

3472/2

*Additional*

*Mathematics*

*August 2015*



**PROGRAM PENINGKATAN PRESTASI AKADEMIK**

**SPM 2015**

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**ADDITIONAL MATHEMATICS**

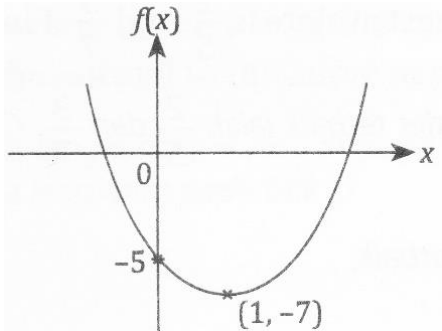
**Paper 2**

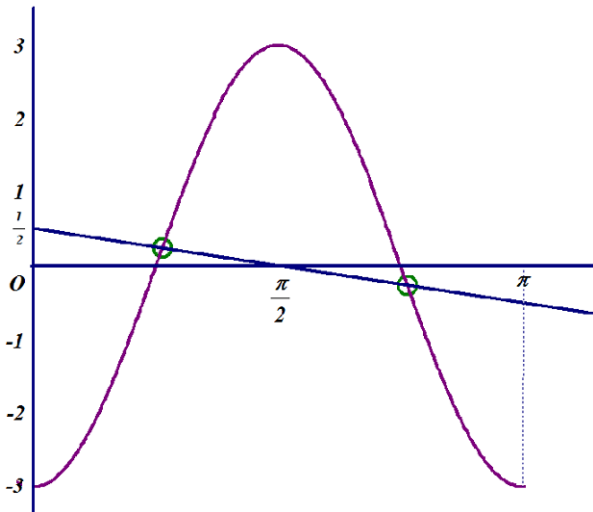
**( MODULE 2 )**

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**MARKING SCHEME**

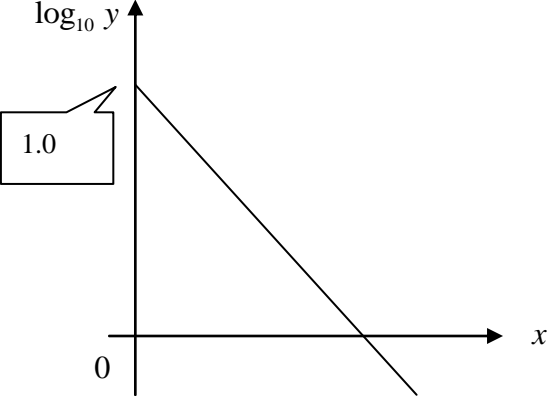
**MARKING SCHEME**  
**ADDITIONAL MATHEMATICS TRIAL EXAMINATION AUGUST 2015**  
**MODULE 2 ( PAPER 2 )**

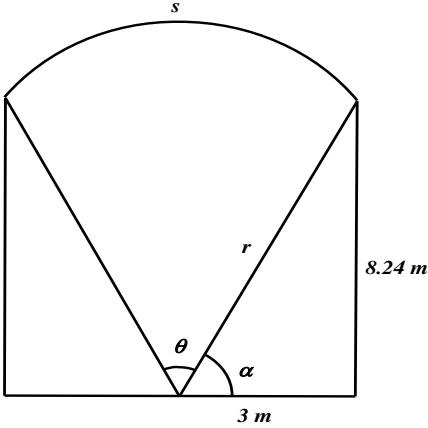
N0.	SOLUTION	MARKS
1	$y = 5 - 2x \quad \text{or} \quad x = \frac{5 - y}{2}$ $3x^2 - 2(5 - 2x) = 3$ $3x^2 + 4x - 13 = 0$ $x = \frac{-4 \pm \sqrt{4^2 - 4(3)(-13)}}{2(3)}$ $x = 1.519 \quad \text{and} \quad x = -2.852 \quad (\text{both})$ $y = 1.962 \quad \text{and} \quad y = 10.704$	<p>P1</p> <p>K1 Eliminate x/y</p> <p>K1 Solve quadratic equation</p> <p>N1</p> <p>N1</p>
		5
2 (a)	$2\left(x - \frac{n}{4}\right)^2 - \frac{x^2}{8} + p$ $x = \frac{n}{4} \text{ or } -\frac{n^2}{8} + p = -7$ <p>n = 4,</p> <p>p = -5</p>	<p>K1</p> <p>N1</p> <p>N1</p>
(b)		<p>P1 (Shape)</p> <p>P1 ( Min point)</p>
(c)	$(-4)^2 - 4(2)(-5 - h) > 0$ $h > -7$	<p>K1</p> <p>N1</p>
		7

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

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

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

N0.	SOLUTION						MARKS														
7 (a)	<table border="1"> <tr> <td><math>x</math></td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> </tr> <tr> <td><math>\log_{10} y</math></td> <td>0.70</td> <td>0.55</td> <td>0.40</td> <td>0.25</td> <td>0.10</td> <td>-0.06</td> </tr> </table>						$x$	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 $\log_{10} y$
$x$	1	2	3	4	5	6															
$\log_{10} y$	0.70	0.55	0.40	0.25	0.10	-0.06															
(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 $\log_{10} y = -0.3x + 1$ $y = 10^{-0.3x+1}$						K1 finding gradient K1 for y-intercept K1 N1														
(ii)	$\log_{10} y = 0.30$ $x = 2.35$						K1 finding $x$ N1														
							10														

N0.	SOLUTION	MARKS
<p>8</p> <p>(a)</p>	 <p> <math display="block">\alpha = \tan^{-1}\left(\frac{8.24}{3}\right)</math> </p> <p> <math display="block">\theta = 180 - (2 \times 70) = 40</math> </p> <p> <math display="block">r = \sqrt{3^2 + 8.24^2}</math> <math display="block">= 8.769m</math> </p> <p> <math display="block">s = 8.769 \times \left(\frac{40}{180} \times \pi\right)</math> <math display="block">= 6.12m</math> </p> <p>(b)</p> <p> <math display="block">A_1 = 3 \times 8.24 = 24.72</math> </p> <p> <math display="block">A_2 = \frac{1}{2} (8.769)^2 \left(\frac{40}{180} \times \pi\right) = 26.8415</math> </p> <p>Area of the cross section of the tunnel</p> <p> <math display="block">A = 24.72 + 26.8415</math> <math display="block">= 51.56 m^2</math> </p>	<p>K1</p> <p>K1</p> <p>K1</p> <p>K1 Use <math>s = r\theta</math></p> <p>K1 <math>\theta</math> in rad</p> <p>N1</p> <p>K1</p> <p>K1 Use formula</p> $A = \frac{1}{2} r^2 \theta$ <p>K1</p> <p>N1</p>
		10

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



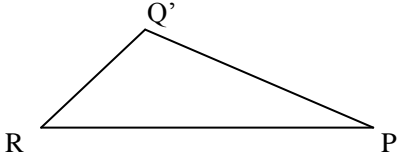
N0.	SOLUTION	MARKS
<p><b>10</b></p> <p>(a)</p> <p>(b)</p> <p>(c)</p>	$\frac{16}{x^2} = 2x$ <p>Coordinate A = (2,4)</p> $\frac{1}{2}(4+8)(2)$ $\int_2^4 16x^{-2} dx$ $12 - \left[ -\frac{16}{x} \right]_2^4$ <p>8</p> $\int_2^4 \pi \left( \frac{16}{x^2} \right)^2 dx$ $\frac{1}{3} \pi (4)^2 (2)$ $\frac{28}{3}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

N0.	SOLUTION	MARKS
<p><b>11</b></p> <p><b>(a)</b></p> <p><b>(i)</b></p> <p>Standard deviation,</p> $\sigma = \sqrt{20(0.65)(0.35)}$ $= 2.133$ <p><b>(ii)</b></p> $P(X=12) = {}^{20}C_{12} (0.65)^{12} (0.35)^8$ $= 0.1614$ <p><b>(b)</b></p> <p><b>(i)</b></p> $\mu = 2, \quad \sigma = 0.8$ $P(X > 1) = P\left(Z > \frac{1-2}{0.8}\right)$ $= P(Z > -1.25)$ $= P(Z > -1.25)$ $= 1 - 0.1056$ $= 0.8944$ <p><b>(ii)</b></p> $P(X < m) = 0.68$ $P(X > m) = 1 - 0.68 = 0.32$ $\frac{m-2}{0.8} = 0.468$ $m = 2.374$		<p><b>P1</b> <math>p = 0.65</math> and <math>q = 0.35</math></p> <p><b>K1</b></p> <p><b>N1</b></p> <p><b>K1</b></p> <p><b>N1</b></p> <p><b>K1</b> Use <math>Z = \frac{X - \mu}{\sigma}</math></p> <p><b>N1</b></p> <p><b>K1</b></p> <p><b>K1</b></p> <p><b>N1</b></p>
		<b>10</b>

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

N0.	SOLUTION	MARKS
<b>13</b> <b>(a)</b>	$175 = \frac{0.7}{x} \times 100 \quad (\text{or formula finding } y/z)$ $x = 0.40$ $y = 137.5$	<b>K1</b>  <b>N1</b>  <b>N1</b>
<b>(b)</b>	$W = 16, 32, 25, 34, 13$ $\bar{I} = \frac{(175 \times 16) + (125 \times 32) + (137.5 \times 25) + (150 \times 34) + (120 \times 13)}{120}$ $= 140.81$	<b>P1</b>  <b>K1</b>  <b>N1</b>
<b>(c)</b>	$\frac{456 \times 140.81}{100}$ $= \text{RM } 642.09$	<b>K1</b>  <b>N1</b>
<b>(d)</b>	$\frac{140.81 \times 120}{100} \quad (\text{or } 140.81 + 140.81 \times 0.2)$ $= 168.97$	<b>K1</b>  <b>N1</b>
		<b>10</b>



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

END OF MARKING SCHEME