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Paper 4 (Extended) **October/November 2017**

MARK SCHEME

Maximum Mark: 120

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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MARK SCHEME NOTES

The following notes are intended to aid interpretation of mark schemes in general, but individual mark schemes may include marks awarded for specific reasons outside the scope of these notes.

Types of mark

M Method marks, awarded for a valid method applied to the problem.

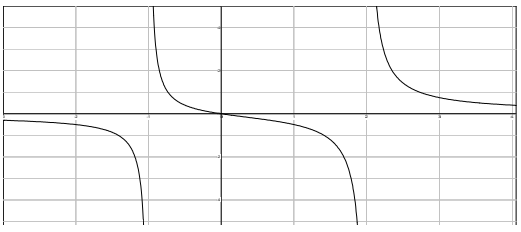
A Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. For accuracy marks to be given, the associated Method mark must be earned or implied.

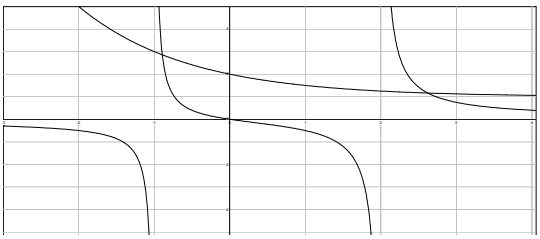
B Mark for a correct result or statement independent of Method marks.

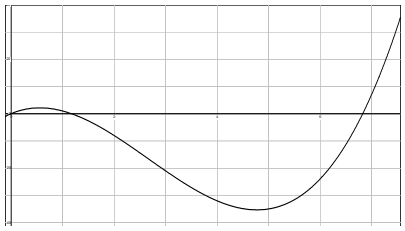
When a part of a question has two or more 'method' steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. The notation '**dep**' is used to indicate that a particular M or B mark is dependent on an earlier mark in the scheme.

Abbreviations

awrt	answers which round to
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
nfww	not from wrong working
oe	or equivalent
rot	rounded or truncated
SC	Special Case
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	– 1 – 8	**2**	**B1** for each
1(a)(ii)	$-7n + 34$ oe final answer	**2**	**B1** for $-7n + k$ or $-kn + 34$ oe or correct unsimplified seen
1(b)(i)	128, 256	**2**	**B1** for each
1(b)(ii)	2^{n+2} oe final answer nfww	**2**	**M1** for $k \times 2^p \ (k \neq 0)$ seen, k numerical and $p = \text{f}(n)$
2(a)(i)	55.25	**2**	**M1** for 65×0.85 oe
2(a)(ii)	$\frac{99}{320}$ cao	**2**	**B1** for 80 or **M1** for 24.75 + *their* 55.25
2(b)	95[.00]	**3**	**M2** for $80.75 \div 0.85$ oe or **M1** for recognising 80.75 as 85%.
2(c)	23.5	**2**	**M1** for 0.85×0.90 oe or $\frac{0.9 \times their(a)(i)}{65}$ oe 0.765 implies M1
3(a)(i)	Image at (2, 4), (3, 6), (6, 6), (6, 4)	**2**	**SC1** for reflection in other horizontal line or in the line $x = 1$
3(a)(ii)	Image at (– 4, – 2), (– 6, – 3), (– 6, – 6), (– 4, – 6)	**2**	**SC1** for correct orientation but wrong centre
3(a)(iii)	Reflection $y = -x$ oe	**2**	**B1** for each
3(b)	Enlargement [centre] (0, 0) oe [factor] – 0.5 oe	**3**	**B1** for each
3(c)	Image at (2, – 4), (6, – 4), (6, – 8), (3, – 8)	**2**	**SC1** for stretch with x-axis invariant with other factor or stretch with $y = k$ invariant with stretch factor 2
4(a)	Correct sketch 	**3**	**B1** for correct middle branch **B1** for correct left hand branch **B1** for correct right hand branch

Question	Answer	Marks	Partial Marks
4(b)	– 1 2	**2**	**B1** for each
4(c)	2	**1**	
4(d)(i)	Correct sketch 	**2**	Must intersect *y*-axis and be above *x*-axis **B1** for decreasing exponential graph
4(d)(ii)	$y = 1$ oe	**1**	
4(e)	– 0.892 or – 0.8919 to – 0.892[0] 2.62 or 2.622 to 2.623	**2**	**B1** for each
5(a)	22 100	**4**	**B3** for 22 140 or 22 143. … seen and incorrectly or not rounded or **M2** for $17\,500 \times 1.04^6$ oe or **M1** for $17\,500 \times 1.04^k$ $k > 1$ oe
5(b)	1.5[0] or 1.499 to 1.5[00]	**3**	**M2** for $\sqrt[12]{\frac{239.12}{200}}$ or **M1** for $200 \times x^{12} = 239.12$ or better
6(a)(i)	$50 < t \leqslant 60$	**1**	
6(a)(ii)	Correct curve	**4**	**B2** for 3 or 4 correct heights or **B1** for 2 correct heights or correct cumulative frequencies seen **B1** for plotting correct *t* co-ordinates, **dependent** on increasing curve
6(a)(iii)(a)	52 to 55	**1**	**FT** *their* curve, **dependent** on increasing
6(a)(iii)(b)	Strict follow through	**2**	**FT** *their* curve, **dependent** on increasing **B1FT** for *their* cum freq value soi
6(b)(i)	52.5 or 52.48 to 52.49	**2**	**M1** for evidence of at least three correct mid-values 30, 45, 52.5, 57.5, 70 soi by 10497.5
6(b)(ii)	1.3, … , 11, 8.4, 1.9	**2**	**B1** for 3 correct
6(b)(iii)	Correct histogram	**3**	**FT** *their* (ii) **B1** for correct widths **B2** for correct heights or **B1** for three correct heights

Question	Answer	Marks	Partial Marks
7(a)	$x+2\left(x+\frac{1}{4}\right)=8$ oe	**M2**	**M1** for $2\left(x+\frac{1}{4}\right)$ oe seen
	2.5	**B1**	
7(b)(i)	$x^3=2x(x-2)(x-2)$ oe	**M1**	
	$[(x-2)^2=]\ x^2-2x-2x+4$ or $2x^3-4x^2-4x^2+8x$	**B1**	Allow $-4x$ for $-2x-2x$ Allow $-8x^2$ for $-4x^2-4x^2$
	leading to $x^3-8x^2+8x=0$	**A1**	Final equation reached without any errors or omissions
7(b)(ii)	Correct sketch 	**2**	**B1** for correct shaped cubic with max before min
7(b)(iii)	318 or 319 or 318.3 to 318.7	**2**	**B1** for 6.83 or 6.828… seen isw use of other values (1.1715…)
8(a)(i)	$\frac{2}{6}$ oe	**1**	
8(a)(ii)	$\frac{4}{6}$ oe	**1**	
8(a)(iii)	$\frac{4}{6}$ oe	**1**	
8(b)(i)	$\frac{1}{36}$ oe	**2**	**M1** for $\frac{1}{6}\times\frac{1}{6}$
8(b)(ii)	$\frac{4}{36}$ oe	**3**	**M2** for $\frac{1}{6}\times\frac{2}{6}+\frac{2}{6}\times\frac{1}{6}$ oe or **M1** for one product soi by $\frac{1}{18}$ oe
8(c)	$\frac{215}{216}$ oe	**2**	**M1** for $1-\frac{1}{6}\times\frac{1}{6}\times\frac{1}{6}$ oe

Question	Answer	Marks	Partial Marks
9(a)(i)	$[y =] 5x - 3$	**3**	**M1** for gradient = $\frac{12-2}{3-1}$ oe **M1** for substituting (1, 2) or (3, 12) into $y = mx + c$ OR **M2** for $\frac{y-2}{x-1} = \frac{12-2}{3-1}$ oe
9(a)(ii)	$y = -\frac{1}{5}x + 2$ oe	**2**	**FT** *their* gradient in (i) **M1** for answer in form $y = mx + 2$ oe or for $y = \frac{-1}{their\ 5}x + c$ oe
9(b)(i)	-2, $\frac{2}{3}$ oe with correct working	**3**	**B2** for sketch with one –ve and one +ve zero or **B1** for sketch of parabola vertex downwards OR **B2** for $(3x - 2)(x + 2)$ or **B1** for $3x(x + 2) - 2(x + 2)$ or $x(3x - 2) + 2(3x - 2)$ or for $(3x + a)(x + b)$ where $ab = -4$ or $a + 3b = 4$ OR **B2** for $\frac{-4 \pm \sqrt{4^2 - 4(3)(-4)}}{2(3)}$ oe or **B1** for $\sqrt{4^2 - 4(3)(-4)}$ or $\frac{-4 \pm \sqrt{.....}}{2(3)}$ If 0 or B1 scored, then + **B1** for -2, $\frac{2}{3}$
9(b)(ii)	$-2 < x < \frac{2}{3}$	**2**	**FT** *their* (b)(i) **B1** for $-2 < x$ or for $x < \frac{2}{3}$ seen If 0 scored **SC1 FT** for $-2 \leqslant x \leqslant \frac{2}{3}$
9(c)	$[a =] -4$, $[b =] 8$, $[c =] 1$	**3**	**M2** for $y = a(x-1)^2 + 5$ or **M1** for use of $y = a(x-h)^2 + k$ or for $c = 1$ or $-\frac{b}{2a} = 1$
10(a)(i)	125	**1**	
10(a)(ii)	305	**2**	**FT** *their* (i), Dep on (i) < 180 **M1** for 180 + *their*(i), Dep on (i) < 180

Question	Answer	Marks	Partial Marks
10(b)	69.3 or 69.32 to 69.33	**3**	**M1** for $90^2 + 120^2 - 2 \times 90 \times 120 \cos 35$ **A1** for 4806…
10(c)	60.3 or 60.28 to 60.29	**3**	**M2** for $\frac{115 \sin 65}{120}$ oe or **M1** for $\frac{115}{\sin BAC} = \frac{120}{\sin 65}$ oe
10(d)(i)	8730 or 8728 to 8730…	**4**	**M1** for $0.5 \times 90 \times 120 \times \sin 35$ **M2** for $0.5 \times 120 \times 115 \times \sin(180 - 65 - \textit{their}\ (c))$ oe or **M1** for angle $ACB = 180 - 65 - \textit{their}$ (c)
10(d)(ii)	349 or 349.1 to 349.2…	**3**	**FT** *their* (d)(i) ÷ 25 **M2** for *their* (i) ÷ 25 oe or **M1** for squaring scale oe or for figs 349 or 3491 to 3492
11(a)(i)	10	**1**	
11(a)(ii)	1	**1**	
11(b)	$\frac{x-1}{2}$ oe	**2**	**M1** for $y - 1 = 2x$ or $x = 2y + 1$ or $\frac{y}{2} = x + \frac{1}{2}$
11(c)	$4x^2 + 4x + 2$ final answer	**3**	**M1** for $(2x+1)^2 + 1$ **B1** for $[(2x+1)^2 =]\ \ 4x^2 + 2x + 2x + 1$ oe
11(d)	Translation $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$	**2**	**B1** for each
11(e)	3	**1**	