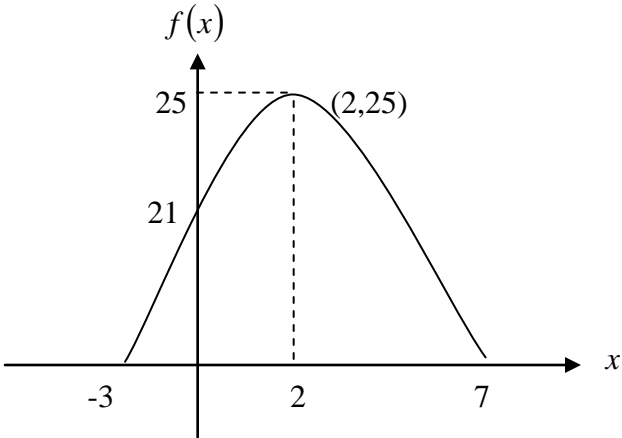
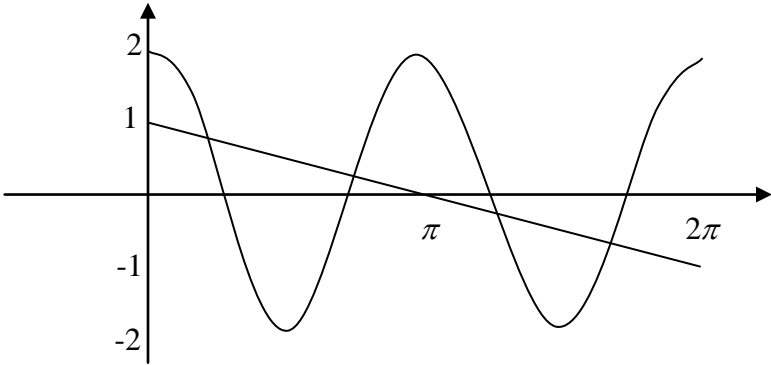


SPM TRIAL EXAM 2010
MARK SCHEME ADDITIONAL MATHEMATICS PAPER 2

SECTION A (40 MARKS)		
No.	Mark Scheme	Total Marks
1	$x = 1 - 2y$ $2(1 - 2y)^2 + y^2 + (1 - 2y)(y) = 5$ $7y^2 - 7y - 3 = 0$ $y = \frac{-(-7) \pm \sqrt{(-7)^2 - 4(7)(-3)}}{2(7)}$ $y = 1.324, -0.324$ $x = -1.648, 1.648$ <u>OR</u> $y = \frac{1-x}{2}$ $2x^2 + \left(\frac{1-x}{2}\right) + x\left(\frac{1-x}{2}\right) = 5$ $7x^2 - 19 = 0$ $x = \frac{-(0) \pm \sqrt{(0)^2 - 4(7)(-19)}}{2(7)}$ $x = -1.648, 1.648$ $y = 1.324, -0.324$	<p>P1</p> <p>K1</p> <p>K1</p> <p>N1</p> <p>N1</p> <p>P1</p> <p>K1</p> <p>K1</p> <p>N1</p> <p>N1</p>
		5

2	<p>(a)</p> $f(x) = -(x^2 - 4x - 21)$ $= -\left[x^2 - 4x + \left(\frac{-4}{2}\right)^2 - \left(\frac{-4}{2}\right)^2 - 21 \right]$ $= -(x - 2)^2 + 25$ <p>(b) Max Value = 25</p> <p>(c)</p>  <p style="text-align: center;">Shape graph Max point $f(x)$ intercept or point (0,21)</p> <p>d) $f(x) = (x - 2)^2 - 25$</p>	<p>K1</p> <p>N1</p> <p>N1</p> <p>N1</p> <p>N1</p> <p>N1</p>
		7
3	<p>a) List of Areas ; $xy, \frac{1}{4}xy, \frac{1}{16}xy$</p> $T_2 \div T_1 = T_3 \div T_2 = \frac{1}{4}$ <p>This is Geometric Progression and $r = \frac{1}{4}$</p> <p>b) $12800 \times \left(\frac{1}{4}\right)^{n-1} = \frac{25}{512}$</p>	<p>K1</p> <p>N1</p>

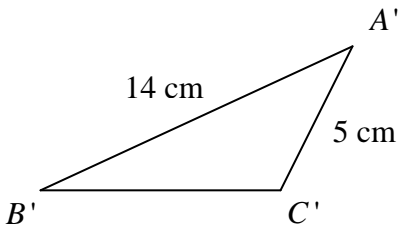
	$\left(\frac{1}{4}\right)^{n-1} = \frac{1}{262144}$ $\left(\frac{1}{4}\right)^{n-1} = \left(\frac{1}{4}\right)^9$ $n-1=9$ $n=10$ <p>(c) $S_{\infty} = \frac{12800}{1 - \frac{1}{4}}$</p> $= 17066\frac{2}{3} \text{ cm}^2$	<p>K1</p> <p>K1</p> <p>N1</p> <p>K1</p> <p>N1</p>
		7
4	<p>a)</p> $4\cos^2 - 1 - 1$ $4\cos^2 - 2$ $2(2\cos^2 - 1)$ $2\cos 2\theta$ <p>b) i)</p>  <ul style="list-style-type: none"> - shape of cos graph - amplitude (max = 2 <u>and</u> min = -2) - 2 periodic/cycle in $0 \leq \theta \leq 2\pi$ <p>b) ii) $y = 1 - \frac{\theta}{\pi}$ (equation of straight line)</p> <p>Number of solution = 4 (without <u>any</u> mistake done)</p>	<p>K1</p> <p>N1</p> <p>P1 P1 P1</p> <p>K1</p> <p>N1</p>
		7

5	a)													
	<table><tr><td>Score</td><td>0 – 9</td><td>10 – 19</td><td>20 – 29</td><td>30 – 39</td><td>40 – 49</td></tr><tr><td>Number</td><td>3</td><td>4</td><td>9</td><td>9</td><td>10</td></tr></table>	Score	0 – 9	10 – 19	20 – 29	30 – 39	40 – 49	Number	3	4	9	9	10	N1
	Score	0 – 9	10 – 19	20 – 29	30 – 39	40 – 49								
	Number	3	4	9	9	10								
	b) $Q_1 = 19.5 + \left(\frac{\frac{1}{4}(35) - 7}{9} \right) 10$	P1												
$= 21.44$	K1													
$Q_3 = 39.5 + \left(\frac{\frac{3}{4}(35) - 25}{10} \right) 10$	K1													
$= 40.75$														
Interquatile range	K1													
$= 40.75 - 21.44$														
$= 19.31$	N1													
			6											
6	(a) $\overrightarrow{OQ} = \overrightarrow{OA} + \overrightarrow{AQ}$	K1												
	$\overrightarrow{OQ} = (1 - m)\underline{\underline{a}} + m\underline{\underline{b}}$	N1												
	(b) $\overrightarrow{PO} + \overrightarrow{OQ} = n(\overrightarrow{PO} + \overrightarrow{OR})$	K1												
	$\overrightarrow{OQ} = \frac{4}{5}(1 - n)\underline{\underline{a}} + 3n\underline{\underline{b}}$	N1												
	(c)													
(i) $\left(\frac{4}{5} - \frac{4}{5}n \right) = 1 - m$ <u>or</u> $3n = m$	K1													
$m = \frac{3}{11}, n = \frac{1}{11}$	N1													
	N1													
(ii) $\overrightarrow{OQ} = \frac{8}{11}\underline{\underline{a}} + \frac{3}{11}\underline{\underline{b}}$	N1													
			8											

7	<p>(a)(i) $Area = \int_0^2 (2y - y^2) dy$</p> $= \left[y^2 - \frac{y^3}{3} \right]_0^2$ $= \frac{4}{3} unit^2$ <p>(ii) $Area \text{ region } P = \int_0^1 y \, dy + \int_1^2 (2y - y^2) dy$</p> $= \left(\frac{1}{2} \times 1 \times 1 \right) + \left[y^2 - \frac{y^3}{3} \right]_1^2$ $= \frac{7}{6} unit^2$ <p>(b) $Area \text{ region } Q = \frac{4}{3} - \frac{7}{6} = \frac{1}{6} unit^2$</p> $= \frac{7}{6} : \frac{1}{6}$ $= 7 : 1$ <p>(c) $Volume = \pi \int_0^1 (2y - y^2)^2 dy$</p> $= \pi \left[\frac{4y^3}{3} - y^4 + \frac{y^5}{5} \right]_0^1$ $= \frac{8}{15} \pi unit^3$	<p>K1</p> <p>N1</p> <p>K1</p> <p>K1</p> <p>N1</p> <p>K1</p> <p>K1</p> <p>N1</p>												
		10												
8	<p>(a)</p> <table border="1"><tr><td>\sqrt{x}</td><td>0.000</td><td>0.7071</td><td>1.000</td><td>1.414</td><td>1.732</td></tr><tr><td>$\log_{10} y$</td><td>1.000</td><td>1.330</td><td>1.477</td><td>1.672</td><td>1.826</td></tr></table> <p>Using the correct, uniform scale and axes All points plotted correctly Line of best fit</p> <p>(b) $\log_{10} y = \frac{1}{3} \sqrt{x} \log_{10} p + \log_{10} k$</p>	\sqrt{x}	0.000	0.7071	1.000	1.414	1.732	$\log_{10} y$	1.000	1.330	1.477	1.672	1.826	<p>N1</p> <p>N1</p> <p>P1</p> <p>P1</p> <p>P1</p> <p>P1</p>
\sqrt{x}	0.000	0.7071	1.000	1.414	1.732									
$\log_{10} y$	1.000	1.330	1.477	1.672	1.826									

	<p>(i) <i>use</i> $*c = \log_{10} k$ $k = 10.0$</p> <p>(ii) <i>use</i> $*m = \frac{1.83-1.0}{1.73-0} = 0.47977 = \frac{1}{3} \log_{10} p$ $p = 27.5$</p>	<p>K1 N1</p> <p>K1 N1</p>
		10
9	<p>(a) $\angle COD = 2\left(\frac{1}{6}\pi\right)$ $= \frac{1}{3}\pi = 1.047rad$</p> <p>(b) (i) $Arc\ ABC = 10\left(\pi - \frac{1}{3}\pi\right) or = \frac{20}{3}\pi$</p> <p>$Length\ AC = \sqrt{20^2 - 10^2} or\ 20\cos\left(\frac{1}{6}\pi rad\right)$</p> <p>$Perimeter = \frac{20}{3}\pi + 20\cos\frac{1}{6}\pi = 38.267cm$</p> <p>(ii) $Area\ of\ shaded\ region = \frac{1}{2}(10^2)\left(\frac{2}{3}\pi - \sin\frac{2}{3}\pi\right)$ $= 61.432cm^2$</p> <p>(c) $\angle CDE = \angle CAD = \frac{1}{6}\pi rad$ (alternate segments)</p> <p>$Area = \frac{1}{2}(10^2)\left(\frac{1}{6}\pi\right)$ $= 26.183cm^2$</p>	<p>K1</p> <p>N1</p> <p>K1</p> <p>K1</p> <p>N1</p> <p>K1</p> <p>N1</p> <p>K1</p> <p>N1</p>
		10

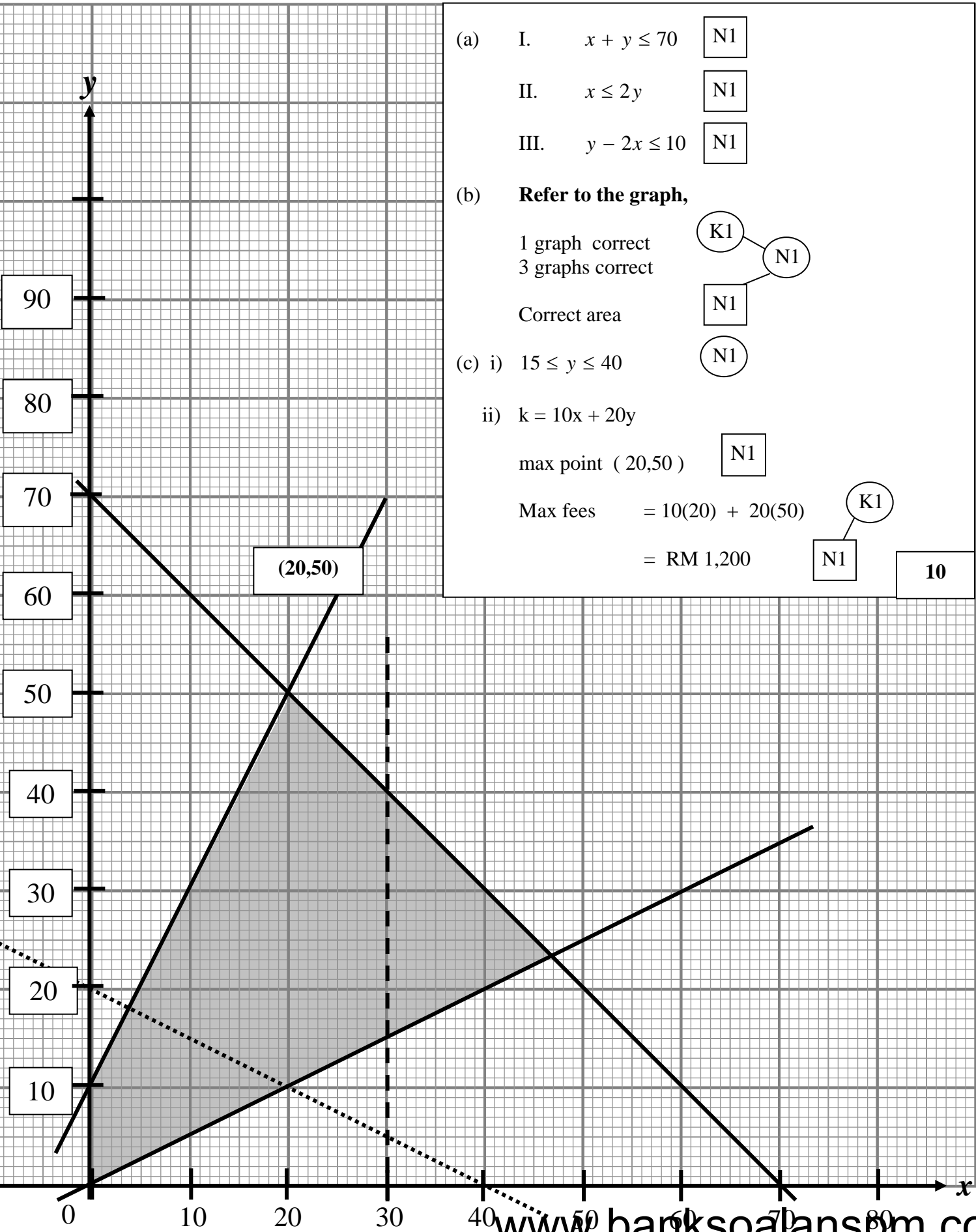
10	<p>(a) $T(4, 2)$ $\frac{6+x}{2} = 4, \frac{6+y}{2} = 2$ $S(2, -2)$</p> <p>(b) $y - 2 = 2(x - 4)$ $y = 2x - 6$</p> <p>(c) $\frac{3x+24}{7} = 2 \text{ or } \frac{3y+24}{7} = -2$</p> <p>$U\left(-\frac{10}{3}, -\frac{38}{3}\right)$</p> <p>(d) $\sqrt{(x-2)^2 + (y+2)^2} = 2\sqrt{(x-4)^2 + (y-2)^2}$ $3x^2 + 3y^2 - 28x - 20y + 72 = 0$</p>	<p>P1</p> <p>K1</p> <p>N1</p> <p>K1 K1</p> <p>N1</p> <p>K1</p> <p>N1</p> <p>K1</p> <p>N1</p>
		10
11	<p>(a) (i) $P(X = 0) = {}^{10}C_0(0.6)^0(0.4)^{10}$ or $P(X = 1) = {}^{10}C_1(0.6)^1(0.4)^9$ $P(X \geq 2) = 1 - [P(X = 0) + P(X = 1)]$ $= 1 - {}^{10}C_0(0.6)^0(0.4)^{10} - {}^{10}C_1(0.6)^1(0.4)^9$ $= 0.9983$</p> <p>(ii) $800 \times \frac{2}{5}$ $= 320$</p> <p>(b)(i) $P(-0.417 \leq z \leq 1.25)$ $= 1 - 0.3383 - 0.1057$ $= 0.556$</p> <p>(ii) $P(X > t) = 0.7977$ $Z = -0.833$ $-0.833 = \frac{t - 4.5}{1.2}$ $t = 3.5004$</p>	<p>K1</p> <p>K1</p> <p>N1</p> <p>K1</p> <p>N1</p> <p>K1</p> <p>N1</p> <p>P1</p> <p>K1</p> <p>N1</p>
		10

No	Mark Scheme	Sub Marks	Total Mark
12a i)	$\frac{1}{2}(14)(5)\sin \theta = 21$ $\theta = 36.87^\circ \text{ or } 36^\circ 52'$	K1	3
	$\angle BAC = 180^\circ - 36.87^\circ$ $= 143.13^\circ \text{ or } 143^\circ 8'$	K1 N1	
	$BC^2 = 14^2 + 5^2 - 2(14)(5)\cos 143.13^\circ$ $BC^2 = 333$ $BC = 18.25 \text{ cm}$	K1 N1	2
iii)	$\frac{\sin \theta}{5} = \frac{\sin 143.13^\circ}{18.25}$ $\theta = 9.46^\circ \text{ or } 9^\circ 28'$	K1 N1	2
b i)		N1	1
ii)	$\angle ACB = 180^\circ - 143.13^\circ - 9.46^\circ$ $= 27.41^\circ$	K1	2
	$\angle A'C'B' = 180^\circ - 27.41^\circ$ $= 152.59^\circ \text{ or } 152^\circ 35'$	N1	10

No	Mark Scheme	Sub Marks	Total Mark
13 a)	$m = \frac{4.55}{3.50} \times 100$ or $\frac{n}{4} \times 100 = 112$ $m = 130$ $n = \text{RM } 4.48$	K1	3
		N1 N1	
b)	$\frac{110(70) + 130(x) + 120(x+1) + 112(2)}{7 + x + x + 1 + 2} = 116.5$ $x = 3$	K1 N1	2
c i)	See 140 $\frac{x(116.5)}{100} = 140$ $x = 120.17 / 120.2$	P1 K1 N1	3
ii)	$\frac{x}{25} \times 100 = 140$ $x = \text{RM } 35$	K1	2
		N1	10

No	Mark Scheme	Sub Marks	Total Mark
15 a)	$v_0 = -30 \text{ ms}^{-1}$	N1	1
b)	$-3t^2 + 21t - 30 > 0$ $(t-5)(t-2) < 0$ $2 < t < 5$	K1 N1	2
c)	$a = -6t + 21$ $a_5 = -6(5) + 21$ $a_5 = -9 \text{ ms}^{-2}$	K1 K1 N1	3
d)	$S = \frac{-3t^3}{3} + \frac{21t^2}{2} - 30t$ $S = -t^3 + \frac{21t^2}{2} - 30t$ $S_3 = -(3)^3 + \frac{21(3)^2}{2} - 30(3) = -22.5 \quad \text{or}$ $S_5 = -(5)^3 + \frac{21(5)^2}{2} - 30(5) = -12.5$ Total distance = $ -22.5 + (-22.5) - (-12.5) $ $= 32.5 \text{ m}$	K1 K1 K1 N1	4 10

Answer for question 14



Answer for question 8

