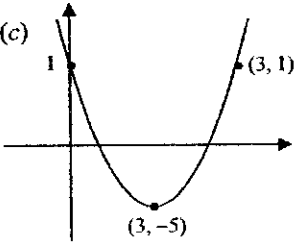


**2008 FINAL YEAR EXAM FORM 4  
MARK SCHEME ADDITIONAL MATHEMATICS 1**

SECTION 4 [40 MARKS]				
No.	MARK SCHEME	Σ MARKS		
<b>1</b>	$x = 2 - 2y$ <b>P1</b> $(2 - 2y)^2 + (2 - 2y) - y = 10$ <b>K1</b> $4y^2 - 11y - 4 = 0$ $y = \frac{-(-11) \pm \sqrt{(-11)^2 - 4(4)(-4)}}{2(4)}$ <b>K1</b> $= 3.075, -0.3252$ $x = -4.15, 2.65$ <b>N1</b> $y = 3.08, -0.33$ <b>N1</b>	<b>OR</b>	$y = \frac{2-x}{2}$ <b>P1</b> $x^2 + x - \left(\frac{2-x}{2}\right) = 10$ <b>K1</b> $2x^2 + 3x - 22 = 0$ $x = \frac{-3 \pm \sqrt{3^2 - 4(2)(-22)}}{2(2)}$ <b>K1</b> $x = 2.65, -4.15$ <b>N1</b> $y = -0.33, 3.08$ <b>N1</b>	<b>5</b>
<b>2</b>	<p>(a) <math>g : x \rightarrow (x + 1)^2 - 6</math>  <math>g(1) = (1 + 1)^2 - 6</math>      <b>K1</b>  <math>= -2</math>  <math>g(-2) = -5</math>      <b>N1</b></p> <p>(b) <math>fg = m[(x + 1)^2 - 6] + n</math>      <b>K1</b>  <math>= m(x + 1)^2 - 6m + n</math>  compare  <math>fg : x \rightarrow 3(x + 1)^2 + 13</math>  <math>m = 3</math>      <b>or</b>      <math>-6m + n = 13</math>      <b>K1</b>  <math>m = 3, n = 31</math>      <b>N1 (both)</b></p> <p>(c) <math>f(x) = 3x + 31</math>  <math>f^{-1}(4) = \frac{4-31}{3}</math>      <b>K1</b> for inverse and substitute  <math>= -9</math>  <math>g(-9) = (-9 + 1)^2 - 6</math>      <b>K1</b>  <math>= 58</math>      <b>N1</b></p>		<b>8</b>	

No.	MARK SCHEME	$\Sigma$ MARKS
3	<p>(a) <math>f(x) = 2\left[x^2 - 3x + \left(\frac{-3}{2}\right)^2 - \left(\frac{-3}{2}\right) + \frac{1}{2}\right]</math> <b>K1</b></p> $= 2\left(x - \frac{3}{2}\right)^2 - \frac{7}{2}$ <b>N1</b> <p style="text-align: center;"><b>OR</b></p> $f(x) = 2\left(x - \frac{6}{2(2)}\right)^2 + 1 - \frac{(-6)^2}{4(2)}$ <b>K1</b> $= 2\left(x - \frac{3}{2}\right)^2 - \frac{7}{2}$ <b>N1</b> <p>(b) <math>\left(\frac{3}{2}, -\frac{7}{2}\right)</math> <b>N1</b></p> <p>(c)  <b>minimum shape N1</b>  <b>passing thro' <math>\left(\frac{3}{2}, -\frac{7}{2}\right)</math> and two other points N1</b></p> <p>(d) <math>p &gt; -\frac{7}{2}</math> <b>K1 N1</b> <b>OR</b> <math>b^2 - 4ac &gt; 0</math></p> $(-6)^2 - 4(2)(1 - p) > 0$ <b>K1</b> $p > -\frac{7}{2}$ <b>N1</b>	7

No.	MARK SCHEME	$\Sigma$ MARKS
4	<p>(a) <math>m - n</math> P1</p> <p>(b) <math>\log_2 p + 2\log_2 q - 5\log_2 2</math> K1  <math>m + 2n - 5</math> N1</p> <p>(c) <math>\frac{\log_2 p}{\log_2 8}</math> <b>or</b> <math>\frac{\log_2 q}{\log_2 4}</math> change of base P1  <math>\frac{\log_2 p}{3} - \frac{\log_2 q}{2}</math> K1  <math>\frac{m}{3} - \frac{n}{2}</math> N1</p>	6
5	<p>(a) (i) <math>A(0, 2)</math> P1</p> <p>(ii) <math>\left( \frac{2(0)+1(x)}{3}, \frac{2(2)+1(y)}{3} \right)</math> K1  <math>\frac{x}{3} = 2</math> <b>or</b> <math>\frac{4+y}{3} = 3</math> N1  <math>C(6, 5)</math> N1</p> <p>(b) <math>\sqrt{(x-6)^2 + (y-5)^2} = 10</math> K1  <math>(x-6)^2 + (y-5)^2 = 10^2</math> K1  <math>x^2 + y^2 - 12x - 10y - 39 = 0</math> N1</p>	7

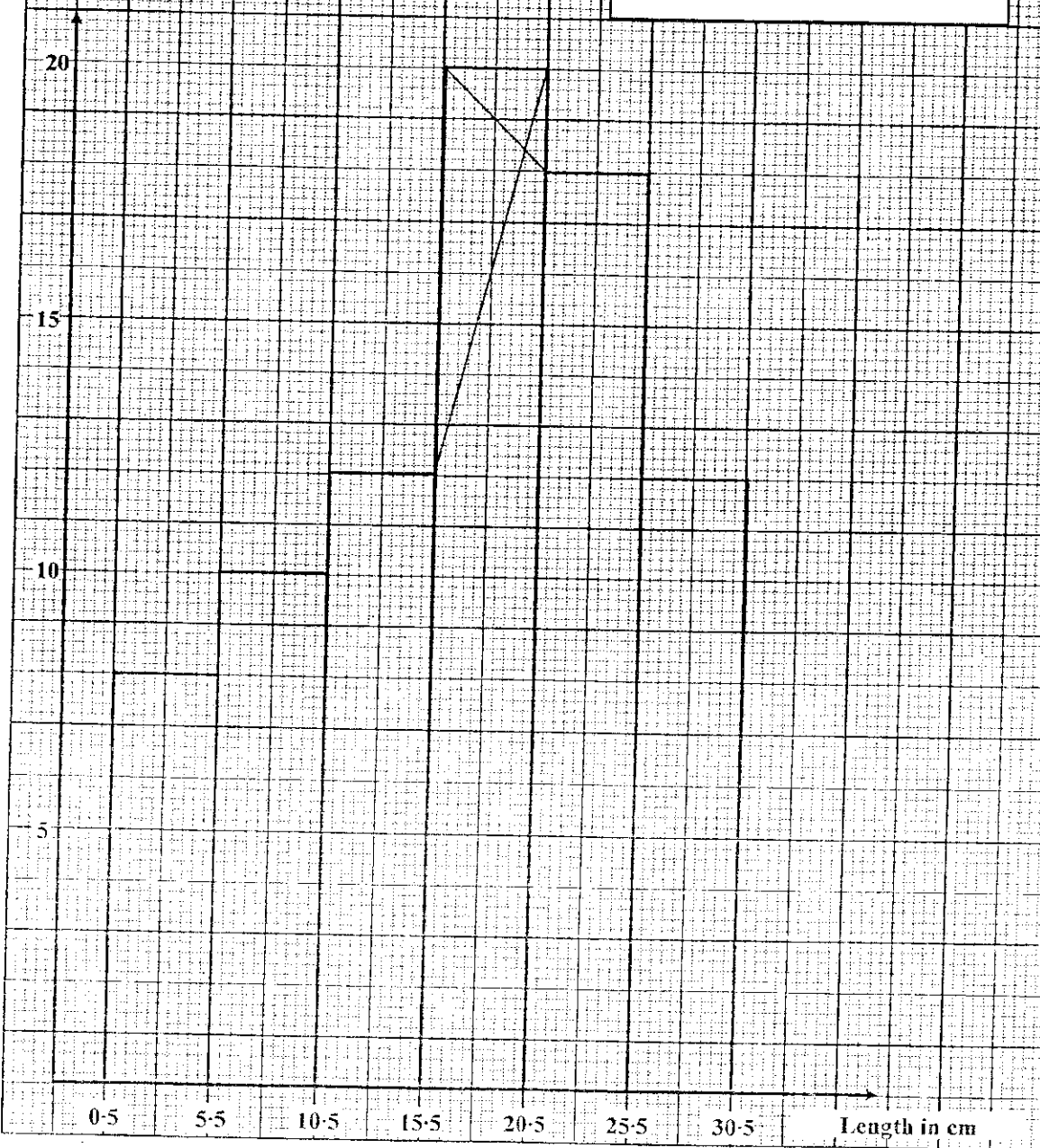
No.	MARK SCHEME	$\Sigma$ MARKS
6	<p>(a) <math>3x^2(4)(1+5x)^3(5) + (1+5x)^4(6x)</math>      <b>K1</b> for using <math>u \frac{dv}{dx} + v \frac{du}{dx}</math></p> <p><b>and</b> <math>6x</math>; <math>4(1+5x)^3(5)</math> both are correct</p> <p><b>N1</b> for all correct</p> <p><math>6x(1+5x)^3 [10x + (1+5x)]</math></p> <p><math>6x(1+5x)^3(15x+1)</math>      <b>N1</b></p> <p>(b) <math>\frac{dy}{dx} = 1 - 2x = \frac{1}{2}</math>      <b>K1</b> for <math>1 - 2x</math></p> <p><math>x = \frac{1}{4}</math> <b>and</b> <math>y = \frac{3}{16}</math>      <b>P1</b></p> <p><math>y - \frac{3}{16} = \frac{1}{2} \left( x - \frac{1}{4} \right)</math>      <b>K1</b></p> <p><math>16y = 8x + 1</math> <b>or</b> equivalent      <b>N1</b></p>	7

SECTION B [40 MARKS]		
No.	MARK SCHEME	Σ MARKS
7	<p>(a) (i) Refer to the graph on page 8.</p> <p>(ii) Finding the mode <b>K1</b> Mode length = 19.5 cm <b>N1</b></p> <p>(iii) <math>L = 10.5</math> <b>or</b> <math>F = 18</math> <b>or</b> <math>f_m = 12</math> <b>P1</b></p> $m = 10.5 + \frac{\left(\frac{1}{4}(80) - 18\right)}{12} (5) \quad \mathbf{K1}$ $= 11.33 \quad \mathbf{N1}$	10
	<p>(b) <math>\Sigma x = 134.4</math> <b>P1</b></p> $\frac{\Sigma x^2}{8} - 16.8^2 = 2.5^2 \quad \mathbf{K1}$ $\Sigma x^2 = 2307.92 \quad \mathbf{N1}$	

No. 7

Number of leaves

K1 for the bars with constant width and proportional height.  
K1 for boundary



No.	MARK SCHEME	$\Sigma$ MARKS
8	<p>(a) <math>m_{PQ} = 2</math> P1</p> <p><math>y - 0 = 2(x - 2)</math> K1</p> <p><math>y = 2x - 4</math> N1</p> <p>(b) <math>y - 8 = -\frac{1}{2}(x + 4)</math> K1</p> <p><math>x + 2y = 12</math> N1</p> <p>(c) <math>2x - 4 = -\frac{1}{2}x + 6</math> K1</p> <p><math>\frac{5}{2}x = 10</math></p> <p><math>x = 4, y = 4</math></p> <p><math>P(4, 4)</math> N1</p> <p>(d) Area PQRS</p> <p><math>= \frac{1}{2}  (0 + 4 - 16 + 16) - (8 + 0 - 8 + 32) </math> K1</p> <p><math>= \frac{1}{2}  -60 </math> N1 (implied)</p> <p><math>= 30</math> N1</p>	10

No.	MARK SCHEME	$\Sigma$ MARKS
9	<p>(a) <math>120^\circ</math>                    <b>K1</b>  <math>= 2.095 \text{ rad.}</math>                <b>N1</b>  (give <b>K1N1</b> for 2.095 rad. without working)</p> <p>(b) Area of sector <math>ORP = \frac{1}{2} (12)^2 (\angle POR)</math>                <b>K1</b>  <math>= 150.8 \text{ cm}^2</math>                <b>N1</b></p> <p>(c) Area of sector <math>QRO = \frac{1}{2} (12)^2 (1.047)</math>                <b>K1</b>  <math>= 75.38 \text{ cm}^2</math></p> <p>Area <math>\Delta QRO = \frac{1}{2} (12)^2 \sin 60^\circ</math>                <b>K1</b>  <math>= 62.35 \text{ cm}^2</math></p> <p>Area of segment = Area of sector <math>QRO - \text{Area of } \Delta QRO</math>                <b>K1</b>  <math>= 13.03</math>                <b>N1</b></p> <p>Area of shaded region = Area of sector <math>ORP - \text{Area of segment}</math>                <b>K1</b>  <math>= 137.8 \text{ cm}^2</math>                <b>N1</b></p>	<b>10</b>



No.	MARK SCHEME	$\Sigma$ MARKS
10	<p>(a) <math>\pi^2 h = 8\pi</math>      <b>K1</b></p> <p><math>h = \frac{8}{r^2}</math>      <b>N1</b></p> <p><math>A = \pi r^2 + 2\pi r h</math></p> <p><math>= \pi r^2 + 2\pi r \left(\frac{8}{r^2}\right)</math>      <b>K1</b></p> <p><math>= \pi r^2 + \frac{16\pi}{r}</math>      <b>N1</b></p> <p>(b) <math>A = \pi r^2 + 16\pi r^{-1}</math></p> <p><math>\frac{dA}{dr} = 2\pi r - 16\pi r^{-2}</math>      <b>K1 N1</b></p> <p><math>\frac{dA}{dr} = 2\pi r - 16\pi r^{-2} = 0</math>      <b>K1 K1</b>      <math>\frac{d^2A}{dr^2} &gt; 0</math></p> <p><math>r = 2</math>      <b>N1</b></p> <p><math>A = 12\pi</math>      <b>N1</b></p>	10

No.	MARK SCHEME	$\Sigma$ MARKS
11	<p>(a) <math>y = \frac{16}{x^4} = 16x^{-4}</math></p> <p><math>\frac{dy}{dx} = -64x^{-5}</math>      K1</p> <p><math>= -\frac{64}{2^5} = -2</math>      N1</p> <p><math>\delta y = \frac{dy}{dx} \times (-0.02)</math>      K1</p> <p><math>= 0.04</math></p> <p><math>\frac{16}{(1.98)^4} = \frac{16}{2^4} + \delta y</math>      K1</p> <p><math>= 1.04</math>      N1</p> <p>(b) <math>V = \frac{1}{3} \pi r^2 h = \frac{1}{3} \pi \left(\frac{h}{3}\right)^2 h</math>      K1</p> <p><math>= \frac{1}{27} \pi h^3</math>      N1</p> <p><math>\frac{dV}{dh} = \frac{1}{9} \pi h^2</math>      N1</p> <p><math>\frac{dV}{dt} = \frac{dV}{dh} \times \frac{dh}{dt}</math></p> <p><math>15 = 9\pi \times \frac{dh}{dt}</math>      K1</p> <p><math>\frac{dh}{dt} = \frac{5}{3\pi}</math> or 0.5304      N1</p>	10

SECTION C [20 MARKS]			Σ MARKS	
No.	MARK SCHEME			
12	(a)	$P_{07} = \frac{100}{105} \times 5250$	K1	
		$P_{07} = RM\ 5000$	N1	
	(b)	$\frac{103}{100} \times P_{04} = 2163$	K1	
		$P_{04} = 2100$	N1	
	(c)	$\frac{P_{07}}{2100} \times 100 = 112$	K1	
		$P_{07} = 2352$	N1	
		use $\frac{\sum IW}{\sum W} = \frac{39960}{360}$	K1	
		$P1$ for $\sum W = 360$ <u>or</u> $W_R = 35$ $P1$ for $\sum IW = 39960$ <u>or</u> equivalent value.		
		$= 111$	N1	
				10

No.	MARK SCHEME	$\Sigma$ MARKS
14	<p>(a) (i) <math>6^2 = 3^2 + 3^2 - 2(3)(3) \cos \angle ADC</math> <b>K1</b>  <math>\cos \angle ADC = -0.4814</math>  <math>\angle ADC = 118.78^\circ</math> <u>or</u> <math>118^\circ 47'</math> <b>N1</b></p> <p>(ii) <math>\angle BDC = 61.22^\circ</math> <u>or</u> <math>61^\circ 13'</math>, <math>\angle BCD = 75.78^\circ</math> <u>or</u> <math>75^\circ 47'</math>  <b>P1 (either one)</b></p> <p><math>\frac{DB}{\sin 75.78^\circ} = \frac{3.8}{\sin 43^\circ}</math> <b>K1</b>  <math>DB = 5.401</math> cm <b>N1</b></p> <p>(b) (i) <math>AQ = \sqrt{180}</math>, <math>AS = 10</math>, <math>SQ = \sqrt{208}</math> <b>P1 (all)</b>  <math>(\sqrt{208})^2 = (\sqrt{180})^2 + 10^2 - 2(\sqrt{180})(10) \cos \angle SAQ</math> <b>K1</b>  <math>\cos \angle SAQ = 0.2683</math>  <math>\angle SAQ = 74.44^\circ</math> <u>or</u> <math>74^\circ 26'</math> <b>N1</b></p> <p>(ii) Area = <math>\frac{1}{2} (10)(\sqrt{180})(\sin 74.44^\circ)</math> <b>K1</b>  = <math>64.62</math> cm<sup>2</sup> <b>N1</b></p>	10

No.	MARK SCHEME	Σ MARKS
13	<p>(a) <math>p = 120</math> N1  <math>q = \text{RM } 14.00</math> N1  <math>r = \text{RM } 3.50</math> N1</p> <p style="text-align: center;">} K1 for using <math>I = \frac{P_1}{P_0} \times 100</math> (once only)</p> <p>(b) <math>\frac{P_{07}}{P_{06}} = \frac{110}{100}</math> or <math>\frac{P_{06}}{P_{02}} = \frac{125}{100}</math> P1</p> <p><math>I_{07/02} = \frac{110}{100} \times \frac{125}{100} \times 100</math> K1</p> <p style="text-align: center;">= 137.5 N1</p> <p>(c) use <math>\bar{I} = \frac{\sum IW}{\sum W}</math></p> <p><math>\sum IW = 1390</math> P1</p> <p><math>\bar{I} = \frac{125(3) + 150(4) + 150(2) + 120(1)}{10}</math> or <math>\bar{I} = \frac{1390}{10}</math> K1</p> <p style="text-align: center;">= 139 N1</p>	10

No.	MARK SCHEME	Σ MARKS
15	<p>(a) (i) <math>PM^2 = 8^2 + 4^2 - 2(8)(4) \cos 60^\circ</math> <b>K1</b>  <math>= \sqrt{48}</math> <b>or</b> 6.928 <b>N1</b></p> <p>(ii) <math>VM = \sqrt{20}</math> <b>or</b> 4.472 <b>P1</b></p> <p><math>VP^2 = (\sqrt{20})^2 + (\sqrt{48})^2 - 2(\sqrt{20})(\sqrt{48}) \cos 70^\circ</math> <b>K1</b>  <math>VP = 6.841 \text{ m}</math> <b>N1</b></p> <p>(b) <math>\frac{\sin P}{\sqrt{20}} = \frac{\sin 70^\circ}{6.841}</math> <b>K1</b>  <math>P = 37.9^\circ</math> <b>or</b> <math>37^\circ 54'</math> <b>N1</b></p> <p>(c) <math>6^2 = 6.841^2 + 8^2 - 2(6.841)(8) \cos P</math> <b>K1</b>  <math>P = 46.89^\circ</math> <b>or</b> <math>46^\circ 54'</math></p> <p><math>\Delta VPQ = \frac{1}{2}(6.841)(8) \sin 46.89^\circ</math> <b>K1</b>  <math>= 16.98 \text{ m}^2</math> <b>N1</b></p>	10

END OF MARK SCHEME