2007 Mathematics

Higher – Paper 1

Finalised Marking Instructions

1. Marks must be assigned in accordance with these marking instructions. In principle, marks are awarded for what is correct, rather than marks deducted for what is wrong.

2. Award one mark for each 'bullet' point. Each error should be underlined in RED at the point in the working where it first occurs, and not at any subsequent stage of the working.

3. The working subsequent to an error must be followed through by the marker with possible full marks for the subsequent working, provided that the difficulty involved is approximately similar. Where, subsequent to an error, the working is eased, a deduction(s) of mark(s) should be made.
   This may happen where a question is divided into parts. In fact, failure to even answer an earlier section does not preclude a candidate from assuming the result of that section and obtaining full marks for a later section.

4. Correct working should be ticked (✓). This is essential for later stages of the SQA procedures. Where working subsequent to an error(s) is correct and scores marks, it should be marked with a crossed tick (✗ or X✓). In appropriate cases attention may be directed to work which is not quite correct (e.g. bad form) but which has not been penalised, by underlining with a dotted or wavy line.
   Work which is correct but inadequate to score any marks should be corrected with a double cross tick (✗✗).

5. • The total mark for each section of a question should be entered in red in the **outer** right hand margin, opposite the end of the working concerned.
   • Only the mark should be written, **not** a fraction of the possible marks.
   • These marks should correspond to those on the question paper and these instructions.

6. It is of great importance that the utmost care should be exercised in adding up the marks. Where appropriate, all summations for totals and grand totals must be carefully checked. Where a candidate has scored zero marks for any question attempted, "0" should be shown against the answer.

7. As indicated on the front of the question paper, full credit should only be given where the solution contains appropriate working. Accept answers arrived at by inspection or mentally where it is possible for the answer so to have been obtained. Situations where you may accept such working will normally be indicated in the marking instructions.

8. Do not penalise:
   - working subsequent to a correct answer
   - legitimate variations in numerical answers
   - correct working in the "wrong" part of a question
   - omission of units
   - bad form

9. No piece of work should be scored through without careful checking - even where a fundamental misunderstanding is apparent early in the answer. Reference should always be made to the marking scheme - answers which are widely off-beam are unlikely to include anything of relevance but in the vast majority of cases candidates still have the opportunity of gaining the odd mark or two provided it satisfies the criteria for the mark(s).

10. If in doubt between two marks, give an intermediate mark, but without fractions. When in doubt between consecutive numbers, give the higher mark.

11. In cases of difficulty covered neither in detail nor in principle in the Instructions, attention may be directed to the assessment of particular answers by making a referal to the P.A. Please see the general instructions for P.A. referrals.

12. No marks should be deducted at this stage for careless or badly arranged work. In cases where the writing or arrangement is very bad, a note may be made on the upper left-hand corner of the front cover of the script.

13 Transcription errors: In general, as a consequence of a transcription error, candidates lose the opportunity of gaining either the first ic mark or the first pd mark.

14 Casual errors: In general, as a consequence of a casual error, candidates lose the opportunity of gaining the appropriate ic mark or pd mark.

15 **Do not write any comments on the scripts**. A **revised** summary of acceptable notation is given on page 4.

16 Working that has been crossed out by the candidate cannot receive any credit. If you feel that a candidate has been disadvantaged by this action, make a P.A. Referral.

17 Throughout this paper, unless specifically mentioned, a correct answer with no working receives no credit.

Summary

Throughout the examination procedures many scripts are remarked. It is essential that markers follow common procedures:

1 **Tick** correct working.
2 Put a mark in the **outer right-hand margin to match the marks allocations on the question paper.**
3 Do **no**t write marks as fractions.
4 Put each mark **at the end** of the candidate's response to the question.
5 **Follow through** errors to see if candidates can score marks subsequent to the error.
6 Do **not** write any comments on the scripts.

1.01

qu	part	mk	code	calc	source	ss	pd	ic	C	B	A
1.01		3	G2, G3	CN	7063	1		2	3		

Find the equation of the line through the point $(-1, 4)$ which is parallel to the line with equation $3x - y + 2 = 0$. **3**

The primary method m.s is based on the following generic m.s.
This generic marking scheme may be used as an equivalence guide but only where a candidate does not use the primary method or any alternative method shown in detail in the marking scheme.

$\bullet^1$	ss	express in standard form
$\bullet^2$	ic	interpret gradient
$\bullet^3$	ic	state equation of line

Primary Method : Give 1 mark for each •

$\bullet^1$	$y = 3x....$	stated/implied by $\bullet^2$
$\bullet^2$	$gradient = 3$	stated/implied by $\bullet^3$
$\bullet^3$	$y - 4 = 3(x - (-1))$	
or		
$\bullet^1$	$form\ is\ 3x - y + c = 0$	
$\bullet^2$	$3 \times (-1) - 4 + c = 0$	
$\bullet^3$	$c = 7$	

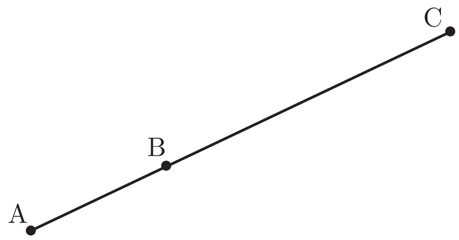
Notes

1 Accept any form of the answer (with or without working) for 3 marks

1.02

qu	part	mk	code	calc	source	ss	pd	ic	C	B	A
1.02		4	G17	CN	7001	1	1	2	4		

Relative to a suitable coordinate system A and B are the points $(-2,1,-1)$ and $(1,3,2)$ respectively.
A, B and C are collinear points and C is positioned such that BC = 2AB.
Find the coordinates of C. **4**



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$\bullet^1$	ss	introduces vectors
$\bullet^2$	pd	completes
$\bullet^3$	ic	interprets positions
$\bullet^4$	ic	finds C

Primary Method : Give 1 mark for each •

$\bullet^1$ $\overrightarrow{AB} = \boldsymbol{b} - \boldsymbol{a}$ stated or implied by $\bullet^2$

$\bullet^2$ $\overrightarrow{AB} = \begin{pmatrix} 3 \\ 2 \\ 3 \end{pmatrix}$

$\bullet^3$ $\overrightarrow{BC} = \begin{pmatrix} 6 \\ 4 \\ 6 \end{pmatrix}$

$\bullet^4$ $C = (7,7,8)$

Notes

1 Treat C=$\begin{pmatrix} 7 \\ 7 \\ 8 \end{pmatrix}$ as bad form

2 In Alt. method 2, without a diagram only $\bullet^2$, $\bullet^3$ and $\bullet^4$ are available.

Alt. method 1

$\bullet^1$ $\boldsymbol{c} - \boldsymbol{b} = 2\boldsymbol{b} - 2\boldsymbol{a}$

$\bullet^2$ $\boldsymbol{c} = 3\boldsymbol{b} - 2\boldsymbol{a}$

$\bullet^3$ $\boldsymbol{c} = 3\begin{pmatrix} 1 \\ 3 \\ 2 \end{pmatrix} - 2\begin{pmatrix} -2 \\ 1 \\ -1 \end{pmatrix}$

$\bullet^4$ $C = (7,7,8)$

Alt. method 2

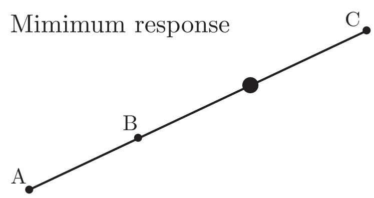
$\bullet^1$ *ic* *diagram* $\rightarrow\rightarrow$

$\bullet^2$ *pd* $x = 7$

$\bullet^3$ *pd* $y = 7$

$\bullet^4$ *pd* $z = 8$

Mimimum response



7

1.03

qu	part	mk	code	calc	source	ss	pd	ic	C	B	A
1.03	a	2	A4	CN	7069	1		1	2		
	b	2	A4			1		1	2		

Functions f and g, defined on suitable domains, are given by

$f(x) = x^2 + 1$ and $g(x) = 1 - 2x$.

Find (a) $g\big(f(x)\big)$ **2**

(b) $g\big(g(x)\big)$ **2**

The primary method m.s is based on the following generic m.s.
This generic marking scheme may be used as an equivalence guide but only where a candidate does not use the primary method or any alternative method shown in detail in the marking scheme.

$\bullet^1$ ss know to start from the "inside"
$\bullet^2$ ic interpret composite function
$\bullet^3$ ss know to start from the "inside"
$\bullet^4$ ic interpret composite function

Primary Method : Give 1 mark for each •

$\bullet^1$ $g\big(f(x)\big) = g(x^2 + 1)$ s/i by $\bullet^2$
$\bullet^2$ $1 - 2(x^2 + 1)$
$\bullet^3$ $g(g(x)) = g(1 - 2x)$ s/i by $\bullet^4$
$\bullet^4$ $1 - 2(1 - 2x)$

Notes

1 in (a) :
for finding $f(g(x))$:
$g(1-2x)$ *no mark*
$(1-2x)^2 + 1$ *award* $\bullet^2$
for finding $f(f(x))$: *no marks*

2 in (b) :
for finding $f(g(x))$: *no mark*
for finding $f(f(x))$:
$f(x^2+1)$ *no mark*
$(x^2+1)^2 + 1$ *award* $\bullet^4$

3 There are no marks available for either $g(x) \times f(x)$ or $g(x) \times g(x)$.

1.04

qu	part	mk	code	calc	source	ss	pd	ic	C	B	A
1.04		4	A18	CN	7099	1	1	2	4		

Find the range of values of k such that the equation $kx^2 - x - 1 = 0$ has no real roots. **4**

The primary method m.s is based on the following generic m.s.

This generic marking scheme may be used as an equivalence guide but only where a candidate does not use the primary method or any alternative method shown in detail in the marking scheme.

$\bullet^1$	ss	know to use discriminant < 0
$\bullet^2$	ic	interpret the values of a, b and c
$\bullet^3$	ic	substitute
$\bullet^4$	pd	solve an inequation

Primary Method : Give 1 mark for each •

$\bullet^1$	$b^2 - 4ac < 0$	
$\bullet^2$	$a = k,\ b = -1,\ c = -1$	s/i by $\bullet^3$
$\bullet^3$	$1 + 4k$	
$\bullet^4$	$k < -\frac{1}{4}$	

Notes

1 The " < 0 " has to appear at least once at the $\bullet^1$ stage or the $\bullet^3$ stage for $\bullet^1$ to be awarded

2 If an x appears at $\bullet^2$ stage, none of $\bullet^2$, $\bullet^3$ or $\bullet^4$ are available

3 Some candidates may start with the quadratic formula. Apply the marking scheme to the part underneath the square root sign

4 The use of any expression masquerading as the discriminant can only gain $\bullet^2$ at most

Common Error 1

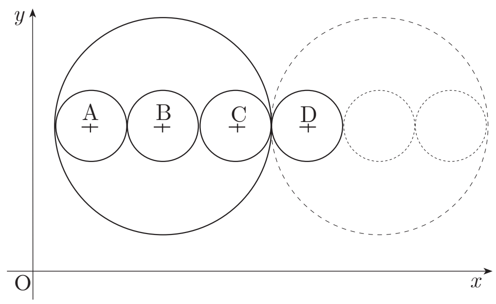
$\bullet^1$X	$b^2 - 4ac$
$\bullet^2\surd$,$\bullet^3\surd$	$1 + 4k$
	$k = -\frac{1}{4}$
$\bullet^4$ X	$k < -\frac{1}{4}$

9

1.05

qu	part	mk	code	calc	source	ss	pd	ic	C	B	A
1.05		5	G10	CN	7041	1	1	3	5		

The large circle has equation $x^2+y^2-14x-16y+77=0$.
Three congruent circles with centres A, B and C are drawn inside the large circle with the centres lying on a line parallel to the x-axis.
This pattern is continued, as shown in the diagram.
Find the equation of the circle with centre D. **5**



The primary method m.s is based on the following generic m.s.
This generic marking scheme may be used as an equivalence guide but only where a candidate does not use the primary method or any alternative method shown in detail in the marking scheme.

$\bullet^1$	ic	state centre
$\bullet^2$	ss	know to, and find, large radius
$\bullet^3$	ss	know to, and find the small radius
$\bullet^4$	ic	interpret new centre
$\bullet^5$	ic	state equation of circle

Primary Method : Give 1 mark for each •

$\bullet^1$	$B=(7,8)$	
$\bullet^2$	$r_{large}=\sqrt{7^2+8^2-77}=6$	
$\bullet^3$	$r_{small}=\dfrac{6}{3}$	s/i by $\bullet^5$
$\bullet^4$	$D=(15,8)$	s/i by $\bullet^5$
$\bullet^5$	$(x-15)^2+(y-8)^2=2^2$	

Note

1 If D = (31,8) then $\bullet^4$ is not available;
however either of
$(x-31)^2+(y-8)^2=2^2$
or $(x-31)^2+(y-8)^2=6^2$
may be awarded $\bullet^5$

2 $\bullet^5$ is only awarded for substituting numerical values for the centre and the radius

1.06

qu	part	mk	code	calc	source	ss	pd	ic	C	B	A
1.06		4	T7	NC	7100	1	2	1	4		

Solve the equation $\sin(2x°) = 6\cos(x°)$ for $0 \le x \le 360$. **4**

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This generic marking scheme may be used as an equivalence guide
but only where a candidate does not use the primary method or any
alternative method shown in detail in the marking scheme.

$\bullet^1$ ss know and use double angle formula
$\bullet^2$ pd write in st. form and factorise
$\bullet^3$ pd start to solve
$\bullet^4$ ic know and use exact values

Primary Method : Give 1 mark for each •

$\bullet^1$ $2\sin(x°)\cos(x°)$
$\bullet^2$ $\cos(x°)\big(2\sin(x°) - 6\big) = 0$

$\bullet^3$ $\cos(x°) = 0$ *and* $x = 90, 270$
$\bullet^4$ $\sin(x°) = 3$ *and no solution*

or
$\bullet^3$ $\cos(x°) = 0$ *and* $\sin(x°) = 3$
$\bullet^4$ $x = 90, 270$ *and no solution*

Notes

1 $\bullet^1$ is NOT available for $2\sin A\cos A$ with no further working
2 The " $= 0$ " has to appear at least once at the $\bullet^1$ stage or the $\bullet^2$ stage
3 The inclusion of extra answers which would have been correct but are outside the given interval should be treated as bad form (i.e. not penalised)
4 In following through from an error, $\bullet^4$ is only available for solving an equation with no solution
5 The phrase "no solution" does not always appear after $\sin(x) = 3$. The minimum indication that no solution exists might simply be a line drawn through or underneath the equation.

Alt. method : Division by cos(x°)

$\bullet^1$ $2\sin(x°)\cos(x°)$
$\bullet^2$ *either* $\cos(x°) = 0$ *or* $\cos(x°) \ne 0$ ***stated explicitly***
$\bullet^3$ $\cos(x°) = 0 \Rightarrow x = 90$ *or* 270
$\bullet^4$ $2\sin(x°) = 6 \Rightarrow$ *no solution*

1.07

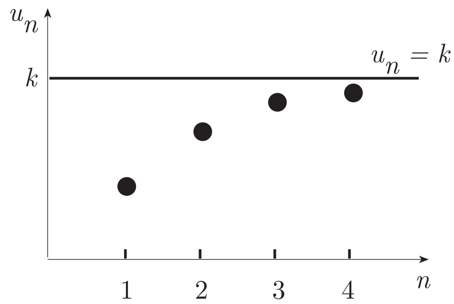
qu	part	mk	code	calc	source	ss	pd	ic	C	B	A
1.07	a	3	A14	CN	7080		2	1	3		
	b	3				1	1	1	3		

A sequence is defined by the recurrence relation

$$u_{n+1} = \tfrac{1}{4}u_n + 16,\ u_0 = 0.$$

(a) Calculate the values of u_1, u_2 and u_3. **3**

Four terms of this sequence, u_1, u_2, u_3 and u_4 are plotted as shown in the graph.
As $n \to \infty$, the points on the graph approach the line $u_n = k$, where k is the limit of this sequence.



(b) (i) Give a reason why this sequence has a limit.

(ii) Find the exact value of k. **3**

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$\bullet^1$	ic	interpret r.r.
$\bullet^2$	pd	process
$\bullet^3$	pd	interpret and process
$\bullet^4$	ic	interpret "a"
$\bullet^5$	ss	know how to find limit
$\bullet^6$	pd	complete

Primary Method : Give 1 mark for each •

$\bullet^1$ $u_1 = \frac{1}{4}u_0 + 16$ s/i by $\bullet^2$

$\bullet^2$ 16

$\bullet^3$ $20, 21$

$\bullet^4$ $-1 < \frac{1}{4} < 1$

$\bullet^5$ $k = \frac{1}{4}k + 16$

$\bullet^6$ $k = \dfrac{64}{3}$

Alternative for $\bullet^5$ and $\bullet^6$

$\bullet^5$ $k = \dfrac{16}{1-0.25}$

$\bullet^6$ $k = \dfrac{64}{3}$

Notes 1

1 In (a) only numerical values for u_1, u_2 and u_3 are acceptable

2 For (b)(i) accept

$|\frac{1}{4}| < 1$

$0 < \frac{1}{4} < 1$

$\frac{1}{4}$ lies between -1 and 1

$\frac{1}{4}$ is a proper fraction

3 For (b)(i) do ***NOT*** accept

$-1 \le \frac{1}{4} \le 1$

$\frac{1}{4} < 1$

$-1 < a < 1$ unless a is clearly identified/replaced by a $\frac{1}{4}$ anywhere in the answer

Notes 2

4 For (b)(ii)

$k = \dfrac{b}{1-a}$ and nothing else gains no marks

5 For (b)(ii)

$k = \dfrac{16}{\frac{3}{4}}$ *or* $k = \dfrac{16}{0.75}$ may be awarded $\bullet^5$

$k = \dfrac{16}{\frac{3}{4}}$ *or* $k = \dfrac{16}{0.75}$ *or* 21.3 does NOT gain $\bullet^6$

6 Accept L in lieu of k

7 An answer of $\frac{64}{3}$ without any working cannot gain $\bullet^5$ or $\bullet^6$

8 Any calculations based on formulae masquerading as a limit rule cannot gain $\bullet^5$ or $\bullet^6$.

1.08

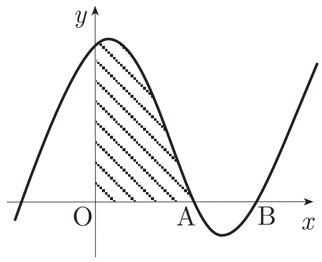
qu	part	mk	code	calc	source	ss	pd	ic	C	B	A
1.08	a	1	A21, C16	NC	7026	1			1		
	b	3				1	1	1	3		
	c	5				1	2	2	4	1	

The diagram shows a sketch of the graph of $y = x^3 - 4x^2 + x + 6$.

(a) Show that the graph cuts the x-axis at (3,0) **1**

(b) Hence or otherwise find the coordinates of A. **3**

(c) Find the shaded area. **5**



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$\bullet^1$	ss	know to evaluate, and evaluate at $x = 3$
$\bullet^2$	ss	strategy for finding other factors
$\bullet^3$	ic	quadratic factor
$\bullet^4$	pd	find +ve root and identify
$\bullet^5$	ss	know to integrate
$\bullet^6$	ic	identify limits
$\bullet^7$	pd	integrate
$\bullet^8$	ic	substitute limits
$\bullet^9$	pd	process limits

Primary Method : Give 1 mark for each •

$\bullet^1$ $'f(3)' = 27 - 36 + 3 + 6 = 0$

$\bullet^2$ $(x-3)(x^2 \; \ldots .)$

$\bullet^3$ $(x-3)(x^2 - x - 2)$

$\bullet^4$ $(x-3)(x-2)(x+1)$ *so* $A = (2,0)$

$\bullet^5$ $\int \left(x^3 - 4x^2 + x + 6\right) dx$

$\bullet^6$ $\int_0^2$

$\bullet^7$ $\frac{1}{4}x^4 - \frac{4}{3}x^3 + \frac{1}{2}x^2 + 6x$

$\bullet^8$ $\frac{1}{4}\times 2^4 - \frac{4}{3}\times 2^3 + \frac{1}{2}\times 2^2 + 6\times 2$

$\bullet^9$ $\dfrac{22}{3}$

Notes

1 The working & evidence for (a) may appear in part (b) and vice versa

2 In Alternative Method 1, $\bullet^1$, candidates must show some acknowledgement of the resulting "zero". Although a statement with respect to the "zero" is preferable, accept something as simple as an underlining of the zero

3 In (c) the appearance of $\int_0^2$ may NOT be used as evidence for $\bullet^4$

4 Since the area is totally above the x-axis, $\bullet^9$ is not available for a negative answer irrespective of whether or not the candidate tries to deal with it

5 For information:

$$\int_0^3 = \frac{27}{4}, \int_0^1 = \frac{65}{12}, \int_0^4 = \frac{32}{3}, \int_0^6 = 90$$

6 For candidates who differentiate, or fail to even try to integrate, $\bullet^7$, $\bullet^8$ and $\bullet^9$ are not available

Alt. Method 1 for $\bullet^1$ to $\bullet^4$

$\bullet^2$
$$\begin{array}{r|rrrr} 3 & 1 & -4 & 1 & 6 \\ & & 3 & -3 & -6 \\ \hline & 1 & -1 & -2 & \underline{\underline{0}} \end{array}$$

$\bullet^1$

$\bullet^3$ $x^2 - x - 2$

$\bullet^4$ $x = 2,\ x = -1$ ***AND*** $x_A = 2$

Alt. Method 2 for $\bullet^1$ to $\bullet^4$

$\bullet^1$ $f(3) = \ldots.. = 0$

$\bullet^2$ try $f(n) = \ldots..$ where $n > 0$

$\bullet^3$ $f(2) = \ldots.. = 0$

$\bullet^4$ $x_A = 2$

1.09

qu	ans	mk	code	calc	source	ss	pd	ic	C	B	A	U1	U2	U3
1.09	a	2	A31	NC	7049	1	1		1	1		2		
	b	7				3	3	1	5	2		7		
	c	1						1		1		1		

A function f is defined by the formula $f(x) = 3x - x^3$.

(a) Find the exact values where the graph of $y = f(x)$ meets the x- and y-axes. **2**

(b) Find the coordinates of the stationary points of the function and determine their nature. **7**

(c) Sketch the graph of $y = f(x)$. **1**

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- $\bullet^1$ ss know to use, and use $x = 0$ and $y = 0$
- $\bullet^2$ pd process
- $\bullet^3$ ss know to differentiate
- $\bullet^4$ pd differentiate
- $\bullet^5$ ss know to set derivative to zero
- $\bullet^6$ pd solve
- $\bullet^7$ pd find corresponding y's
- $\bullet^8$ ss know to justify, and justify stationary pts
- $\bullet^9$ ic interpret (e.g. nature table)
- $\bullet^{10}$ ic sketch including relevant points

Primary Method : Give 1 mark for each •

- $\bullet^1$ *any two of* $x = 0$, $x = \sqrt{3}$ *and* $x = -\sqrt{3}$
- $\bullet^2$ *remaining one*
- $\bullet^3$ $f'(x) =$
- $\bullet^4$ $3 - 3x^2$
- $\bullet^5$ $f'(x) = 0$

$\bullet^6$ $\bullet^7$

	$\bullet^6$	$\bullet^7$
x	1	-1
y	2	-2 s/i by the sketch

$\bullet^8$ $\bullet^9$

		$\bullet^8$			$\bullet^9$	
	...	-1	...	...	1	...
f'	$-$	0	$+$	$+$	0	$-$
		minimum			maximum	

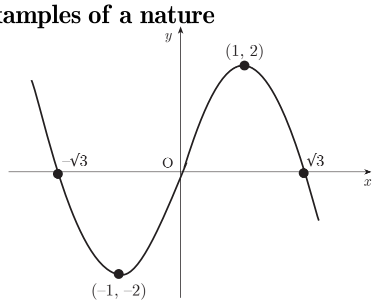
$\bullet^{10}$ *sketch(see below)*

Notes 1

1. $\bullet^2$ is only available if $\bullet^1$ has been awarded
2. The " $= 0$ " shown at $\bullet^5$ must appear at least once somewhere in the working between $\bullet^3$ and $\bullet^6$
3. $\bullet^6$ is only available as a consequence of solving $f'(x) = 0$
4. An unsimplified $\sqrt{1}$ should be penalised at the first occurence
5. The evidence for $\bullet^7$ and $\bullet^9$ may not appear until the sketch
6. The nature table must reflect previous working from $\bullet^4$ and $\bullet^6$
7. The minimum requirement for the sketch is a cubic passing through the origin and with turning points annotated

Notes 2

8. The use of the 2nd derivative is an acceptable strategy for $\bullet^8$
9. As shown in the Primary Method, $\bullet^6$ & $\bullet^7$, and $\bullet^8$ & $\bullet^9$ may be marked in series or in parallel [see foot of next page]
10. A " $-\sqrt{3}$ " appearing for the first time on the sketch may not be awarded $\bullet^1$ / $\bullet^2$ retrospectively
11. **See foot of next page for examples of a nature table.**



1.10

qu	part	mk	code	calc	source	ss	pd	ic	C	B	A
1.10		3	C21	CN	7004	2	1			3	

Given that $y = \sqrt{3x^2 + 2}$, find $\frac{dy}{dx}$. **3**

The primary method m.s is based on the following generic m.s.
This generic marking scheme may be used as an equivalence guide but only where a candidate does not use the primary method or any alternative method shown in detail in the marking scheme.

$\bullet^1$ ss expresses in standard form
$\bullet^2$ pd differentiate a binomial to fractional power
$\bullet^3$ ss know and use chain rule

Primary Method : Give 1 mark for each •

$\bullet^1$ $\left(3x^2 + 2\right)^{\frac{1}{2}}$
$\bullet^2$ $\frac{1}{2}\left(3x^2 + 2\right)^{-\frac{1}{2}}$
$\bullet^3$ $\times\ 6x$

see previous page

Marking in series

$\bullet^6$ $x = 1,\ x = -1$
$\bullet^7$ $y = 2,\ y = -2$

Marking in parallel

$\bullet^6$ $x = 1,\ y = 2$
$\bullet^7$ $x = -1,\ y = -2$

Marking in series or parallel

		$\bullet^6$	$\bullet^7$
$\bullet^6$	x	1	-1
$\bullet^7$	y	2	-2

Example of a minimum requirement nature table

		$\bullet^8$			$\bullet^9$	
$\bullet^8$	...	-1	...	...	1	...
	f' $-$	0	$+$	$+$	0	$-$
$\bullet^9$		minimum			maximum	

Example of a preferred nature table

			$\bullet^8$			$\bullet^9$	
	x	$\rightarrow$	-1	$\rightarrow$	$\rightarrow$	1	$\rightarrow$
$\bullet^8$	f'	$-$	0	$+$	$+$	0	$-$
		$\ddots$	$\cdots$	$\cdot^{\cdot^{\cdot}}$	$\cdot^{\cdot^{\cdot}}$	$\cdots$	$\ddots$
$\bullet^9$			min at $x = -1$			max at $x = 1$	

Common Errors

1 $\bullet^1 X$ $y = (3x^2 + 2)^{-1}$
$\bullet^2 X$ $\frac{dy}{dx} = -(3x^2 + 2)^{-2}$
$\bullet^3 X\checkmark$ ... $\times 6x$

2 $\bullet^1 \checkmark$ $y = (3x^2 + 2)^{\frac{1}{2}}$
$\bullet^2 X$ $\frac{dy}{dx} = -\frac{1}{2}(3x^2 + 2)^{\frac{3}{2}}$
$\bullet^3 X\checkmark$ ... $\times 6x$

1.11

qu	part	mk	code	calc	source	ss	pd	ic	C	B	A
1.11	a	4	T13, T15	NC	7006	1	2	1	4		
	b	4						4		2	2

(a) Express $f(x) = \sqrt{3}\cos(x) + \sin(x)$ in the form $k\cos(x - a)$,

where $k > 0$ and $0 < a < \dfrac{\pi}{2}$. **4**

(b) Hence or otherwise sketch the graph of $y = f(x)$ in the interval $0 \le x \le 2\pi$. **4**

The primary method m.s is based on the following generic m.s.
This generic marking scheme may be used as an equivalence guide
but only where a candidate does not use the primary method or any
alternative method shown in detail in the marking scheme.

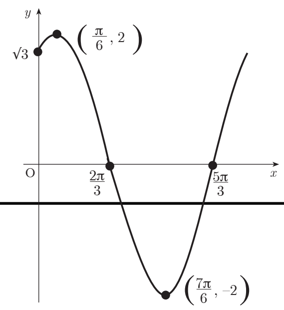
- $\bullet^1$ ss know to use, and use compound formula
- $\bullet^2$ ic equates coefficients
- $\bullet^3$ pd finds k
- $\bullet^4$ pd finds a
- $\bullet^5$ ic interprets a
- $\bullet^6$ ic interprets k
- $\bullet^7$ ic sketch with x-intercepts
- $\bullet^8$ ic sketch with y-intercept

Primary Method : Give 1 mark for each •

- $\bullet^1$ $k\cos(x)\cos(a) + k\sin(x)\sin(a)$ ***stated explicitly***
- $\bullet^2$ $k\cos(a) = \sqrt{3}$, $k\sin(a) = 1$ ***stated explicitly***
- $\bullet^3$ $k = 2$
- $\bullet^4$ $a = \dfrac{\pi}{6}$

a sketch showing

- $\bullet^5$ $\max\left(\frac{\pi}{6},...\right)$ *and* $\min\left(\frac{7\pi}{6},...\right)$
- $\bullet^6$ $\max\left(...,2\right)$ *and* $\min\left(....,-2\right)$
- $\bullet^7$ $\left(\frac{2\pi}{3},0\right)$ *and* $\left(\frac{5\pi}{3},0\right)$
- $\bullet^8$ $\left(0,\sqrt{3}\right)$



Notes 1

1 In the whole question, do not penalise more than once for not using radians

Table showing marks lost for using degrees:

a	$30°$	$\frac{\pi}{6}$	$60°$	$\frac{\pi}{3}$
graph in degrees	**−1**	**−1**	**−2**	**−2**
graph in radians	**−1**	**OK**	**−1**	**−1**

In (a)

2 $k(\cos x\cos a + \sin x\sin a)$ is acceptable for $\bullet^1$

3 $k = \sqrt{4}$ does NOT earn $\bullet^3$

4 $2(\cos x\cos a + \sin x\sin a)$ etc is acceptable for $\bullet^1$ & $\bullet^3$

5 Candidates may use any form of the wave equation as long as their final answer is in the form $k\cos(x - a)$. If not then $\bullet^4$ is not available

6 Treat $k\cos x\cos a + \sin x\sin a$ as bad form ONLY if $\bullet^2$ is gained.

Notes 2

In (b)

7 Do not penalise graphs which go beyond $0 \le x \le 2\pi$

8 A maximum of 3 marks are available for candidates who attempt to sketch graphs of $k\cos(x + a)$, $k\sin(x + a)$ *or* $k\sin(x - a)$. No other graphs can earn any credit

9 **Alternative marking for 2 marks for candidates who do not make a sketch**

$\max\left(\frac{\pi}{6},...\right)$, $\min\left(\frac{7\pi}{6},...\right)$, $(...,2)$, $(...,-2)$,
$\left(\frac{2\pi}{3},0\right)$, $\left(\frac{5\pi}{3},0\right)$ *and* $\left(0,\sqrt{3}\right)$

- $\bullet^5$ *any two from the above list*
- $\bullet^6$ *another two from the above list*

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