw mark	10	10	10
Scaling factor	2.5	1	1
Max. raw scaled mark	25	10	10

Paper 2: Part 1 - Comprehension (see mark allocation analysis)

Assessment objective	AO2	AO1	AO3
Max. raw mark	10	29	21
Scaling factor	0.5	0.5	0.5
Max. raw scaled mark	5	14.5	10.5

Paper 2: Part 2 - Communicating

Strand	Identifying and selecting data	Analysing and reasoning	Reasoning and presenting
Assessment objective	AO2	AO1	AO3
Max. raw mark	10	10	10
Scaling factor	1	0.5	1.5
Max. raw scaled mark	10	5	15

ASSESSMENT OVERALL

Assessment objective	AO2	AO1	AO3
Max. raw scaled mark	40	29.5	35.5