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Additional

Mathematics

August 2015

PROGRAM PENINGKATAN PRESTASI AKADEMIK

SPM 2015

ADDITIONAL MATHEMATICS

Paper 2

(MODULE 2)

.

MARKING SCHEME

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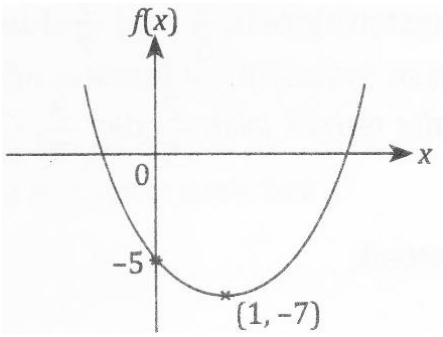
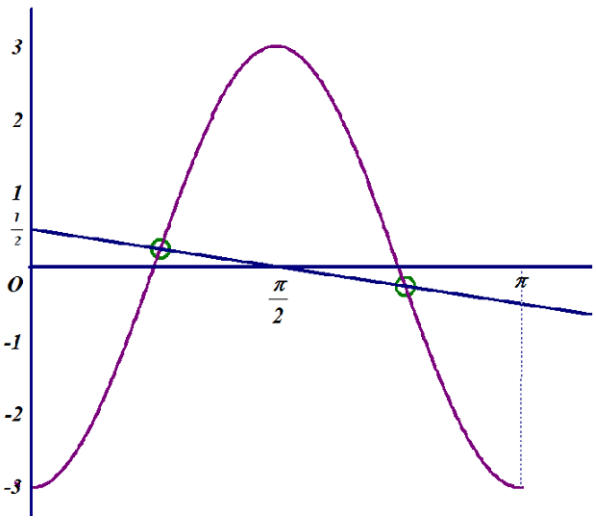
ADDITIONAL MATHEMATICS TRIAL EXAMINATION AUGUST 2015
MODULE 2 (PAPER 2)

N0.	SOLUTION	MARKS
1	$y = 5 - 2x$ or $x = \frac{5-y}{2}$	**P1**
	$3x^2 - 2(5-2x) = 3$ $3x^2 + 4x - 13 = 0$ $x = \frac{-4 \pm \sqrt{4^2 - 4(3)(-13)}}{2(3)}$	**K1 Eliminate x/y** **K1 Solve quadratic equation**
	$x = 1\cdot519$ and $x = -2\cdot852$ (both)	**N1**
	$y = 1\cdot962$ and $y = 10\cdot704$	**N1**
		5
2 **(a)**	$2\left(x - \frac{n}{4}\right)^2 - \frac{x^2}{8} + p$	**K1**
	$x = \frac{n}{4}$ or $-\frac{n^2}{8} + p = -7$	**N1**
	n = 4,	**N1**
	p = -5	
(b)		**P1 (Shape)** **P1 (Min point)**
(c)	$(-4)^2 - 4(2)(-5-h) > 0$	**K1**
	$h > -7$	**N1**
		7

N0.	SOLUTION	MARKS
3		
(a)	$\dfrac{\log_n 3^3 + \log_n 4^3}{\log_n 3 + \log_n 4}$	**K1**
	$\dfrac{3\log_n 3 + 3\log_n 4}{\log_n 3 + \log_n 4}$	
	$\dfrac{3(\log_n 3 + \log_n 4)}{\log_n 3 + \log_n 4}$	**K1**
	3	**N1**
(b)	$\log_a x^3 + \log_a y - \log_a \sqrt{y}$	**K1**
	$3\log_a x + \log_a y - \frac{1}{2}\log_a y$	**K1**
	$3n + \frac{1}{2}n$	**N1**
		6
4		
(a)	$\cos^2 x - \cos^2 x\left(\dfrac{\sin^2 x}{\cos^2 x}\right)$	**K1** for $\dfrac{\sin^2 x}{\cos^2 x}$
	$= \cos^2 x - \sin^2 x$	
	$= \cos 2x$	**N1**
(b)		
(i)		**P1** for - cosine curve **P1** for amplitude 3 and -3 **P1** for cycle 0 to π **K1** for $y = \dfrac{1}{2} - \dfrac{x}{\pi}$

(ii)	$-3\left(\cos^2 x\right)\left(1-\tan^2 x\right)=\frac{1}{2}-\frac{x}{\pi}$ $-3\cos 2x=\frac{1}{2}-\frac{x}{\pi}$ $y=\frac{1}{2}-\frac{x}{\pi}$ Number of solution = 2	**N1** **N1**
		8
5 **(a)**	$\overrightarrow{QU}=\overrightarrow{QP}+\overrightarrow{PU}$ $=-6\underset{\sim}{y}+10\underset{\sim}{x}$ $\left\lvert\overrightarrow{QU}\right\rvert=\sqrt{30^2+40^2}$ $=50 units$	**K1 find (a) triangle law OR b(ii) quadrilateral law** **K1** **N1**
(b) **(i)**	$\overrightarrow{UT}=\frac{1}{2}\overrightarrow{UQ}$ $=\frac{1}{2}\left(6\underset{\sim}{y}-10\underset{\sim}{x}\right)$ $=3\underset{\sim}{y}-5\underset{\sim}{x}$	**N1**
(ii)	$\overrightarrow{PS}=\overrightarrow{PQ}+\overrightarrow{QR}+\overrightarrow{RS}$ $=6\underset{\sim}{y}+15\underset{\sim}{x}+6\underset{\sim}{y}+5\underset{\sim}{x}$ $=20\underset{\sim}{x}+12\underset{\sim}{y}$	**N1**
(c)	$\overrightarrow{PT}=\overrightarrow{PU}+\overrightarrow{UT}$ $=10\underset{\sim}{x}+3\underset{\sim}{y}-5\underset{\sim}{x}$ $=5\underset{\sim}{x}+3\underset{\sim}{y}$	**K1 find** $\overrightarrow{PT}=10\underset{\sim}{x}+3\underset{\sim}{y}-5\underset{\sim}{x}$ **OR** $\overrightarrow{TS}=3\underset{\sim}{y}-5\underset{\sim}{x}+15\underset{\sim}{x}+6\underset{\sim}{y}+5\underset{\sim}{x}$

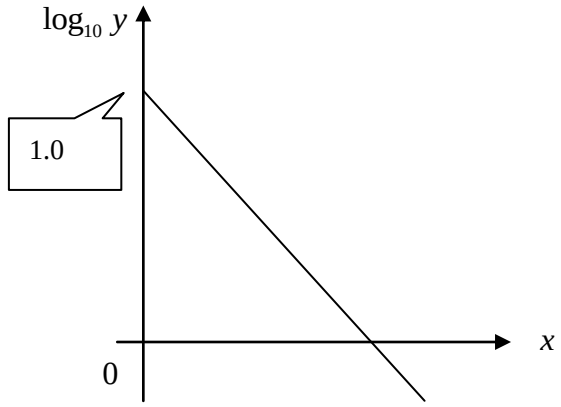
	$\overrightarrow{TS} = \overrightarrow{TQ} + \overrightarrow{QR} + \overrightarrow{RS}$ $= 3\underset{\sim}{y} - 5\underset{\sim}{x} + 15\underset{\sim}{x} + 6\underset{\sim}{y} + 5\underset{\sim}{x}$ $= 15\underset{\sim}{x} + 9\underset{\sim}{y}$ $\overrightarrow{PT} : \overrightarrow{TS}$ $5\underset{\sim}{x} + 3\underset{\sim}{y} : 15\underset{\sim}{x} + 9\underset{\sim}{y}$ $1 : 3$	**K1** **N1**
		8
6	$2x + y = 220$ $y = 220 - 2x$ $A = xy$ $A = x(220 - 2x)$ $= 220x - 2x^2$ $\frac{dA}{dx} = 220 - 4x = 0$ $x = 55$ $\frac{d^2A}{dx^2} = -4 < 0$ Maximum $x = 55 \qquad y = 110$ $A_{\max} = 55 \times 110$ $= 6050m^2$	**P1** **K1** **K1** **K1** **N1** **N1**
		6

N0.	SOLUTION	MARKS
7		
(a)		

x	1	2	3	4	5	6
$\log_{10} y$	0.70	0.55	0.40	0.25	0.10	-0.06

N1 **6 correct values** of $\log_{10} y$

(b)



K1 **Plot** $\log_{10} y$ **vs** x.
Correct axes & uniform scale

N1 **6 points plotted correctly**

N1 **Line of best-fit**

(c)

(i)

*gradient
= **- 0.30**
y-intercept = 1.0

K1 finding gradient

K1 for y-intercept

$\log_{10} y = *-0.3x+*1$

K1

$y = 10^{-0.3x+1}$

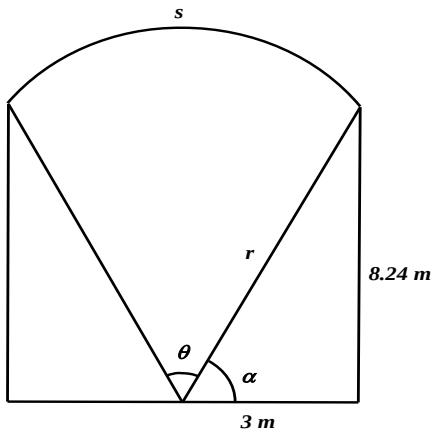
N1

(ii) $\log_{10} y = 0.30$

x = **2.35**

K1 finding x
N1

		10

N0.	SOLUTION	MARKS
8		
(a)		
	$\alpha = \tan^{-1}\left(\frac{8\cdot 24}{3}\right)$	**K1**
	$\theta = 180 - (2\times 70) = 40$	**K1**
	$r = \sqrt{3^2 + 8\cdot 24^2}$ $= 8\cdot 769m$	**K1**
	$s = 8\cdot 769 \times \left(\frac{40}{180}\times\pi\right)$ $= 6\cdot 12m$	**K1 Use** $s = r\theta$ **K1** θ **in rad** **N1**
(b)	$A_1 = 3\times 8\cdot 24 = 24\cdot 72$	**K1**
	$A_2 = \frac{1}{2}(8\cdot 769)^2\left(\frac{40}{180}\times\pi\right) = 26\cdot 8415$	**K1 Use formula** $A = \frac{1}{2}r^2\theta$
	Area of the cross section of the tunnel $A = 24\cdot 72 + 26\cdot 8415$ $= 51\cdot 56\, m^2$	**K1** **N1**
		10

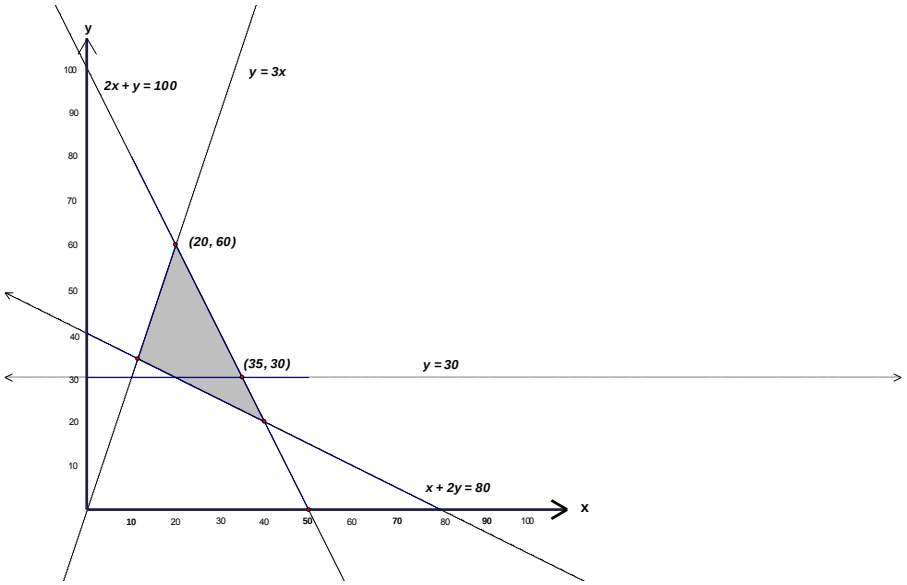
N0.	SOLUTION	MARKS
9		
(a)	Distance $= \sqrt{(7+1)^2 + (1-7)^2}$ $= 10$ *units*	**K1** **N1**
(b)	Locus T $\sqrt{(x+1)^2 + (y-7)^2} = 5$ $x^2 + 2x + 1 + y^2 - 14y + 49 - 25 = 0$ $x^2 + y^2 + 2x - 14y + 25 = 0$	**K1** **N1**
(c) **(i)**	$x = -5$ $25 + h^2 - 10 - 14h + 25 = 0$ $h^2 - 14h + 40 = 0$ $h = 4 \quad h = 10$ $h = 4$ [Use distance PS]	**K1** **N1**
(ii)	$y = 10$ $x^2 + 100 + 2x - 140 + 25 = 0$ $x^2 + 2x - 15 = 0$ $x = -5 \quad x = 3$ $Q = (3, 10)$ [Use mid-point / distance QS] OR $\frac{x-5}{2} = -1$ *and* $\frac{y+4}{2} = 7$ *mid point* $x = 3$ $y = 10$	**K1** **N1**
(d)	Area OPQR $= \frac{1}{2}\begin{vmatrix} 0 & 7 & 3 & -5 & 0 \\ 0 & 1 & 10 & 4 & 0 \end{vmatrix}$ $= \frac{1}{2}\left[(70+12) - (3-50)\right]$ $= \frac{129}{2} \quad @ \quad 64\frac{1}{2}$	**K1** **N1**
		10

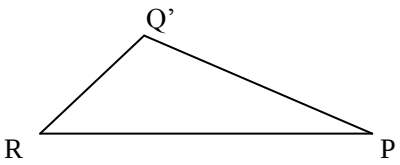
N0.	SOLUTION	MARKS
10		
(a)	$\frac{16}{x^2} = 2x$	**K1**
	Coordinate A = (2,4)	**N1**
(b)	$\frac{1}{2}(4+8)(2)$	**K1 Area of trapezium**
	$\int_2^4 16x^{-2}dx$	**K1 integrate and sub. the limit correctly**
	$12-\left[-\frac{16}{x}\right]_2^4$	**K1**
	8	**N1**
(c)	$\int_2^4 \pi\left(\frac{16}{x^2}\right)^2 dx$	**K1 integrate and sub. the limit correctly**
	$\frac{1}{3}\pi(4)^2(2)$	**K1 volume of cone**
	$\frac{28}{3}\pi+\frac{32}{3}\pi$	**K1**
	20π	**N1**
		10

N0.	SOLUTION	MARKS
11 (a) (i)	Standard deviation, $\sigma = \sqrt{20(0\cdot65)(0\cdot35)}$ $= 2\cdot133$	**P1** $p = 0\cdot65$ *and* $q = 0\cdot35$ **K1** **N1**
(ii)	$P(X = 12) = {}^{20}C_{12}(0\cdot65)^{12}(0\cdot35)^{8}$ $= 0\cdot1614$	**K1** **N1**
(b) (i)	$\mu = 2$, $\sigma = 0.8$ P(X > 1) = P (Z > $\frac{1-2}{0.8}$) = P(Z > -1.25) = $P(Z > -1.25)$ = 1 – 0.1056 = 0.8944	**K1 Use Z =** $\frac{X-\mu}{\sigma}$ **N1**
(ii)	P($X < m$) = 0.68 P($X > m$) = 1 − 0.68 = 0.32 $\frac{m-2}{0.8} = 0.468$ m = 2.374	**K1** **K1** **N1**
		10

N0.	SOLUTION	MARKS
12		
(a)	$a = \frac{dv}{dt} = 0$	**K1**
	$7 - 4t = 0$	
	$t = \frac{7}{4}$	**K1** **sub t into v**
	$v = 28\frac{1}{8}$	**N1**
(b)		
	$(2t - 11)(t + 2) = 0$	**K1**
	$t = \frac{11}{2}$, $t = -2$ (not accepted)	**N1** **(for $t = \frac{11}{2}$ only)**
(c)		
	$S = 22t + \frac{7}{2}t^2 - \frac{2t^3}{3}$	**K1** **(for integration)**
	$t = \frac{11}{2}$	
	$s = 115\frac{23}{24}$	**N1**
(d)	$S_7 = 22(7) + \frac{7}{2}(7)^2 - \frac{2}{3}(7)^3$	**K1**
	Total distance $= 115\frac{23}{24} + (115\frac{23}{24} - 96\frac{5}{6})$	**K1** **(for summation)**
	$= 135\frac{1}{12}$ **m**	**N1**
		10

N0.	SOLUTION	MARKS
13 (a)	$175 = \frac{0.7}{x} \times 100$ (or formula finding y/z)	K1
	x = **0.40**	N1
	y = **137.5**	N1
(b)	W = 16 , 32 , 25 , 34 , 13	P1
	$\bar{I} = \frac{(175x16)+(125x32)+(137.5x25)+(150x34)+(120x13)}{120}$	K1
	= **140.81**	N1
(c)	$\frac{456x140.81}{100}$	K1
	= **RM 642.09**	N1
(d)	$\frac{140.81x120}{100}$ (or 140.81 + 140.81x0.2)	K1
	= **168.97**	N1
		10

N0.	SOLUTION	MARKS
14		
(a)	I : $50x + 25y \leq 2500$ *or*	**N1**
	$2x + y \leq 100$	
	II : $20x + 40y \geq 1600$ *or*	**N1**
	$x + 2y \geq 80$	
	III : $y \leq 3x$	**N1**
(b)		
	• At least one straight line is drawn correctly from inequalities involving x and y.	**K1**
	• All the three straight lines are drawn correctly	**N1**
	• Region is correctly shaded	**N1**
(c)	**35**	**N1**
(d)	Maximum point **(20, 60)**	**N1**
	Maximum profit = 20(20) + 30(60)	**K1**
	= **RM 2200**	**N1**
		10

N0.	SOLUTION	MARKS
15		
(a)(i)	$\frac{\sin \angle PQR}{15} = \frac{\sin 30^o}{9}$	**K1**
	$\angle$PQR = **56.44°**	**N1**
(ii)	$\cos \angle RSP = \frac{8^2 + 10^2 - 15^2}{2(8)(10)}$	**K1**
	$\angle$RSP = **112.41°**	**K1**
(iii)	$\angle PRQ$ = 93.56°	**K1**
	Area = $\frac{1}{2}(9)(15)\sin 93.56^o + \frac{1}{2}(8)(10)\sin 112.41^o$	**K1, K1 (for using *area= ½absinc* and summation)**
	= 67.37 + 36.98	
	= **104.35**	**N1**
(b)(i)		**N1**
(ii)	**123.56°**	**N1**
		10

END OF MARKING SCHEME