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Mark Scheme (Results)

June 2012

Methods in Mathematics (GCSE)
Unit 1: Methods 5MM1H_01

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NOTES ON MARKING PRINCIPLES

1 All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.

2 Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.

3 All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.

4 Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.

5 Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

6 Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:

i) *ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear*
Comprehension and meaning is clear by using correct notation and labeling conventions.

ii*) selectand use a form and style of writing appropriate to purpose and to complex subject matter*
Reasoning, explanation or argument is correct and appropriately structured to convey mathematical reasoning.

iii) *organise information clearly and coherently, using specialist vocabulary when appropriate*.
The mathematical methods and processes used are coherently and clearly organised and the appropriate mathematical vocabulary used.

7 With working

If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.

If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.

If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks. Send the response to review, and discuss each of these situations with your Team Leader.

If there is no answer on the answer line then check the working for an obvious answer.

Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks. Discuss each of these situations with your Team Leader.

If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.

8 Follow through marks

Follow through marks which involve a single stage calculation can be awarded without working since you can check the answer yourself, but if ambiguous do not award.

Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

9 Ignoring subsequent work

It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: e.g. incorrect canceling of a fraction that would otherwise be correct

It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect e.g. algebra.

Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

10 Probability

Probability answers must be given a fractions, percentages or decimals. If a candidate gives a decimal equivalent to a probability, this should be written to at least 2 decimal places (unless tenths).

Incorrect notation should lose the accuracy marks, but be awarded any implied method marks.

If a probability answer is given on the answer line using both incorrect and correct notation, award the marks.

If a probability fraction is given then cancelled incorrectly, ignore the incorrectly cancelled answer.

11 Linear equations

Full marks can be gained if the solution alone is given on the answer line, or otherwise unambiguously indicated in working (without contradiction elsewhere). Where the correct solution only is shown substituted, but not identified as the solution, the accuracy mark is lost but any method marks can be awarded.

12 Parts of questions

Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

13 Range of answers

Unless otherwise stated, when an answer is given as a range (e.g 3.5 – 4.2) then this is inclusive of the end points (e.g 3.5, 4.2) and includes all numbers within the range (e.g 4, 4.1)

Guidance on the use of codes within this mark scheme
M1 – method mark A1 – accuracy mark B1 – Working mark C1 – communication mark QWC – quality of written communication oe – or equivalent cao – correct answer only ft – follow through sc – special case dep – dependent (on a previous mark or conclusion) indep – independent isw – ignore subsequent working

5MM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
1	(a)		22	1	B1 cao
	(b)(i)		49.28	1	B1 cao
	(ii)		2.8	1	B1 cao
	(c)	$\frac{200\times 3}{60}$	10	2	M1for at least one of 200, 60 or 3 seen A1 cao

5MM1H_01

Question		Working	Answer	Mark	Notes
2	(i)	<table><tr><td>+</td><td>2</td><td>3</td><td>7</td><td>8</td></tr><tr><td>1</td><td>3</td><td>4</td><td>8</td><td>9</td></tr><tr><td>3</td><td>5</td><td>6</td><td>10</td><td>11</td></tr><tr><td>4</td><td>6</td><td>7</td><td>11</td><td>12</td></tr></table>	$\frac{2}{12}$	5	M1 for identifying 2,4 and 3,3 M1 for 12 seen **OR** an attempt to get the 12 outcomes or attempt at a sample space or a list of possibilities or a list of ordered pairs (at least 6 correct outcomes or possibilities or ordered pairs (ignore repeats) A1 for $\frac{2}{12}$ o.e. **OR** M1 for $\frac{1}{4}\times\frac{1}{3}$ o.e. seen M1 for $\frac{1}{4}\times\frac{1}{3} + \frac{1}{3}\times\frac{1}{4}$ A1 for $\frac{2}{12}$ o.e.
	(ii)		$\frac{4}{12}$		M1 ft from their ordered list from part (i) for identifying all 4 possible score from; 7+4(=11), 7+3(=10), 8+4(=12), 8+3(=11), (condone the inclusion of 8+1(=9) as a misread) [accept an answer of $\frac{5}{12}$ for M1 ONLY if the 5 outcomes are identified in either part (i) or part (ii)] A1 for $\frac{4}{12}$ oe

5MM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
3	(a)	$2x + 12 + 10x - 15$	$12x - 3$	2	M1 for attempt to expand one bracket or sight of $2 \times x + 2 \times 6$ or $5 \times 2x + 5 \times -3$ A1 cao
	(b)		$3y\,(2x - 3y)$	2	B2 for $3y\,(2x - 3y)$ (B1 for $3(2xy - 3y^2)$ or $y\,(6x - 9y)$ or $3y(2x + 3y)$ condone missing end bracket
	(c)	$12c^2 - 4c + 21c - 7$	$12c^2 + 17c - 7$	2	M1 for expanding brackets with four correct terms seen ignoring signs or four terms seen three of which are correct and have the correct signs A1 cao
4	(a)		Correct enlargement	2	B2 for a correct enlargement, scale factor 3 in any orientation (B1for a right angled triangle with1 line correctly enlarged or a correct enlargement by incorrect scale factor in any orientation
	(b)		translation $\begin{pmatrix} -5 \\ 3 \end{pmatrix}$	2	B1 for translation B1 for $\begin{pmatrix} -5 \\ 3 \end{pmatrix}$ NOTE: Combination of transformations scores B0
5	(a)	$1 - (0.35+0.15+0.18+0.12)$ $= 1 - 0.8(0)$	0.2	2	M1 for $1 - '(0.35 + 0.15 + 0.18 + 0.12)'$ o.e. A1 oe
	(b)	300×0.35	105	2	M1 for 300×0.35 A1 cao SC B1 for $\frac{105}{300}$

<table>
<tr><th colspan="5">5MM1H_01</th></tr>
<tr><th colspan="2">Question</th><th>Working</th><th>Answer</th><th>Mark</th><th>Notes</th></tr>
<tr><td>6</td><td></td><td>
<table>
<tr><td>x</td><td>–2</td><td>–1</td><td>0</td><td>1</td><td>2</td></tr>
<tr><td>y</td><td>–8</td><td>–3</td><td>2</td><td>7</td><td>12</td></tr>
</table>
</td><td>$y = 5x + 2$ drawn</td><td>4</td><td>C1 for acceptable scaling and labelling of the axes

(Table of values)
M1 for at least 2 correct attempts to find points by substituting values of x
M1 ft for plotting at least 2 of their points (any points from their table must be correctly plotted)
A1 for correct line

(No table of values)
M2 for at least 2 correct points (and no incorrect points) plotted
OR line segment of $y = 5x + 2$ drawn (ignore any additional incorrect line segments)
(M1 for at least 3 correct points plotted with no more than 2 incorrect points)
A1 for correct line

(Use of $y = mx + c$)
M2 for line segment of $y = 5x + 2$ drawn (ignore any additional incorrect line segments)
(M1 for line drawn with gradient of 5 OR
Line drawn with a y intercept of 2 and a positive gradient)
A1 for correct line</td></tr>
</table>

5MM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
7	(a)		$6n + 2$	2	B2 for $6n + 2$ oe (B1 for linear expression of the form $6n + a$ where a is an integer)
	(b)	$6n + 2 = 124$ $6n = 124 – 2 = 122$ $n = 122 \div 6 = 20.3$ n is not an integer	explanation	2	M1 for '$6n + 2$' = 124 or any other valid method e.g. counting on in 6's to get a term > 110 eg 20^{th} term is 122 eg $8 + 20 \times 6 = 128$ A1 for a complete explanation eg $n = 20.3$... so n is not an integer or establishing 122 and 128 are in the sequence so 124 is not in the sequence
8		$<DBF = 180 – 52 – 78 = 50$ angles on a line = 180 $<BFD = (180 – '50') \div 2 = 65$ isosceles triangle angles in a triangle add up to 180 $x = 180 – 92 – 65 = 23$	$y = 23$ with reasons	5	M1 for $<DBF = 180 – 52 – 78$ or 50 seen or $x = 180 – 92 –$ '65' M1 for $<BFD = (180 – '50') \div 2$ (= 65) A1 for y = 23 C2(dep on M1) for correct reasons :- angles on a straight line sum to 180º, base angles in an isosceles triangle are equal, and angles in a triangle add up to 180 (C1(dep on M1) for any one correct reason used correctly)

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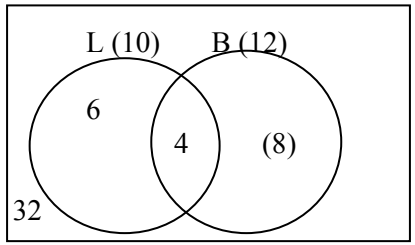
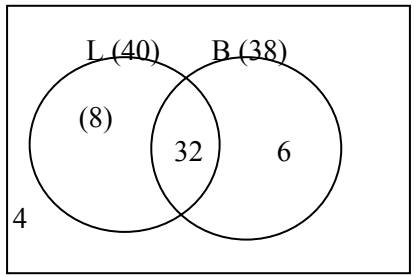
Question		**Working**	**Answer**	**Mark**	**Notes**
9		$(x + 8) + (2x – 3) + (x + 1) + (x + 5) + 7 + (3x + 2)$ $8x + 20 = 68$ $8x = 68 – 20 = 48$	6 with working	5	M1 for attempt to work out missing length of vertical side or sight of $2x – 3 + x + 5$ or $3x + 2$ M1 for attempt to work out missing length of horizontal side or sight of $x + 8 – (x + 1)$ or 7 M1 adding at least 4 sides e.g. $x + 8 + 2x – 3 + x + 1 + x + 5$ M1 for attempt to add all their 6 sides and form equation e.g. '$8x + 20$' = 68 C1(dep on M1 indicating that $x = 6$ (cm) **OR** M1 for using any value for x, substituting to find lengths of at least 4 sides and clear intent to add M3 for a complete method using $x = 6$ C1 (dep on M1) indicating that $x = 6$ (cm)

5MM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
10	(a)	Fail Venn diagram  or Pass Venn diagram  	Venn diagram	4	M1 for two overlapping ovals M1 for 4 shown in the intersection M1 for attempt to show 10 – 4 or 50 – 32 – 10 A1 for 6, and 32 in the correct places. OR M1 for two overlapping ovals M1 for 32 shown in the intersection M1 for attempt to show 50 –10 – 32 or 50 – 40 – 4 A1 for 6and 4 in the correct places.
	(b)		$\frac{12}{50}$	2	M1 ft for 4 + "8" (but not 0) A1 for $\frac{12}{50}$ o.e.

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Question		**Working**	**Answer**	**Mark**	**Notes**
11	(a)		e^{9}		B1 for e^{9} accept e^{12-3}
	(b)		$10\,x^4y^5$		B2 cao (B1 for any two from 10, x^4 or y^5 in a product)
12	(a)	30 = 2 × 3 × 5 42 = 2 × 3 × 7 HCF = 2 × 3	6	2	M1 for 30 or 42 written correctly as a product of prime factors or attempt to list the factors of 30 and 42 (at least 4 for each including 6) A1 for HCF = 6
	(b)	30 , 60, 90, ... 45, 90, 135, ...	90	2	M1 for listing multiples of 30 and 45 (at least 60 and 90) or 2 × 3 × 5 × 3 A1 for LCM = 90 SC B1 for 210
13		Area *APF* = ½ (3 × 3) = 4.5 Area *CDEF* = ½ (8 +12) × 4 or 8 × 4 +1/2 × 4 × 4 = 40 Area *BCFP* = 12 × 3 Total area = 4.5 + 40 + 36 **Or** Area *APF* = ½ (3 × 3) = 4.5 Area *DCBQ* = ½ (7 + 3) × 4 Or 3 × 4 + ½ 4 × 4 = 20 Area *EDQP* = 8 × 7 = 56 Total area = 4.5 + 20 + 56 **Or** Area *APF* = ½ (3 × 3) = 4.5 Area outer rectangle = 12 × 7 = 84 Area missing triangle ½ 4 × 4 = 8 Total area = 84 + 4.5 – 8	80.5cm^2	5	M1 for ½ (3 × 3) oe (= 4.5) M1 for ½ (8 + 12) × 4 or 8 × 4 +1/2 × 4 × 4 = (40) M1 for 12 × 3 (= 36) A1 for 80.5 or 80½ cao **Or** M1 for (3 × 3) oe (= 4.5) M1 for ½ (7 + 3) × 4 or 3 × 4 + ½ 4 × 4 (= 20) M1 for 8 × 7 (= 56) A1 for 80.5 or 80½ cao **Or** M1 for (3 × 3) oe (= 4.5) M1 for Area outer rectangle = 12 × 7 (= 84) M1 for Area missing triangle ½ 4 × 4 (= 8) A1 for 80.5 or 80½ cao B1 (indep) for cm^2

5MM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
14	(a)		5.37×10^{-1}	1	B1 cao
	(b)		96000	1	B1 cao
15		$2(5x-1) + 3(x+4) = 12$ $10x - 2 + 3x + 12 = 12$ $13x + 10 = 12$ $13x = 2$	$\frac{2}{13}$	4	M1 recognising the need to multiply by 2 or 3 or 6 or any multiple of these numbers M1 for a complete method M1 (dep on M1) for isolating terms in x and constant terms for a linear equation in the form $ax + b = c$ A1 for $\frac{2}{13}$ oe
16		$\frac{25}{8} - \frac{5}{3} = \frac{75-40}{24} = \frac{35}{24}$ **Or** $2\frac{1}{8} - \frac{2}{3} = 2\frac{3-16}{24} = 1\frac{27-16}{24} =$ **Or** $2\frac{1}{8} - \frac{2}{3} = 2\frac{3-16}{24} = 2\frac{-13}{24} =$	$1\frac{11}{24}$	3	M1 for converting to improper fractions, at least one correct or $3 - 1 = 2$ and 'borrowing' or negative fraction answer M1 for putting fractions over a common denominator, at least one correct A1 for $\frac{35}{24}$ or $1\frac{11}{24}$
17	(a)	1, 2, 3, 5, 6, 9, 10, 11	$\frac{8}{11}$	2	M1 for indicating A $\cup$ B (could be by listing or shading etc) A1 for $\frac{8}{11}$
	(b)	1, 3, 4, 6, 7, 8, 11	$\frac{7}{11}$	2	M1 for indicating B' (could be by listing or shading etc) A1 for $\frac{7}{11}$

5MM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
18	(a)		10	1	B1 cao
	(b)		1	1	B1 cao
	(c)		$\frac{1}{27}$	1	B1 cao
	(d)	$5^x = 125^{-2/3} = (5^3)^{-2/3}$ $= 5^{-2}$	–2	2	M1 for showing that $125 = 5^3$ or $\sqrt[3]{125} = 5$ or $\frac{1}{5^2}$ seen oe A1 cao
19		$\frac{(2x+1)(x-4)}{(x+4)(x-4)}$	$\frac{(2x+1)}{(x+4)}$	3	M1 for $(2x \pm 1)(x \pm 4)$ M1 for $(x+4)(x-4)$ A1 cao

5MM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
20		$(\frac{6}{11} \times \frac{2}{10}) + (\frac{2}{11} \times \frac{6}{10})$ $= \frac{12}{110} + \frac{12}{110}$	$\frac{24}{110}$	4	B1 for $\frac{2}{10}$ or $\frac{6}{10}$ oe seen as the 2nd probability M1 for $(\frac{6}{11} \times \frac{2}{10})$ or $(\frac{2}{11} \times \frac{6}{10})$ oe M1 for $(\frac{6}{11} \times \frac{2}{10}) + (\frac{2}{11} \times \frac{6}{10})$ o.e. A1 for $\frac{24}{110}$ oe **Tree diagram method** B1 for $\frac{2}{10}$ or $\frac{6}{10}$ oe seen as the 2nd probability M1 for $(\text{`}\frac{6}{11}\text{'} \times \text{`}\frac{2}{10}\text{'})$ or $(\text{`}\frac{2}{11}\text{'} \times \text{`}\frac{6}{10}\text{'})$ oe M1 for $(\text{`}\frac{6}{11}\text{'} \times \text{`}\frac{2}{10}\text{'}) + (\text{`}\frac{2}{11}\text{'} \times \text{`}\frac{6}{10}\text{'})$ oe A1 for $\frac{24}{110}$ oe **Alternative scheme for replacement** B0 for $\frac{6}{11}$ or $\frac{2}{11}$ seen as the 2nd probability M1 for $(\frac{6}{11} \times \frac{2}{11})$ or $(\frac{2}{11} \times \frac{6}{11})$ oe M1 for $(\frac{6}{11} \times \frac{2}{11}) + (\frac{2}{11} \times \frac{6}{11})$ oe A0 for $\frac{24}{121}$ **Special Cases** SC: Award B2 for $\frac{24}{121}$ or $\frac{10}{110}$ oe or $\frac{20}{110}$ oe SC: Award B1 for $\frac{10}{121}$ or $\frac{20}{121}$

5MM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
21		Angle $ADC = 60 + x$ $2x + 60 + x = 180$ $3x = 120$ exterior angle triangle = sum of interior opposite angles (or angles in a triangle and angles on a straight line both sum to 180) **and** opposite angles of a cyclic quad sum to 180 **Or** Angle $ADE = 2x$ opposite angles in a cyclic quadrilateral add to 180 and angles in a straight line add to 180º or exterior angle of cyclic quad = interior opposite angle $2x + x + 60 = 180$ angles in a Δ add up to 180 $3x = 120$ **Or** Angle $BCD = 60$ angles in a straight line add to 180º and opposite angles in a cyclic quadrilateral add to 180 or exterior angle of cyclic quad = interior opposite angle In Δ BCE, $2x + x + 60 = 180$ angles in a Δ add up to 180 $3x = 120$	40	4	M1 for angle $ADC = 60 + x$ M1 for $2x + 60 + x = 180$ A1 for $x = 40$ C1 (dep on M1) for exterior angle triangle = sum of interior opposite angles (or angles in a triangle and angles on a straight line both sum to 180) **and**opposite angles of a cyclic quad sum to 180 **or** M1 for angle $ADC = 180 – 2x$ M1 for $180 – 2x = 60 + x$ A1 for $x = 40$ C1 (dep on M1) for exterior angle triangle = sum of interior opposite angles (or angles in a triangle and angles on a straight line both sum to 180) **and**opposite angles of a cyclic quad sum to 180 **Or** M1 for angle $ADE = 180– 60 – x$ M1 for '$180– 60 – x$' = $2x$ A1 for $x = 40$ C1 (dep on M1) for angles in a triangle sum to 180 **and**opposite angles in a cyclic quadrilateral add to 180 and angles in a straight line add to 180º or exterior angle cyclic quad = interior opposite angle **or** M1 for Angle $BAD = 120$º and Angle $BCD = 60$º In Δ BCE, $2x + x + 60 = 180$ A1 for $3x = 120$ C1 (dep on M1) for angles in a straight line add to 180º and opposite angles in a cyclic quadrilateral add to 180or exterior angle of cyclic quad= interior opposite angle and angles in a triangle add up to 180

5MM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
22	(a)	$(x-4)^2 - 4^2 - 3$ $= (x-4)^2 - 16 - 3$	$a = 4$ $b = 19$	2	M1 for $(x-4)^2 - 4^2 - 3$ or $a = 4$ or $b = 19$ A1 cao
	(b)	$(x-4)^2 - 16 - 3 = 0$ $x - 4 = \pm\sqrt{19}$	$4 \pm \sqrt{19}$	2	M1 for $(x - \text{'4'})^2 = \text{'16'} + 3$ oe (or correct substitution in quadratic formula) A1 cao
23	(a)	$-(3\mathbf{a} + 2\mathbf{b}) + (4\mathbf{a} + \mathbf{b})$	Show using vector algebra	1	C1 for $-(3\mathbf{a} + 2\mathbf{b}) + (4\mathbf{a} + \mathbf{b}) = \mathbf{a} - \mathbf{b}$ OR $-3\mathbf{a} - 2\mathbf{b} + 4\mathbf{a} + \mathbf{b} = \mathbf{a} - \mathbf{b}$ OR $3\mathbf{a} + 2\mathbf{b} + \mathbf{a} - \mathbf{b} = 4\mathbf{a} + \mathbf{b}$
	(b)	$\overrightarrow{QR} = \overrightarrow{QO} + \overrightarrow{OR}$ $= -4\mathbf{a} - \mathbf{b} + 8\mathbf{a} - 3\mathbf{b}$ $= 4\mathbf{a} - 4\mathbf{b} = 4(\mathbf{a} - \mathbf{b})$ **Or** $\overrightarrow{PR} = -(3\mathbf{a} + 2\mathbf{b}) + (8\mathbf{a} - 3\mathbf{b})$ $= 5\mathbf{a} - 5\mathbf{b} = 5(\mathbf{a} - \mathbf{b})$ $= 5\overrightarrow{PQ}$	1 : 4	3	M1 for $\overrightarrow{QR} = \overrightarrow{QO} + \overrightarrow{OR} = -4\mathbf{a} - \mathbf{b} + 8\mathbf{a} - 3\mathbf{b}$ A1 for $4\mathbf{a} - 4\mathbf{b}$ A1 for 1 : 4 **Or** M1 for $\overrightarrow{PR} = -(3\mathbf{a} + 2\mathbf{b}) + (8\mathbf{a} - 3\mathbf{b})$ o.e. A1 for $5\mathbf{a} - 5\mathbf{b}$ A1 for 1 : 4

5MM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
*24		$x^2 + (x + 1)^2$ $= x^2 + x^2 + 2x + 1$ $= 2x^2 + 2x + 1$ = even + even + odd = odd or $x^2 + (x + 1)^2$ $= x^2 + x^2 + 2x + 1$ $= 2x^2 + 2x + 1$ $= 2(x^2 + x) + 1$ = even + odd = odd	proof	3	M1 for $x^2 + (x + 1)^2$ or $(x – 1)^2 + x^2$ oe M1 for correctly expanding $(x + 1)^2$ or $(x – 1)^2$ C1 for simplifying correctly and for final explanation and states x is an integer. eg $2(x^2 + x)$ is even and 1 is odd **and e**ven + odd is odd

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