



**Cambridge Assessment International Education**  
Cambridge International General Certificate of Secondary Education (9–1)

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**MATHEMATICS**

**0980/04**

Paper 4 (Extended)

**For examination from 2019**

MARK SCHEME

Maximum Mark: 130

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**Specimen**

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This document consists of **9** printed pages and **1** blank page.

**Generic Marking Principles**

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

**GENERIC MARKING PRINCIPLE 1:**

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

**GENERIC MARKING PRINCIPLE 2:**

Marks awarded are always **whole marks** (not half marks, or other fractions).

**GENERIC MARKING PRINCIPLE 3:**

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

**GENERIC MARKING PRINCIPLE 4:**

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

**GENERIC MARKING PRINCIPLE 5:**

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

**GENERIC MARKING PRINCIPLE 6:**

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

**Abbreviations**

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	1848 final answer	2	<b>M1</b> for $1650 \times \left(1 + \frac{12}{100}\right)$ oe
1(b)(i)	1750	2	<b>M1</b> for $\frac{500}{9-5}$ [ $\times 5$ ] or [ $\times 9$ ] or any equation which would lead to $4x = 500$ or $4x = 2500$ or $4x = 4500$ or $4x = 7000$ when simplified
1(b)(ii)	$64\frac{2}{7}$ or 64.3 or 64.28 to 64.29	1	
1(c)(i)	33:20 oe	2	<b>B1</b> for 33:6 or 20:6 or 5.5 oe seen or 3.33... oe seen or <b>M1</b> for two ratios with a common number of children implied by $20k$ and $33k$ seen, $k > 0$
1(c)(ii)	236	3	<b>M2</b> for $\frac{24}{2} \times 11 + \frac{24}{3} \times 10$ oe or $((3 \times 11) + (2 \times 10)) \times 24 \div 6$ or $\frac{6}{6+20+33} \times x = 24$ or <b>M1</b> for $\frac{24}{2} \times 11$ or $\frac{24}{2} \times 13$ soi or $\frac{24}{3} \times 10$ or $\frac{24}{3} \times 13$ soi oe or $24 \div 6$ soi
1(d)	17[.00]	3	<b>M2</b> for $20.40 \div \left(1 + \frac{20}{100}\right)$ oe or <b>M1</b> for $(100 + 20)\%$ oe associated with 20.40 seen

Question	Answer	Marks	Partial Marks
2(a)(i)	66	1	
2(a)(ii)	24	1	<b>FT</b> 90 – <i>their</i> (a)(i)
2(a)(iii)	66	2	<b>FT</b> 90 – <i>their</i> (a)(ii) <b>M1</b> for [BOD =] $180 - 48$ or $180 - 2 \times \textit{their} (a)(ii)$
2(a)(iv)	114	1	<b>FT</b> 180 – <i>their</i> (a)(iii)

Question	Answer	Marks	Partial Marks
2(b)	83.6 or 83.60[...]	2	<b>M1</b> for $\frac{1}{2} \times 15 \times 15 \times \sin(180 - 48)$ oe or $\frac{1}{2} \times 15 \times 15 \times \sin(180 - 2 \times \textit{their (a)(ii)})$ oe
2(c)	Opposite angles add up to 180 OR Angle in a semicircle [= 90]	1	

Question	Answer	Marks	Partial Marks
3(a)(i)	$\frac{600}{x+20}$ final answer	1	
3(a)(ii)	$\frac{600}{x} - \textit{their} \frac{600}{x+20} = 1.5$ oe	1	<b>M1</b>
	$600(x+20) - 600x = 1.5x(x+20)$ or $\frac{600(x+20) - 600x}{x(x+20)} [= \textit{their} 1.5]$	1	<b>M1</b> Correctly clearing, or correctly collecting into a single fraction, two fractions both with algebraic denominators, one being $\frac{600}{x}$
	$600x + 12000 - 600x = 1.5x^2 + 30x$ [ $0 = 1.5x^2 + 30x - 12000$ ]	1	<b>M1</b> Dep on previous <b>M1</b> , correctly multiplying <i>their</i> brackets <b>and</b> clearing fraction
	$0 = x^2 + 20x - 8000$	1	<b>A1</b> With no errors or omissions seen, dep on <b>M3</b>
3(b)	-100, 80	3	<b>M2</b> for $(x+100)(x-80)$ or <b>M1</b> for $(x+a)(x+b)$ where $ab = -8000$ or $a+b = 20$ OR <b>B1</b> for $\sqrt{20^2 - 4 \times 1 \times (-8000)}$ or better and <b>B1</b> for $\frac{-20 + \sqrt{q}}{2 \times 1}$ or $\frac{-20 - \sqrt{q}}{2 \times 1}$
3(c)	6.67 or 6.666 to 6.667 oe	2	<b>FT</b> $\frac{12}{2(\textit{their} 80) + 20} \times 100$ correctly evaluated to at least 3 sf <b>M1</b> for choosing and using <i>their</i> positive root

Question	Answer	Marks	Partial Marks
4(a)(i)	$9\pi$ final answer	2	<b>M1</b> for $\frac{135}{360} \times 2 \times \pi \times 12$ oe
4(a)(ii)(a)	4.5[0] or 4.497 to 4.504...	2	<b>FT</b> <i>their</i> $9 \div 2$ <b>M1</b> for $2\pi r = \textit{their} 9\pi$ or $12\pi r = \frac{135}{360}\pi 12^2$ oe

Question	Answer	Marks	Partial Marks
4(a)(ii)(b)	11.1 or 11.12[...]	3	<b>FT</b> <i>their</i> $\sqrt{12^2 - \text{their } 4.5^2}$ to 3 sf or better ( <i>their</i> $4.5 < 12$ ) <b>M2</b> for $\sqrt{12^2 - \text{their } 4.5^2}$ ( <i>their</i> $4.5 < 12$ ) or <b>M1</b> for $12^2 = h^2 + \text{their } 4.5^2$ oe ( <i>their</i> $4.5 < 12$ )
4(b)(i)	75 nfw	3	<b>M2</b> for $l = \frac{35}{7} \times 15$ or $x = \frac{35}{7} \times 8$ oe or for 40 seen nfw or correct trig or Pythagoras' method leading to value rounding to 40.0 <b>M1</b> for $\frac{l}{15} = \frac{35}{7}$ oe or $\frac{x}{8} = \frac{35}{7}$ oe or $\frac{l-35}{8} = \frac{35}{7}$ oe or $\frac{l-35}{l} = \frac{8}{15}$ oe
4(b)(ii)	2730 or 2730.0 to 2730.4 nfw	3	<b>M2 dep</b> for $\pi \times 15 \times \text{their } 75 - \pi \times 8 \times (\text{their } 75 - 35)$ [ $+\pi \times 8^2$ ] dep <i>their</i> $75 > 35$ or $805\pi$ [2527.7 to 2530] nfw or $869\pi$ [2728.6 to 2731.2] nfw or <b>M1</b> for $\pi \times 15 \times \text{their } 75$ or $1125\pi$ [3532.5 to 3535.8] nfw seen or $\pi \times 8 \times (\text{their } 75 - 35)$ or $320\pi$ [1004.8 to 1005.8] nfw seen or $\pi \times 8^2$ or $64\pi$ [200.9 to 201.2] nfw seen
4(c)(i)	$16r^3$	2	<b>M1</b> for $[M =] k \times r^3$ or $1458 = k \times 4.5^3$ oe or $\frac{M}{1458} = \frac{r^3}{4.5^3}$ oe After <b>M0</b> , <b>SC1</b> for 16 seen
4(c)(ii)	8:27 oe	1	Must be numeric, e.g. 128:432

Question	Answer	Marks	Partial Marks
5(a)	2 and 7	2	<b>B1</b> for each value
5(b)	Complete correct curve	5	<b>B3 FT</b> for <i>their</i> 9 or 10 points or <b>B2 FT</b> for <i>their</i> 7 or 8 points or <b>B1 FT</b> for <i>their</i> 5 or 6 points and <b>B1</b> independent for one branch on each side of the y-axis and <b>not touching</b> the y-axis <b>SC4</b> for correct curve with branches joined

Question	Answer	Marks	Partial Marks
5(c)	Correct tangent and $-13 \leq \text{grad} \leq -8$	3	<b>B2</b> for close attempt at tangent at $x = 1$ and answer in range OR <b>B1</b> for ruled tangent at $x = 1$ , no daylight at $x = 1$ Consider point of contact as midpoint between two vertices of daylight, the midpoint must be between $x = 0.8$ and $1.2$ <b>and M1</b> (dep on <b>B1</b> or close attempt at tangent [at any point] for $\frac{\text{rise}}{\text{run}}$
5(d)(i)	-1.4 to -1.2	1	
5(d)(ii)	6, 7, 8, 9, 10, 11	2	<b>B1</b> for 3 correct values
5(e)	[a =] -5 [b =] -1 [c =] 12	3	<b>B2</b> for two correct values or for $x^3 - 5x^2 - x + 12 [= 0]$ oe or <b>M1</b> for $x^2 - 2x + \frac{12}{x} = 3x + 1$

Question	Answer	Marks	Partial Marks
6(a)	$95.5^2 + 83.1^2 - 2 \times 95.5 \times 83.1 \times \cos 101$	2	<b>M2</b> <b>M1</b> for $\cos 101 = \frac{95.5^2 + 83.1^2 - AB^2}{2 \times 95.5 \times 83.1}$
	138.0...	2	<b>A2</b> <b>A1</b> for 19054.[...] also implies <b>M2</b>
6(b)	110 or 109.7 to 109.8	4	<b>B3</b> for 36.2 or 36.20 to 36.24[1...] or <b>M2</b> for $[\sin =] \frac{83.1 \times \sin 101}{138[.0...]}$ oe or <b>M1</b> for correct implicit version After <b>M0</b> , <b>SC1</b> for angle $ABC = 42.76$ to 42.8
6(c)	18.8 or 18.79[...]	2	<b>M1</b> for $46.2 \times \cos(45 + 21)$ oe After <b>M0</b> , <b>SC1</b> for answer 42.2 or 42.20 to 42.21

Question	Answer	Marks	Partial Marks
7(a)(i)	316	4	<b>M1</b> for 100, 250, 325, 375, 450 soi <b>M1</b> for $\Sigma fm$ with $m$ 's in intervals including boundaries [15 800] <b>M1</b> (dep on 2nd <b>M1</b> ) for $their \Sigma fm \div 50$
7(a)(ii)	Three correct blocks with heights 0.09, 0.36, 0.24 with correct widths and no gaps	3	<b>B2</b> for two correct blocks or <b>B1</b> for one correct block or three correct frequency densities soi

Question	Answer	Marks	Partial Marks
7(b)	Students have a greater range of estimates oe	1	<b>B1</b>
	[On average] adults estimated a greater mass oe	1	<b>B1</b>

Question	Answer	Marks	Partial Marks
8(a)(i)	$x \geq 100$ final answer	1	
8(a)(ii)	$y \geq 120$ final answer	1	
8(a)(iii)	$x + y \leq 300$ final answer	1	
8(a)(iv)	$40x + 80y \geq 16000$ or $0.4x + 0.8y \geq 160$	1	<b>M1</b> with no errors seen but isw substitution of values after correct inequality
8(b)	$x = 100$ ruled $y = 120$ ruled $x + y = 300$ ruled $x + 2y = 400$ ruled Correct shading	6	<b>B1</b> <b>B1</b> <b>B1</b> <b>B2</b> Allow <b>B1</b> for line with negative gradient passing through (400, 0) or (0, 200) when extended <b>B1</b> Dep on all previous marks earned Condone any clear indication of the required region
8(c)	200	2	<b>M1</b> for $x = 100$ and $y = 200$ selected or for $x \times 0.4 + y \times 0.8$ oe evaluated where (x, y) is an integer point in <i>their</i> [unshaded] region

Question	Answer	Marks	Partial Marks
9(a)	$4x - 3x^2$ or $x(4 - 3x)$ nfwf final answer	3	<b>B2</b> for $3x^2 - 6x - 6x^2 + 10x$ or <b>M1</b> for $3x^2 - 6x$ or $-6x^2 + 10x$
9(b)(i)	$(2 + y)(3w - 2x)$ oe final answer	2	<b>M1</b> for $3w(2 + y) - 2x(2 + y)$ or $2(3w - 2x) + y(3w - 2x)$
9(b)(ii)	$(2x + 5y)(2x - 5y)$ final answer	2	<b>M1</b> for $(2x \pm 5y)(2x \pm 5y)$ or $(2x + ky)(2x - ky)$ or $(kx + 5y)(kx - 5y)$ , $k \neq 0$ or $(2x + 5)(2x - 5)$ or $(2 + 5y)(2 - 5y)$
9(c)	$\frac{27x^6}{64}$ final answer	2	<b>B1</b> for 2 [out of 3] elements correct in the right form in final answer or final answer contains 27 and 64 and $x^{-16}$ or $\frac{3x^2}{4}$ seen or $\frac{729x^{12}}{4096}$ seen
9(d)(i)	$2n$ is even and subtracting 1 gives an odd number	1	Must interpret the $2n$ as even or not odd and then the $-1$ oe
9(d)(ii)	$2n + 1$ oe final answer	1	

Question	Answer	Marks	Partial Marks
9(d)(iii)	$their (2n + 1)^2 - (2n - 1)^2$	1	<b>M1</b> Could use alternate correct expressions for consecutive <b>odd</b> numbers. Allow method and accuracy marks if correct. Could reverse the algebraic terms $their (2n - 1)^2 - (2n + 1)^2$ leading to $-8n$ . Allow method and accuracy marks if correct.
	$4n^2 + 4n + 1 - 4n^2 + 4n - 1$	1	<b>M1 Dep on M1</b> for expanding brackets in <i>their</i> expressions. If seen alone and completely correct then implies previous <b>M1</b> Allow $4n^2 + 4n + 1 - (4n^2 - 4n + 1)$
	$8n$	1	<b>A1</b> With no errors seen. After <b>0</b> scored, allow <b>SC1</b> for two correctly evaluated numeric examples of subtracting consecutive odd squares isw

Question	Answer	Marks	Partial Marks
10(a)(i)	9.43[...]	2	<b>M1</b> for $5^2 + ([-]8)^2$ or better
10(a)(ii)	(-3, 5)	1	
10(b)(i)(a)	$\frac{1}{2}(\mathbf{a} + \mathbf{b})$ or $\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}$	2	<b>M1</b> for $\mathbf{a} + \frac{1}{2}\overrightarrow{AB}$ oe, e.g. $\mathbf{a} + \overrightarrow{AM}$ , $\overrightarrow{OA} + \frac{1}{2}\overrightarrow{AB}$
10(b)(i)(b)	$\frac{1}{4}(\mathbf{a} + \mathbf{b})$ or $\frac{1}{4}\mathbf{a} + \frac{1}{4}\mathbf{b}$	1	<b>FT</b> $\frac{1}{2}$ <i>their (b)(i)(a)</i> <u>in terms of a and/ or b</u> in simplest form
10(b)(i)(c)	$\frac{1}{4}(\mathbf{b} - 3\mathbf{a})$ or $\frac{1}{4}\mathbf{b} - \frac{3}{4}\mathbf{a}$	2	<b>M1</b> for $-\mathbf{a} + their (b)(i)(b)$ or any correct route
10(b)(ii)	3 : 4 final answer	3	<b>M1</b> for $[\overrightarrow{AN} =] -\mathbf{a} + \frac{1}{3}\mathbf{b}$ <b>A1</b> for $\frac{1}{4} : \frac{1}{3}$ oe or $\overrightarrow{AN} = \frac{1}{3}(-3\mathbf{a} + \mathbf{b})$ or $3k$ to $4k$ After <b>0</b> scored <b>SC1</b> for final answer 4 : 3
10(c)(i)	Triangle drawn at (-3, -3), (-6, -3), (-6, $-4\frac{1}{2}$ )	3	<b>B2</b> for 2 vertices correct in triangle or 3 correct co-ordinates soi in working or <b>B1</b> for 1 vertex in triangle correct soi or triangle of correct size and orientation but wrong position or <b>M1</b> for correct set up e.g. $\begin{pmatrix} -1.5 & 0 \\ 0 & -1.5 \end{pmatrix} \begin{pmatrix} 2 & 4 & 4 \\ 2 & 2 & 3 \end{pmatrix}$

Question	Answer	Marks	Partial Marks
10(c)(ii)	$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$	2	SC1 for 1 correct row or column or for $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$
11(a)	$\frac{38}{56}$ or $\frac{19}{28}$ oe	4	[0.679 or 0.6785 to 0.6786] M3 for $\frac{4}{8} \times \frac{4}{7} + \frac{3}{8} \times \frac{5}{7} + \frac{1}{8} [\times \frac{7}{7}]$ oe or M2 for sum of two of the products isw $\frac{4}{8} \times \frac{4}{7}, \frac{3}{8} \times \frac{5}{7}, \frac{1}{8} [\times \frac{7}{7}]$ oe or M1 for $\frac{4}{8} \times \frac{4}{7}$ or $\frac{3}{8} \times \frac{5}{7}$ oe isw or $\frac{1}{8} \times \frac{7}{7}$ isw After 0 scored, SC1 for answer of $\frac{38}{64}$ oe
11(b)	$\frac{60}{336}$ or $\frac{5}{28}$ oe	2	M1 for $\frac{5}{8} \times \frac{4}{7} \times \frac{3}{6}$ or $\left(\frac{4}{8} \times \frac{3}{7} \times \frac{2}{6}\right) + 3\left(\frac{4}{8} \times \frac{1}{7} \times \frac{3}{6}\right)$ oe

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