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SPM TRIAL EXAM 2011
Marking Scheme
Additional Mathematics Paper 2

Section A

Question	Part	Solution	Marks
1		$x = 5 + 3y$ … (1) $x^2 + 2y^2 = 31$ … (2)	1
		$(5 + 3y)^2 + 2y^2 = 31$ $11y^2 + 30y - 6 = 0$	1
		$y = \dfrac{-30 \pm \sqrt{30^2 - 4(11)(-6)}}{2(11)}$	1
		$y = 0.187, -2.914$	1
		$x = 5 + 3(0.187)$, $x = 5 + 3(-2.914)$ $= 5.561$ $= -3.742$ or -3.743	1

Question	Part	Solution	Marks
2	(a)	A(0, -2)	1
	(b)	$f(x) = (x^2 - kx + \frac{k^2}{4} - \frac{k^2}{4}) - 2$	1
		$= (x - \frac{k}{2})^2 - \frac{k^2}{4} - 2$	1
		$3 - \frac{k}{2} = 0$ $k = 6$	1
		$p = -\frac{k^2}{4} - 2$ $= -11$	1
	(c)	$x(x-6) \le 0$	1
		$0 \le x \le 6$	1

Question	Part	Solution	Marks
3	(a)	$L_1 = \pi r$, $L_2 = \pi(r+3)$, $L_3 = \pi(r+6)$	1
		$L_2 - L_1 = \pi(r+3) - \pi r = 3\pi$ $L_3 - L_2 = \pi(r+6) - \pi(r+3) = 3\pi$	1
		Common difference, $d = 3\pi$	1
	(b)(i)	$4\pi + (n-1)(3\pi) = 172.81$	1
		$n = \dfrac{172.81 - 3.142}{3 \times 3.142}$ $n = 18$	1
	(b)(ii)	$S_{10} = \frac{10}{2}\left[2 \times 4 \times 3.142 + (10-1)(3 \times 3.142)\right]$	1
		$S_{10} = 549.85$ cm or 549.78 cm (using π in calculator)	1

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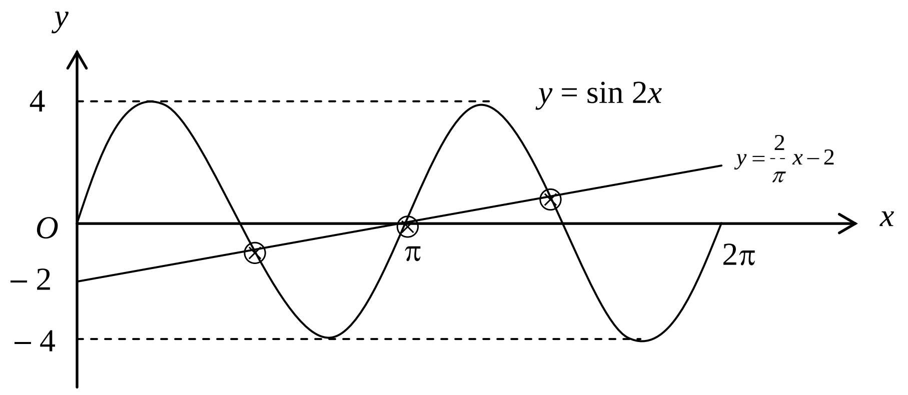
4	(a)	LHS $= \dfrac{2\sin x(\cos^2 x)}{\cos x}$	**1**
		$= 2\sin x\cos x$ $= \sin 2x$	**1**
	(b)		
		Graph $y = \sin x$	**1**
		2 cycle <u>or</u> amlitude 4	**1**
		All correct	**1**
	(c)	$y = \dfrac{2}{\pi}x - 2$	**1**
		Straight line $y = \dfrac{2}{\pi}x - 2$	**1**
		Number of solution = 3	**1**

5	(a)	$\bar{x} = \dfrac{12(9.5)+17(19.5)+26(29.5)+31(39.5)+16(49.5)+10(59.5)+8(69.5)}{120}$	**1**
		$= 36.5$	**1**
	(b)	$Q_1 = 24.5 + \left(\dfrac{\frac{1}{4}(120) - 29}{26}\right)10$	**1**
		$Q_3 = 44.5 + \left(\dfrac{\frac{3}{4}(120) - 86}{16}\right)10$	**1**
		$Q_3 - Q_1 = 47 - 24.88$	**1**
		$= 22.12$	**1**

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6	(a)(i)	$32\underline{u} - 20\underline{v}$	**1**
	(ii)	$\overrightarrow{EF} = \frac{3}{5}\overrightarrow{EC}$ $= \frac{3}{5}(\overrightarrow{ED} + \overrightarrow{DC})$ $= \frac{3}{5}(24\underline{u} - 24\underline{u} + 25\underline{v})$ $= 15\underline{v}$	**1**
		$\overrightarrow{BF} = \overrightarrow{BA} + \overrightarrow{AE} + \overrightarrow{EF}$ $= -20\underline{v} + 8\underline{u} + 15\underline{v}$	**1**
		$= 8\underline{u} - 5\underline{v}$	**1**
	(b)	$\overrightarrow{BF} = 8\underline{u} - 5\underline{v}$ $\overrightarrow{BD} = 32\underline{u} - 20\underline{v}$ $= 4(8\underline{u} - 5\underline{v})$ $\overrightarrow{BF} = \frac{1}{4}\overrightarrow{BD}$	**1**
		BF // BD and B is the common point	**1**
		Thus B, F and D are collinear	**1**

Section B

7	(a)	$f(x) = -x^2 + c$	**1**
		$3 = -1 + c$	**1**
		$f(x) = -x^2 + 4$	**1**
	(b)	$\int_1^2 (-x^2 + 4)\, dx$ + ½ (1)(3)	**1**
		$\left[-\frac{x^3}{3} + 4x \right]_1^2$	**1**
		$\left[\left(-\frac{2^3}{3} + 4(2) \right) - \left(-\frac{1^3}{3} + 4(1) \right) \right] + \frac{3}{2}$	**1**
		$\frac{19}{6}\ unit^2$	**1**
	(c)	$\pi \int_3^4 (4 - y) dy$ $= \pi \left[4y - \frac{y^2}{2} \right]_3^4$	**1**
		$= \pi \left[\left(4(4) - \frac{4^2}{2} \right) - \left(4(3) - \frac{3^2}{2} \right) \right]$	**1**
		$= \frac{1}{2}\pi$	**1**

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8	(a)	$\frac{y}{x^2}$: 2.98, 5.01, 8.97, 11.05, 13.01; x: 2, 3, 5, 6, 7	**1**
		Refer to graph Using the correct, uniform scale and axes	**1**
		All points plotted correctly	**1**
		Line of best fit	**1**
	(b)(i)	$\frac{y}{x^2} = hx + k$	**1**
		$h = \frac{13.01 - 2.98}{7 - 2}$	**1**
		$= 2.01$	**1**
	(ii)	$k = -1$	**1**
	(iii)	when $x = 4$, $\frac{y}{x^2} = 7$	**1**
		$y = 7x^2 = 7(4)^2$ $p = 112$	**1**

Table within (a):

$\frac{y}{x^2}$	2.98	5.01	8.97	11.05	13.01
x	2	3	5	6	7

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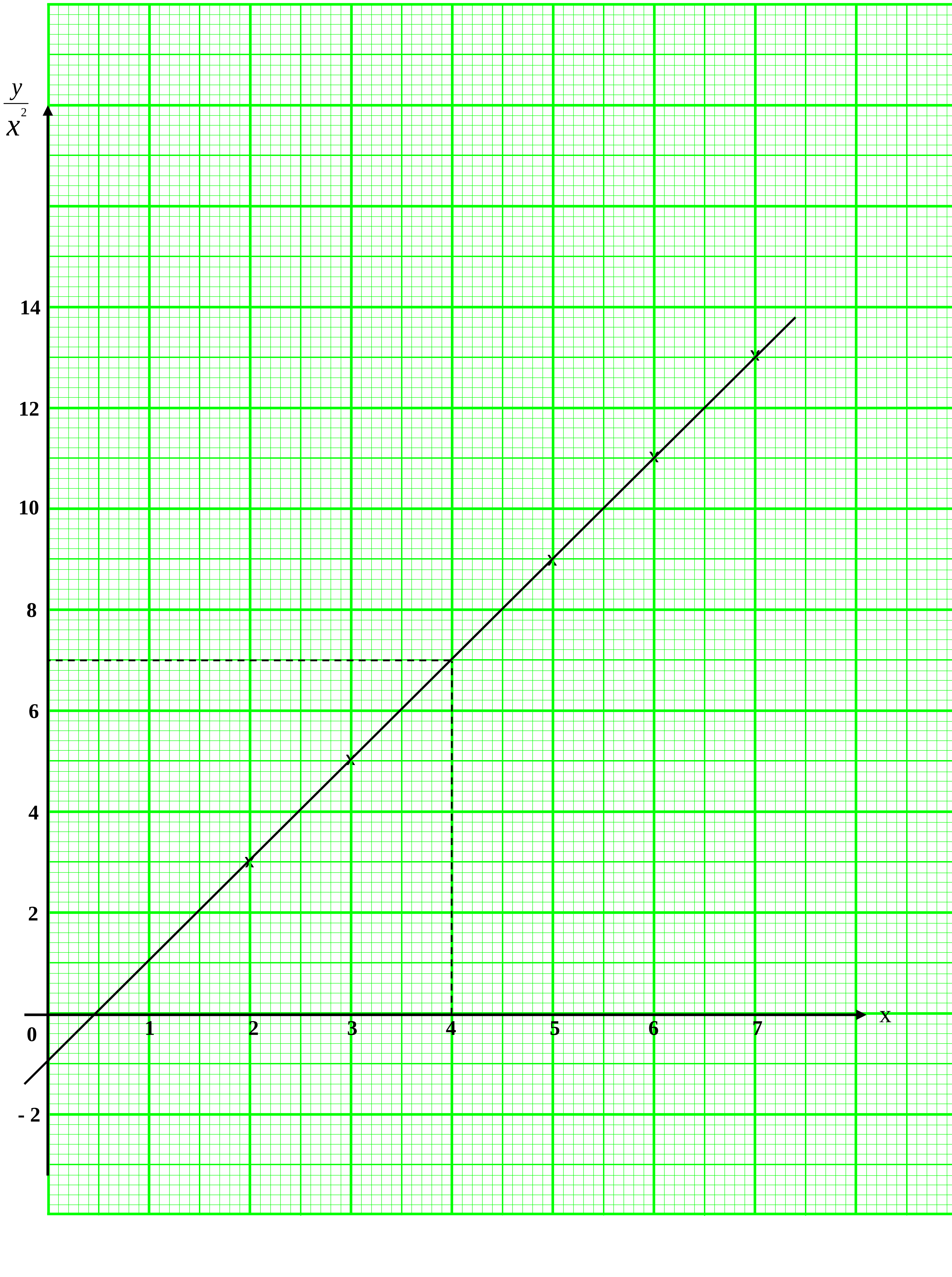
Answer for No. 8(a)



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9	**(a)**	$0.6\times\frac{180}{\pi}$ *or* 34.38^o or 34.37^o	
		$PR = 2\ (10)\ \sin\left(\frac{34.38}{2}\right)$ or 2(10)sin(0.3r)	**1**
		= 5.910	**1**
	(b)	$S_{PQR} = 10(0.6)$ *or* $S_{RST} = 5.910(0.6)$	**1**
		OT = $10 - 2(5.910)\sin\left(\frac{34.38}{2}\right)$ or 6.507	**1**
		Perimeter = 10 + 10(0.6) + 5.911(0.6) + 6.507	**1**
		= 26.05	**1**
	(c)	$\frac{1}{2}(5.910)^2(0.6)$	**1**
		$\frac{1}{2}(10)^2\left(0.6 - \sin 34.38^o\right)$	**1**
		$\frac{1}{2}(5.910)^2(0.6) + \frac{1}{2}(10)^2\left(0.6 - \sin 34.38^o\right)$	**1**
		= 12.24	**1**

10	**(a)(i)**	$m_{BD} = 2$	**1**
		$y - 5 = 2(x - 2)$	**1**
		$y = 2x + 1$	**1**
	(ii)	$2(2x + 1) + x = 7$ or equivalent	**1**
		$M(1, 3)$	**1**
		$\frac{x + 4}{1 + 2} = 1$ or $\frac{y + 10}{1 + 2} = 3$, $1=\frac{x(1)+2(2)}{1+2}$, $3=\frac{y(1)+2(5)}{1+2}$	**1**
		$D(-1, -1)$	**1**
	(b)	$\sqrt{(x-1)^2 + (y-3)^2}$ **or** $\sqrt{(1+1)^2 + (3+1)^2}$	**1**
		$(x - 1)^2 + (y - 3)^2 = (1 + 1)^2 + (3 + 1)^2$	**1**
		$x^2 + y^2 - 2x - 6y - 10 = 0$	**1**

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11	**(a)(i)**	$^{9}C_{3}\left(\frac{4}{7}\right)^{3}\left(\frac{3}{7}\right)^{6}$	**1**
		$= 0.0971$	**1**
	(ii)	$^{9}C_{0}\left(\frac{3}{7}\right)^{0}\left(\frac{4}{7}\right)^{9}$ or $^{9}C_{1}\left(\frac{3}{7}\right)^{1}\left(\frac{4}{7}\right)^{8}$ or $^{9}C_{2}\left(\frac{3}{7}\right)^{2}\left(\frac{4}{7}\right)^{7}$ or equivalent	**1**
		$^{9}C_{0}\left(\frac{3}{7}\right)^{0}\left(\frac{4}{7}\right)^{9} + {}^{9}C_{1}\left(\frac{3}{7}\right)^{1}\left(\frac{4}{7}\right)^{8} + {}^{9}C_{2}\left(\frac{3}{7}\right)^{2}\left(\frac{4}{7}\right)^{7}$ or equivalent	**1**
		$= 0.1819$	**1**
	(b)	$P(X > 70) = P\left(Z > \frac{70-76}{15}\right)$	**1**
		$= 0.6554$	**1**
		$P(X > p) = 33\%$ or $P\left(Z > \frac{p-76}{15}\right) = 0.33$	**1**
		$\frac{p-76}{15} = 0.44$	**1**
		$p = 82.60$	**1**

Section C

12	(a)	$v = 8\ ms^{-1}$	**1**
	(b)	$a = 10 - 6t$	**1**
		$= 10 - 6(0)$ $= 10$ cm s^{-2}	**1**
	(c)	$10 - 6t = 0$ $t = \frac{5}{3}\ s$	**1**
		$v = 8 + 10(\frac{5}{3}) - 3\left(\frac{5}{3}\right)^{2}$	**1**
		$= 16\frac{1}{3}\ cm\,s^{-1}$	**1**
	(d)	$v = 0$ $8 + 10t - 3t^{2} = 0$	**1**
		$(4 - t)(2 + 3t) = 0$ $t = 4$	**1**
		$s = 8t + \frac{10t^{2}}{2} - \frac{3t^{3}}{3} + c$	**1**

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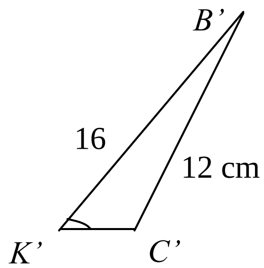
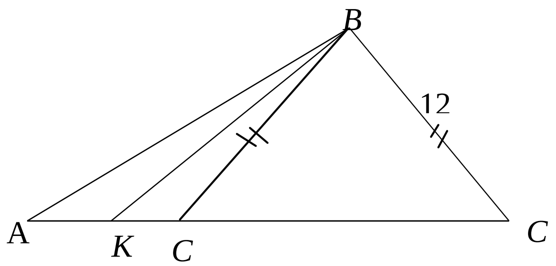
		$s = 8t + 5t^2 - t^3$	
		$= 8(4) + 5(4)^2 - 4^3$ $= 48\ cm$	1

13	(a)	$x = 120$	**1**
		$y = 97.50$	**1**
		$z = 60$	**1**
	(b)	$h = 72$	**1**
		$\dfrac{120\times144+130\times108+150\times72+135\times36}{360}$	**1**
		130.5	**1**
	(c)	$\dfrac{130.5\times600}{100}$	**1**
		RM783	**1**
	(d)	$130.5\times\dfrac{120}{100}$	**1**
		156.6	**1**

14	(a)(i)	½(16)(AK)($\frac{3}{5}$) = 24 Using formula of area of triangle	**1**
		AK = 5 cm	**1**
	(ii)	$\cos\angle AKB = -\dfrac{4}{5}$	**1**
		$AB^2 = 5^2 + 16^2 - 2(5)(16)(-\frac{4}{5})$ Using cosine rule	**1**
		AB = 20.22 cm	**1**
	(b)	$12^2 = x^2 + 16^2 - 2(x)(16)(\frac{4}{5})$ Using cosine rule	**1**
		$5x^2 - 128x + 560 = 0$ Simplify to general form	**1**
	(c)(i)	Draw obtuse triangle or shows point *C*' on *KC* and side *BC*'   or	**1**

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	(ii)	$\frac{\sin \angle K'C'B'}{16} = \frac{3/5}{12}$ Using sine rule	**1**
		$\angle K'C'B' = 126.87°$	**1**

15	(a)	$2x + 2.5y \geq 20$ or $4x + 5y \geq 40$	**1**
		$40x + 80y \leq 640$ or $x + 2y \leq 16$	**1**
		$x \leq 2y$	**1**
	(b)	Refer to graph	
		x and y axes with correct scales	**1**
		At least two lines drawn correctly	**1**
		Correct region shaded	**1**
	(c)(i)	{4,5,6} or $4 \leq x \leq 6$	**1**
	(ii)	Maximum point (8 , 4)	**1**
		25 (8) + 45 (4)	**1**
		RM 380	**1**

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Graph for Question **15**