

SPM TRIAL EXAM 2012
Marking Scheme
Additional Mathematics Paper 2

SECTION A

Question	Important Steps	Marks
1	$y = 3x - 4$	1
	$5x^2 - 4x(3x - 4) + (3x - 4)^2 = 9$ or $2x^2 - 8x + 7 = 0$	1
	$x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(2)(7)}}{2(2)}$	1
	$x = 2.707, 1.293$	1
	$y = 3(2.707) - 4, \quad y = 3(1.293) - 4$ $= 4.121 \quad \quad \quad = -0.121$	1
TOTAL		5

2 (a)	Change base of logarithm : $\log_4(1 - 2x) = \frac{\log_2(1 - 2x)}{\log_2 4}$ or <i>equivalent</i>	1
	Use $n \log x = \log x^n$: $2 \log_2(1 - 2x) = \log_2(1 - 2x)^2$	1
	Solve : $(2x + 5) = (1 - 2x)^2$	1
	$x = -\frac{1}{2}, 2$	1
	$x = -\frac{1}{2}$	1
(b)	$\frac{1}{3}$	1
TOTAL		6

3 (a)	-8	1
	Use $T_n = a + (n - 1)d$: $-8 + (22 - 1)(3)$	1
(b)	Use $S_n = \frac{n}{2}[2a + (n - 1)d]$: $\frac{n}{2}[2(-8) + (n - 1)(3)]$	1
	Solve : $\frac{n}{2}[2(-8) + (n - 1)(3)] = 55$	1
	$n = 10$	1
(c)	T_{13}	1
	28	1
TOTAL		7

4 (a)	$x = 3$	1
(b)	$median = 9.5 + \left(\frac{10 - 9}{5}\right) 5$	1
	Median = 10.5	1

(c)	All midpoints are correct.	1
	$\bar{x} = \frac{3(2) + 6(7) + 5(12) + 4(17) + 2(22)}{20} = \frac{220}{20} = 11$	1
	$\sum fx^2 = 3(2^2) + 6(7^2) + 5(12^2) + 4(17^2) + 2(22^2) = 3150$ or $\sum f(x-\bar{x})^2 = 730$	1
	$\sigma^2 = \frac{3150}{20} - \left(\frac{220}{20}\right)^2$ or $\sigma^2 = \frac{730}{20}$	1
	$= 36.5$	1
TOTAL		8

5 (a)		Shape 1
		Max/min 1
		One period 1
		Complete from 0 to 2pi 1
(b)	Equation $y = \frac{2}{\pi}x$	1
	Straight line $y = \frac{2}{\pi}x$	1
	2 solutions	1
TOTAL		7

6 (a)	$m_{QS} = \frac{3}{2}$	1
	$y - 1 = \frac{3}{2}(x - 6)$	1
	$y = \frac{3}{2}x - 8$	1
(b)	Q(0, -8)	1
	$\sqrt{[(x - 6)^2 + (y - 1)^2]}$ or $\sqrt{[(6 - 0)^2 + (1 + 8)^2]}$	1
	$x^2 - 12x + 36 + y^2 - 2y + 1 = 117$	1
	$x^2 + y^2 - 12x - 2y - 80 = 0$	1
TOTAL		7

7 (a)	<table border="1"> <tr> <td>x</td> <td>1</td> <td>1.5</td> <td>2</td> <td>2.5</td> <td>3</td> <td>3.5</td> <td>4</td> </tr> <tr> <td>$\log_{10} y$</td> <td>0.04</td> <td>0.18</td> <td>0.28</td> <td>0.40</td> <td>0.52</td> <td>0.62</td> <td>0.76</td> </tr> </table>	x	1	1.5	2	2.5	3	3.5	4	$\log_{10} y$	0.04	0.18	0.28	0.40	0.52	0.62	0.76	1
	x	1	1.5	2	2.5	3	3.5	4										
$\log_{10} y$	0.04	0.18	0.28	0.40	0.52	0.62	0.76											
(b)	Plot $\log_{10} y$ against x [correct axes and uniform scales]	1																
	All 7 points plotted correctly	1																
	Line of best fit	1																
(c) (i)	3.72	1																
(ii)	$\log_{10} y = \left(\frac{\log_{10} k}{2}\right)x - \frac{\log_{10} h}{2}$	1																
	Use $c = -\frac{\log_{10} h}{2}$: $-\frac{\log_{10} h}{2} = -0.2$	1																
	$h = 2.5$	1																
(iii)	Use $m = \frac{\log_{10} k}{2}$: $\frac{\log_{10} k}{2} = 0.24$	1																
	$k = 3.0$	1																
TOTAL		10																

8 (a)	$y = \int -2x \, dx$	1
	$y = \frac{-2x^2}{2} + c$	1
	$y = -x^2 + 9$	1
(b)	$\int_0^3 (-x^2 + 9) \, dx$	1
	$\left[\frac{-x^3}{3} + 9x\right]_0^3$	1
	$\frac{1}{2}(10)(10) - \int_0^3 (-x^2 + 9) \, dx$ or $50 - \int_0^3 (-x^2 + 9) \, dx$	1
	or $\frac{1}{2}(10)(10) - \left[\frac{-x^3}{3} + 9x\right]_0^3$ or $50 - \left[\frac{-x^3}{3} + 9x\right]_0^3$	
	$= 32$	1
(c)	Volume = $\pi \int (9 - y) \, dy$	1
	$\pi \left[9y - \frac{y^2}{2}\right]_0^9$	1
	$\frac{81}{2}\pi$ or equivalent	1
TOTAL		10

9	Angle AOB = 6.5/5	1
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(a)	$= 1.3 \text{ rad.}$	1
	Angle $POQ = 0.8667 \text{ rad.}$	1
(b)	$MN = 5 \times \sin(0.8667 \text{ rad.}) = 3.811 \text{ cm}$ or $ON = 5 \times \cos(0.8667 \text{ rad.}) = 3.2367 \text{ cm}$	1
	Length of arc $PQ = 6 \times 0.8667 = 5.2002$	1
	Perimeter $= 3.811 + 5.2002 + 1 + (6 - 3.2367)$ $= 12.77 \text{ cm}$	1
	Area of sector $OPQ = \frac{1}{2} \times 6^2 \times 0.8667$	1
(c)	Area of shaded region $= 15.60 - \frac{1}{2}(3.811)(3.2367)$	1
	$= 9.433$	1
TOTAL		10

10 (a) (i)	$\overline{PT} = \overline{PR} + \overline{RT}$ $\overline{RT} = \frac{1}{2}(-8\underline{y} + 14\underline{x})$	1
	$\overline{PT} = 8\underline{y} + \frac{1}{2}(-8\underline{y} + 14\underline{x})$ $= 7\underline{x} + 4\underline{y}$	1
(ii)	$\overline{RS} = \overline{RP} + \overline{PS}$ $= -8\underline{y} + \frac{1}{3}(14\underline{x})$	1
	$= \frac{14}{3}\underline{x} - 8\underline{y}$	1
(b) (i)	$\overline{PM} = 7h\underline{x} + 4h\underline{y}$	1
(ii)	$\overline{PM} = \overline{PR} + \overline{RM}$ $= 8\underline{y} + k(\frac{14}{3}\underline{x} - 8\underline{y})$	1
	$= \frac{14}{3}k\underline{x} + (8 - 8k)\underline{y}$	1
(c)	$7h = \frac{14}{3}k$ or $8 - 8k = 4h$	1
	$h = \frac{1}{2}$	1
	$k = \frac{3}{4}$	1
TOTAL		10

11 (a)(i)	$P(X = 7) = {}^{10}C_7(0.45)^7(0.55)^3$	1
	$= 0.07460$	1
(ii)	$P(X = 0, 1, 3)$ $= {}^{10}C_0(0.45)^0(0.55)^{10} + {}^{10}C_1(0.45)^1(0.55)^9 + {}^{10}C_2(0.45)^2(0.55)^8$	1
	$= 0.09956$	1

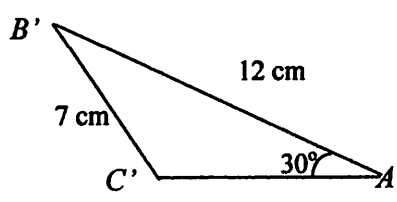
(b) (i)	$P\left(\frac{6.0-7.2}{1.2} < z < \frac{8.1-7.2}{1.2}\right)$ OR $P(-1 < z < 0.75)$	1
	$= 1 - 0.1587 - 0.2266$	1
	$= 0.6147$	1
(ii)	$P\left(z > \frac{t-7.2}{1.2}\right) = \frac{48}{60} = 0.8$	1
	$\frac{t-7.2}{1.2} = -0.842$	1
	$t = 6.1896$ or 6.190	1
TOTAL		10

SECTION C

12 (a)	$a = \frac{dv}{dt} = 1.4 - 0.6t$	1
	$= 1.4 - 0.6(2)$ $= 0.2$	1
(b)	$1.4t - 0.3t^2 + 0.5 = 0$	1
	$(3t+1)(t-5) = 0$ or using quadratic formula	1
	$t = 5$	1
(c)	$s = \int (1.4t - 0.3t^2 + 0.5) dt = 0.7t^2 - 0.1t^3 + 0.5t + c$ integrate	1
	At $t = 0, s = 0 \Rightarrow c = 0$ finding c	
	or $\int_0^6 1.4t - 0.3t^2 + 0.5 dt + \left \int_5^{10} 1.4t - 0.3t^2 + 0.5 dt \right $ limits \checkmark	1
	When $t = 5, s = 7.5$ m, when $t = 10, s = -25$ m or substitute $t = 0, 5, 10$ in $[0.7t^2 - 0.1t^3 + 0.5t]$	1
	Total distance = $7.5 \times 2 + 25$ or $7.5 + -25 - 7.5 $ $= 40$ m	1
TOTAL		10

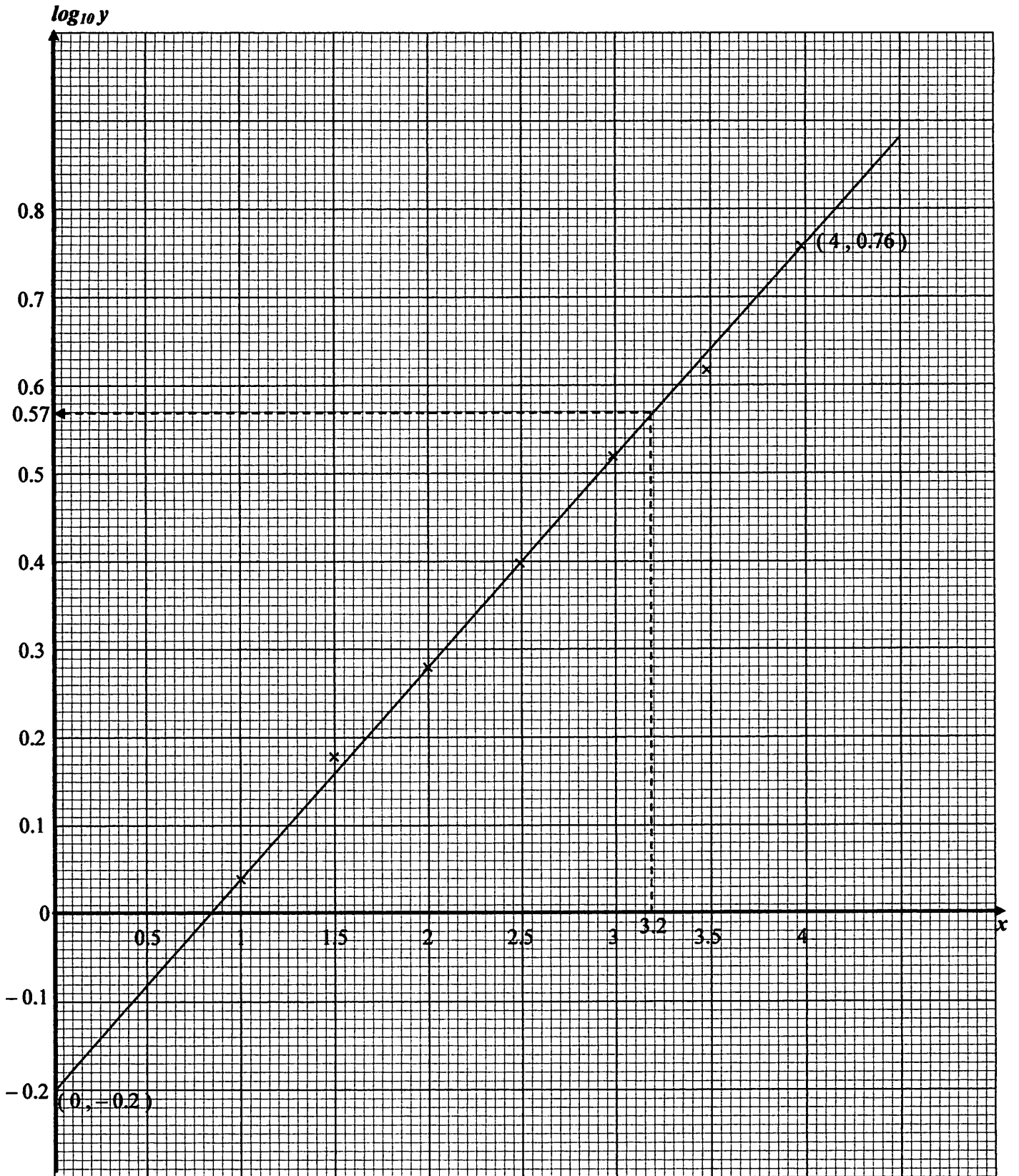
13 (a)	$x = \frac{158}{130} \times 100$	1
	$= 121.54$	1
(b)	$A \Rightarrow \frac{150}{140} \times 100 = 107.14$	1
	$B \Rightarrow \frac{121.54}{135} \times 100 = 90.03$	1
	$C \Rightarrow \frac{120}{110} \times 100 = 109.09$	1
	$D \Rightarrow \frac{123}{120} \times 100 = 102.5$	1
(c)	$I = \frac{(107.14 \times 3) + (90.03 \times 5) + (109.09 \times 2) + (102.5 \times 2)}{12}$	1

	$= 99.56$	1
(d)	$I_{2013} = \frac{120}{100} \times 99.56$	1
	$= 119.47$	1
TOTAL		10

14 (a) (i)	$\frac{\sin \angle ACB}{12} = \frac{\sin 30^\circ}{7}$	1
	$\angle ACB = 59^\circ$	1
(ii)	$\cos \angle AKB = \frac{4^2 + 11.47^2 - 12^2}{2(4)(11.47)}$	1
	$\cos \angle AKB = 0.0388$ $\angle AKB = 87.78^\circ$ or $87^\circ 47'$	1
(iii)	$\angle ABC = 91^\circ$	1
	Area $\triangle ABC = \frac{1}{2} (7)(12) \sin 91^\circ$ or Area of $\triangle AKB = \frac{1}{2} (4)(11.47) \sin 87.78^\circ$	1
	Area of quadrilateral = Area $\triangle ABC$ + Area of $\triangle AKB$ = $41.99 + 22.92$	1
	= 64.91 cm^2	1
(b)(i)		1
(ii)	$\angle A'C'B' = 121^\circ$	1
TOTAL		10

15 (a)(i)	$x + y \leq 10$ or equivalent	1
	$y - x \leq 4$ or equivalent	1
	$x \leq 2y$ or equivalent	1
(b)	Draw correctly one straight line from the inequalities	1
	Draw correctly two more straight line from the inequalities	1
	Region R correctly shaded	1
(c)(i)	Maximum point (3 , 7)	1
	RM [$10(3) + 25(7)$] = RM 205	1
(ii)	Minimum point (2 , 6)	1
	RM [$10(2) + 25(6)$] = RM 170	1
TOTAL		10

GRAPH FOR QUESTION 7



GRAPH FOR QUESTION 15

