



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

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**MATHEMATICS**

**0580/42**

Paper 4 Paper 4 (Extended)

**October/November 2016**

MARK SCHEME

Maximum Mark: 130

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**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.

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**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	Mark	Part marks
<b>1 (a) (i)</b>	11 054.25 final answer	<b>2</b>	<b>M1</b> for $18000 \times \left(1 - \frac{15}{100}\right)^3$ oe
<b>(ii)</b>	16 500	<b>3</b>	<b>M2</b> for $14025 \div \left(1 - \frac{15}{100}\right)$ oe or <b>M1</b> for recognition of 14 025 as 85% soi
<b>(b)</b>	260 final answer	<b>2</b>	<b>M1</b> for $P\left(1 + \frac{5}{100}\right)^2 = 286.65$ oe
<b>(c) (i)</b>	6.18	<b>3</b>	<b>M2</b> for $\frac{224.72 - 200}{200 \times 2} \times 100$ oe or $\frac{1}{2} \left( \frac{224.72}{200} \times 100 - 100 \right)$ or <b>M1</b> for $\frac{200 \times r \times 2}{100}$ oe or $\frac{224.72 - 200}{200 \times 2}$ or $\frac{224.72}{200} \times 100 - 100$ soi by 12.36 If zero scored, <b>SC1</b> for 56.18 or 56.2 as final answer
<b>(ii)</b>	6	<b>3</b>	<b>M2</b> for $\sqrt{\frac{224.72}{200}}$ or $\sqrt{\frac{224.72}{2}}$ soi by 1.06 or 106 or 10.6 or <b>M1</b> for $200 \left(1 + \frac{r}{100}\right)^2 = 224.72$ oe

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Question	Answer	Mark	Part marks
<b>2</b> (a)	1	<b>1</b>	
	1	<b>1</b>	
	(b) Fully correct graph	<b>4</b>	<b>B3FT</b> for 6 or 7 points plotted or <b>B2FT</b> for 4 or 5 points plotted or <b>B1FT</b> for 2 or 3 points plotted
	(c) (i) $-1 < \text{ans} < -0.8$	<b>1</b>	
	$1.25 < \text{ans} < 1.45$	<b>1</b>	
	$2.5 < \text{ans} < 2.6$	<b>1</b>	
	(ii) $-0.7 < \text{ans} < -0.5$	<b>2</b>	<b>M1</b> for evidence of $y = -x$ or $\frac{x^3}{3} - x^2 + 1 = -x$
(d) (i)	$y = 1$ to 1.1 oe	<b>1FT</b>	<b>FT</b> only if a clear maximum point
	$y = -0.4$ to $-0.33$ oe	<b>1FT</b>	<b>FT</b> only if a clear minimum point
	(ii) $-0.4$ to $-0.33$ oe	<b>1FT</b>	Correct or <b>FT</b> <i>their</i> graph
<b>3</b> (a)	$\frac{240 \sin 85}{\sin 50}$	<b>M2</b>	or <b>M1</b> for $\frac{\sin 50}{240} = \frac{\sin 85}{AB}$ oe
	312 or 312.1 ....	<b>B1</b>	
	(b) $\frac{1}{2} \times 180 \times 240 \times \sin A = 12000$	<b>M1</b>	
	33.748 to 33.749	<b>A2</b>	<b>A1</b> for $\sin = \frac{24000}{43200}$ or better or 0.555 or 0.556 or 0.5 or 0.5555 to 0.5556
	(c) 328 or 328.3 to 328.5	<b>5</b>	<b>B1</b> for [angle $A =$ ] 78.75 seen  <b>M2</b> for $180^2 + (\text{their } AB)^2 - 2 \times 180 \times \text{their } AB \times \cos 78.75$ or <b>M1</b> for $\cos 78.75 = \frac{180^2 + (\text{their } AB)^2 - x^2}{2 \times 180 \times (\text{their } AB)}$ <b>A1</b> for 107 800 to 107 900
	(d) (i) 108.75 or 108.7 or 108.8	<b>1</b>	
	(ii) 288.75 or 288.7 or 288.8	<b>2FT</b>	<b>FT</b> $180 + \text{their (d)(i)}$ <b>M1</b> for $180 + \text{their (d)(i)}$ or $360 - (180 - \text{their (d)(i)})$

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Question	Answer	Mark	Part marks
<b>4 (a)</b>	15	<b>2</b>	<b>M1</b> for $10 \div 40 [\times 60]$
<b>(b)</b>	49.2 nfw	<b>4</b>	<b>M1</b> for 35, 42.5, 47.5, 52.5, 57.5, 70 soi  <b>M1</b> for $\Sigma fx$ $8 \times 35 + 22 \times 42.5 + 95 \times 47.5 + 55 \times 52.5 + 14 \times 57.5 + 6 \times 70$  <b>M1 dep</b> for <i>their</i> $\Sigma fx \div 200$
<b>(c)</b>	Fully correct histogram	<b>4</b>	<b>B3</b> for 4 correct blocks or <b>B2</b> for 2 or 3 correct blocks or <b>B1</b> for 1 correct block  If zero scored, <b>SC1</b> for correct frequency densities 0.8, 19, 11, 2.8, 0.3 soi
<b>(d) (i)</b>	125, 180	<b>1</b>	
<b>(ii)</b>	Correct diagram	<b>3</b>	<b>B1FT</b> <i>their</i> <b>(d)(i)</b> for 6 correct heights within correct square(including boundaries) or touching correct line if should be on a grid line and <b>B1</b> for 6 points at upper ends of intervals on correct vertical line and <b>B1FT</b> (dep on at least B1) for increasing curve or polygon through 6 points  If zero scored, <b>SC1FT</b> for 5 correct points plotted
<b>(iii) (a)</b>	48 to 49	<b>1</b>	
<b>(b)</b>	55	<b>1</b>	
<b>(c)</b>	8 to 14	<b>2FT</b>	<b>B1FT</b> for 186 to 192 seen

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Question	Answer	Mark	Part marks
<b>5 (a) (i)</b>	$\frac{3}{4}, \frac{1}{4}$ $\frac{7}{8}, \frac{1}{8}$	<b>2</b>	<b>B1</b> for any 2 correct
<b>(ii)</b>	$\frac{21}{32}$ oe	<b>2</b>	<b>M1</b> for $\frac{7}{8} \times \frac{3}{4}$ oe
<b>(iii)</b>	$\frac{441}{1024}$ oe	<b>2FT</b>	<b>M1</b> for $\left(\frac{7}{8} \times \frac{3}{4}\right)^2$ or <i>their</i> <b>((a)(ii))<sup>2</sup></b> oe
<b>(b)</b>	175	<b>2</b>	<b>M1</b> for $200 \times \frac{7}{8}$
<b>(c)</b>	2400	<b>2</b>	<b>M1</b> for $1575 \div \text{their(a)(ii)}$

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Question	Answer	Mark	Part marks	
6	(a) (i)	1.32	2	M1 for $0.8 \times 1.5 \times 1.1$
	(ii)	0.725 or 0.7246 to 0.7247...	2	M1 for $\pi r^2 \times 0.8 = \text{their(a)(i)}$ or $\pi r^2 = 1.5 \times 1.1$ oe
	(iii)	0.513 to 0.518 nfw	5	M1 for $2(1.5 \times 1.1 + 1.5 \times 0.8 + 1.1 \times 0.8)$  M1 for $[2 \times] \pi \times (\text{their (a)(ii)})^2$  M2 for $\pi \times 2 \times (\text{their (a)(ii)}) \times 0.8$ or M1 for $\pi \times 2 \times (\text{their (a)(ii)})$
	(b) (i)	$x + y \geq 9$ oe $y \geq 2$ oe	1 1	If zero scored, SC1 for $x + y > 9$ and $y > 2$
	(ii)	Fully correct diagram with unwanted region shaded	4	B1 for $2x + 3y = 24$ ruled  B1 for $x + y = 9$ ruled  B1 for $y = 2$ ruled
	(iii)	20 [x =] 7 [y =] 2	1 1 1	If zero scored, SC1 for $2x + 3y$ evaluated from integers

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7	(a)	54.50 final answer	2	<b>B1</b> for 54.495 to 54.496 or 54.5 or <b>M1</b> for $200 \div 3.67$
	(b) (i)	$\frac{1000}{x(x+1)}$ final answer	3	<b>M1</b> for $1000(x+1) - 1000x$ <b>M1</b> for denominator $x(x+1)$
	(ii)	$\frac{1000}{x} - \frac{1000}{x+1} = 4.5[0]$ oe or $\frac{1000}{x(x+1)} = 4.5$ $1000 = 4.5x(x+1)$ $4.5x^2 + 4.5x - 1000 = 0$ $9x^2 + 9x - 2000 = 0$	<b>M1</b>  <b>M1dep</b>  <b>A1</b>	Allow <i>their</i> (b)(i) for first <b>M1</b> only for a single fraction  Correctly multiplying by algebraic denominator  Equation reached without any errors or omissions and at least one step after clearing the denominators of the fractions still with brackets included
	(iii)	$\frac{-9 \pm \sqrt{9^2 - 4(9)(-2000)}}{2(9)}$  – 15.42 14.42	2    <b>B1</b> <b>B1</b>	<b>B1</b> for $\sqrt{9^2 - 4(9)(-2000)}$  If in form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ then <b>B1</b> for $p = -9$ and $r = 2(9)$  <b>SC1</b> for answers – 15.4 or – 15.42 to – 15.41 <b>and</b> 14.4 or 14.41 to 14.42 or for – 14.42 <b>and</b> 15.42 or – 15.42 <b>and</b> 14.42 seen but not final answer  <b>Answers without working only score B1, B1 or SC1</b>
	(iv)	69.34 to 69.37 final answer <b>must be 2 dp</b>	<b>2FT</b>	<b>FT</b> $1000 \div$ <i>their</i> positive $x$ with final answer rounded up or down to 2 dp or <b>M1</b> for $1000 \div$ <i>their</i> positive $x$

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<b>8</b>	<b>(a)</b>	$[u = ] 80$ $[v = ] 160$	<b>1</b> <b>1</b>	
	<b>(b)</b>	6.24 or 6.244 to 6.245	<b>3</b>	<b>M2</b> for $\sqrt{8^2 - 5^2}$ oe or <b>M1</b> for $l^2 + 5^2 = 8^2$ oe or <b>B1</b> for suitable right angled triangle drawn with 5 on correct side
	<b>(c)</b>	5.05 or 5.052....	<b>2</b>	<b>M1</b> for $\frac{4.8}{2.5} = \frac{9.7}{MN}$ oe
	<b>(d)</b>	4 nfw	<b>4</b>	<b>M3</b> for $[x^n](x+1) = 4 \times \frac{5}{12}[x^n](x-1)$ oe, $n = 1, 2$ or 3 or <b>M2</b> for $\frac{[x](x+1)}{\frac{5}{12}[x](x-1)} = \left(\frac{2[x]}{[x]}\right)^2$ oe or <b>M1</b> for $2^2$ or $\left(\frac{1}{2}\right)^2$ soi
<b>9</b>	<b>(a) (i)</b>	1.5 oe	<b>1</b>	
	<b>(ii)</b>	$\frac{3}{y-2}$ oe final answer	<b>3</b>	<b>M1</b> for correct removal of fraction <b>M1</b> for collection of terms in $x$ <b>and</b> factorises OR <b>M1</b> subtracts 2 from both sides <b>M1</b> multiplies by $x$ to remove fraction and <b>M1</b> for correct division by expression of the form $ay + b$ , $a$ and $b \neq 0$
	<b>(b) (i)</b>	-3	<b>1</b>	
	<b>(ii)</b>	65 536 final answer	<b>2</b>	<b>B1</b> for $h(16)$ oe e.g. $h(2^4)$
	<b>(iii)</b>	-6	<b>2</b>	<b>M1</b> for $2 - x = 2^3$ oe
	<b>(iv)</b>	3	<b>1</b>	
<b>10</b>	<b>(a)</b>	7.5	<b>2</b>	<b>M1</b> for $3x + x + 3x + x = 60$ oe
	<b>(b)</b>	5	<b>3</b>	<b>B2</b> for $3x + 4x + 5x [= 60]$ or better or <b>M1</b> for $(3x)^2 + (4x)^2$ oe
	<b>(c)</b>	16.8 or 16.80....	<b>3</b>	<b>M2</b> for $x + x + \frac{90}{360} \times \pi \times 2 \times x [= 60]$ oe or <b>M1</b> for $\frac{90}{360} \times \pi \times 2 \times x$ oe