



GCE

Mathematics (MEI)

Advanced Subsidiary GCE

Unit 4752: Concepts for Advanced Mathematics

Mark Scheme for January 2011

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SECTION A

1	11.4 o.e.	2	M1 for $12/3 + 12/4 + 12/5 + 12/6$ o.e.	M0 unless four terms summed
2	$\frac{1}{2}x^6 + 4x^{\frac{1}{2}} + c$	4	B1 for $\frac{1}{2}x^6$, M1 for $kx^{\frac{1}{2}}$, A1 for $k = 4$ 4 or 1 , B1 for $+c$ dependent on at least one power increased	3 allow 6 x^6 isw,
3	$\frac{1}{2} \times 1.5 \times (0.6 + 0.7 + 2(2.3+3.1+2.8+1.8))$ = 15.975 rounded to 2 s.f. or more	M2 A1	M1 if one error or M2 for sum of 5 unsimplified individual trapezia: 2.175, 4.05, 4.425, 3.45, 1.875	basic shape of formula must be correct. Must be 5 strips. M0 if pair of brackets omitted or $h = 7.5$ or 1. allow recovery of brackets omitted to obtain correct answer. M0 for other than 5 trapezia isw only if 15.975 clearly identified as cross-sectional area
4	(i) (3, 15)	B2	B1 for each coordinate	s.c. B0 for (3, 5)
4	(ii) (1.5, 5)	B2	B1 for each coordinate	s.c. B0 for (3, 5)
5	$ar = 6$ and $ar^4 = -48$ $r = -2$ tenth term = 1536 $\frac{-3(1-(-2)^n)}{1-(-2)}$ o.e. $(-2)^n - 1$	M1 M1 A1 M1 A1	B2 for $r = -2$ www B3 for 1536 www allow M1 for $a = 6$ ÷ their r and substitution in GP formula with their a and r c.a.o.	ignore incorrect lettering such as $d = -2$ condone the omission of the brackets round “-2” in the numerator and / or the denominator

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6	$a+2d = 24$ and $a + 9d = 3$ $d = -3; a = 30$ $S_{50} - S_{20}$ -2205 cao	M1 A1 A1 M1 A1	if M0 , B2 for either, B3 for both ft their a and d ; $M1$ for $S_{30} = \frac{30}{2}(u_{21} + u_{50})$ o.e. B2 for -2205 www	do not award B2 or B3 if values clearly obtained fortuitously $S_{50} = -2175; S_{20} = 30$ $u_{21} = 30 - 20 \times 3 = -30$ $u_{50} = 30 - 49 \times 3 = -117$
7	(i) $17 \log_{10} x$ or $\log_{10} x^{17}$	B2	M1 for $5 \log_{10} x$ or $12 \log_{10} x$ or $\log_{10} x^{12}$ as part of the first step	condone omission of base
7	(ii) $-b$	B2	M1 for $\log_a 1 = 0$ or $\log_a a = 1$ soi	allow $0 - b$
8	substitution of $\sin^2 \theta = 1 - \cos^2 \theta$ $-5 \cos^2 \theta = \cos \theta$ $\theta = 90$ and 270 , 102 258 101 and 259	M1 A1 A1 A1 SC 1	soi or better accept $101.5(\dots)$ and $258.(46\dots)$ rounded to 3 or more sf; if M0 , allow B1 for both of 90 and 270 and B1 for 102 and B1 for 258 (to 3 or more sf)	if the 4 correct values are presented, ignore any extra values which are outside the required range, but apply a penalty of minus 1 for extra values in the range if given in radians deduct 1 mark from total awarded ($1.57, 1.77, 4.51, 4.71$)

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9	$\text{area sector} = \frac{1}{2} \times r^2 \times \frac{\pi}{6} \left[= \frac{\pi r^2}{12} \right]$ $\text{area triangle} = \frac{1}{2} \times a^2 \times \sin \frac{\pi}{6} \left[= \frac{a^2}{4} \right]$ $\frac{1}{2} a^2 \times \frac{1}{2} = \frac{1}{2} \times r^2 \times \frac{\pi}{6} \times \frac{1}{2}$ $\frac{a^2}{4} = \frac{\pi r^2}{24} \text{ o.e. and completion to given answer}$	<p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p>	<p>soi</p> <p>soi</p> <p>soi</p>	<p>allow sin30</p> <p>no follow through marks available</p> <p>at least one correct intermediate step required, and no wrong working to obtain given answer</p>
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Section A Total: 36

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SECTION B

10	<p>(i) eqn of AB is $y = 3x + 1$ o.e.</p> <p>their "$3x + 1$" = $4x^2$</p> <p>$(4x + 1)(x - 1) = 0$ o.e. so $x = -1/4$</p> <p>at C, $x = -1/4$, $y = 4 \times (-1/4)^2$ or $3 \times (-1/4) + 1 [=1/4$ as required]</p>	<p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p>	<p>or equiv in $y: y = 4\left(\frac{y-1}{3}\right)^2$</p> <p>or rearranging and deriving roots $y = 4$ or $1/4$</p> <p>condone verification by showing lhs = rhs o.e.</p> <p>or $y = 1/4$ implies $x = \pm 1/4$ so at C $x = -1/4$</p>	<p>SC3 for verifying that A, B and C are collinear and that C also lies on the curve</p> <p>SC2 for verifying that A, B and C are collinear by showing that gradient of AB = AC (for example) or showing C lies on AB</p> <p>solely verifying that C lies on the curve scores 0</p>
10	<p>(ii) $y' = 8x$</p> <p>at A $y' = 8$</p> <p>eqn of tgt at A</p> <p>$y - 4 = \text{their "8"}(x - 1)$</p> <p>$y = 8x - 4$</p> <p>at C $y' = 8 \times -1/4 [= -2]$</p> <p>$y - 1/4 = -2(x - (-1/4))$ or other unsimplified equivalent to obtain given result.</p> <p>allow correct verification that $(-1/4, 1/4)$ lies on given line</p>	<p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p>	<p>ft their gradient</p> <p>NB if $m = -2$ obtained from given answer or only showing that $(-1/4, 1/4)$ lies on given line $y = -2x - 1/4$ then 0 marks.</p>	<p>gradient must follow from evaluation of </p> <p>condone unsimplified versions of $y = 8x - 4$</p> <p>dependent on award of first M1</p> <p>SC2 if equation of tangent and curve solved simultaneously to correctly show repeated root</p>
10	<p>(iii) their "$8x - 4$" = $-2x - 1/4$</p> <p>$y = -1$ www</p>	<p>M1</p> <p>A1</p>	<p>or $\frac{y+4}{8} = \frac{y+1/4}{-2}$</p>	<p>o.e.</p> <p>$[x = 3/8]$</p>

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12	(iii) 4.27, 4.21, 4.13, 4.08 plots ruled line of best fit drawn	B1 B1 B1	accept 4.273..., 4.2108..., 4.130..., 4.079... rounded to 2 or more dp 1 mm tolerance fit their values if at least 4 correct values are correctly plotted	f.t. if at least two calculated values correct must have at least one point on or above and at least one point on or below the line and must cover $0 \leq t \leq 25$
12	(iv) $a = 25000$ to 25400 $0.01 \leq k \leq 0.014$ $P = a \times 10^{-kt}$ or $P = 10^{\log a - kt}$ with values in acceptable ranges	B1 B2 B1	allow $10^{4.4..}$ M1 for $-k = \frac{\Delta y}{\Delta x}$ using values from table or graph; condone $+k$ B0 if left in logarithmic form	M1 for a correct first step in solving a pair of valid equations in either form A1 for k A1 for a A1 for $P = a \times 10^{-kt}$
12	(v) $P = a \times 10^{-35k}$ 8600 to 9000 comparing their value with 9375 o.e. and reaching the correct conclusion for their value	M1 A1 A1	Their a and k f.t.	allow $\log P = \log a - 35k$

Section B Total: 36