

**[C100/SQP321]**

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Mathematics  
Higher  
Paper 1  
Specimen Marking Instructions  
(for examinations from Diet 2008 onwards)

NATIONAL  
QUALIFICATIONS

**Note:** In the Specimen Marking Instructions the Marking Scheme indicates which marks awarded are strategy marks (ss), which marks awarded are processing marks (pd) and which marks awarded are interpretation and communication marks (ic).

## SECTION A

1	B	$x - x^{-1}, 1 - x^{-2}, 1 + \frac{1}{x^2}$	2 marks
2	A	$g(f(x)) = g(2x - 3) = (2x - 3)^2 = 4x^2 - 12x + 9$	2 marks
3	C	$x^{-\frac{1}{3}}, \frac{1}{2}x^{-\frac{1}{3}+1}, \frac{3}{2}x^{\frac{2}{3}} + c$	2 marks
4	C	$d^2 = (2 - (-1))^2 + (3 - (-4))^2 + (-2 - 0)^2 = 62; d = \sqrt{62}$	2 marks
5	A	$u_1 = 3 \times (-1) - 4 = -7, u_2 = 3 \times (-7) - 4 = -25$	2 marks
6	A		2 marks
7	C	minimum at (4, -5)	2 marks
8	A	$\sin x^\circ = \frac{2\sqrt{2}}{3}, \sin 2x^\circ = 2\sin x^\circ \cos x^\circ = 2 \times \frac{2\sqrt{2}}{3} \times \frac{1}{3} = \frac{4\sqrt{2}}{9}$	2 marks
9	B	$\sin a \cos b - \cos a \sin b = \frac{1}{\sqrt{5}} \cdot \frac{4}{\sqrt{17}} - \frac{2}{\sqrt{5}} \cdot \frac{1}{\sqrt{17}} = \frac{2}{\sqrt{85}}$	2 marks
10	C	$r^2 = 4^2 + (-3)^2 - (-12) = 37, r = \sqrt{37}$	2 marks
11	C	$\vec{PQ} = \begin{pmatrix} 4 \\ 10 \\ 6 \end{pmatrix}, \vec{QR} = \begin{pmatrix} s-5 \\ 20 \\ 12 \end{pmatrix}; s-5 = 2 \times 4, s = 13$	2 marks
12	B	$2(x-3)^2 - 18 + 11, c = -7$	2 marks
13	A	$y = x^3 + \frac{9}{2}x^2 + x + c, c = 0$	2 marks
14	D	$(-3)^2 - 4k = 0; 4k = 9; k = \frac{9}{4}$	2 marks
15	A	$C = (3, 4), m_{cp} = \frac{1}{2}, m_{tgt} = -2$	2 marks
16	C	$2\sin 2x, 2\sin \frac{\pi}{3} - 2\sin 0, 2 \times \frac{\sqrt{3}}{2} - 0 = \sqrt{3}$	2 marks

17	A	$period = 2\pi / 2, p = 2; q = +1$	2 marks
18	B	$a.c = 3 \times 5 \times \frac{3}{5} = 9$ so (1) T, $a.b = 0$ so (2) F	2 marks
19	D	$\log_3 t - \log_3 5 = 2, \log_3 \left(\frac{t}{5}\right) = 2, \frac{t}{5} = 3^2, t = 45$	2 marks
20	C	$\log_e(3^k) = \log_e(e^4), k \log_e(3) = 4 \log_e(e), k = 4 / \log_e(3)$	2 marks

[END OF SECTION A]

## SECTION B

Qu	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •																		
21	<p><b>(a)</b> <span style="float: right;"><b>2 marks</b></span></p> <p><b>(b)</b> <span style="float: right;"><b>4 marks</b></span></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> ic: interpret “a” and “b” in <math>au_n + b</math></li> <li>•<sup>2</sup> ic: interpret “a” and “b” in <math>av_n + b</math></li> <li>•<sup>3</sup> ic: state limit conditions</li> <li>•<sup>4</sup> ss: know how to find limit</li> <li>•<sup>5</sup> pd: process</li> <li>•<sup>6</sup> pd: process and decide</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>u_{n+1} = 0.3u_n + 300</math></li> <li>•<sup>2</sup> <math>v_{n+1} = 0.2v_n + 350</math></li> <li>•<sup>3</sup> <i>limits are valid since <math>-1 &lt; 0.3 &lt; 1</math> and <math>-1 &lt; 0.2 &lt; 1</math></i></li> <li>•<sup>4</sup> A : <math>L_1 = 0.3L_1 + 300</math></li> <li>•<sup>5</sup> A : <math>L_1 = 428</math> or 429</li> <li>•<sup>6</sup> A : <math>L_1 = 437</math> or 438 <b>and</b> product A more effective</li> </ul>																		
22	<p><b>(a)</b> <span style="float: right;"><b>7 marks</b></span></p> <p><b>(b)</b> <span style="float: right;"><b>4 marks</b></span></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> ss: know to differentiate</li> <li>•<sup>2</sup> pd: differentiate</li> <li>•<sup>3</sup> ss: set derivative to zero</li> <li>•<sup>4</sup> pd: solve for <math>x</math></li> <li>•<sup>5</sup> pd: evaluate corresponding <math>y</math>'s</li> <li>•<sup>6</sup> ss: know to justify eg use nature table</li> <li>•<sup>7</sup> ic: interpret the stationary points</li> <li>•<sup>8</sup> pd: expand and complete</li> <li>•<sup>9</sup> ic: state <math>x</math>-axis intersections</li> <li>•<sup>10</sup> ic: state <math>y</math>-axis intersections</li> <li>•<sup>11</sup> ic: complete sketch</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>\frac{dy}{dx} = \dots</math> (1 term correct)</li> <li>•<sup>2</sup> <math>\frac{dy}{dx} = 3x^2 - 18x + 24</math></li> <li>•<sup>3</sup> <math>\frac{dy}{dx} = 0</math></li> <li>•<sup>4</sup> <math>x = 2</math> or <math>x = 4</math></li> <li>•<sup>5</sup> <math>y = 0</math> or <math>y = -4</math></li> <li>•<sup>6</sup> <table style="border-collapse: collapse; margin: 5px 0;"> <tr> <td style="border-right: 1px dashed black; border-bottom: 1px dashed black; padding: 2px;"><math>x</math></td> <td style="border-right: 1px dashed black; border-bottom: 1px dashed black; padding: 2px;">...</td> <td style="border-right: 1px dashed black; border-bottom: 1px dashed black; padding: 2px;">2</td> <td style="border-right: 1px dashed black; border-bottom: 1px dashed black; padding: 2px;">...</td> <td style="border-right: 1px dashed black; border-bottom: 1px dashed black; padding: 2px;">4</td> <td style="border-bottom: 1px dashed black; padding: 2px;">...</td> </tr> <tr> <td style="border-right: 1px dashed black; border-bottom: 1px dashed black; padding: 2px;"><math>\frac{dy}{dx}</math></td> <td style="border-right: 1px dashed black; border-bottom: 1px dashed black; padding: 2px;">+</td> <td style="border-right: 1px dashed black; border-bottom: 1px dashed black; padding: 2px;">0</td> <td style="border-right: 1px dashed black; border-bottom: 1px dashed black; padding: 2px;">-</td> <td style="border-right: 1px dashed black; border-bottom: 1px dashed black; padding: 2px;">0</td> <td style="border-bottom: 1px dashed black; padding: 2px;">+</td> </tr> <tr> <td style="border-right: 1px dashed black; padding: 2px;">.</td> <td style="border-right: 1px dashed black; padding: 2px;">...</td> <td style="border-right: 1px dashed black; padding: 2px;">.</td> <td style="border-right: 1px dashed black; padding: 2px;">...</td> <td style="border-right: 1px dashed black; padding: 2px;">.</td> <td style="padding: 2px;">.</td> </tr> </table> </li> <li>•<sup>7</sup> max. at (2, 0), min at (4, -4)</li> <li>•<sup>8</sup> <math>y = (x^2 - 4x + 4)(x - 5)</math> and complete</li> <li>•<sup>9</sup> <math>x</math>-axis: at (2, 0), (5, 0)</li> <li>•<sup>10</sup> <math>y</math>-axis: at (0, -20)</li> <li>•<sup>11</sup> sketch</li> </ul>	$x$	...	2	...	4	...	$\frac{dy}{dx}$	+	0	-	0	+	.	...	.	...	.	.
$x$	...	2	...	4	...															
$\frac{dy}{dx}$	+	0	-	0	+															
.	...	.	...	.	.															

Qu	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
23	<p style="text-align: right;"><b>8 marks</b></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> ss: equate functions</li> <li>•<sup>2</sup> pd: rearrange in “standard form”</li> <li>•<sup>3</sup> ss: try a particular value of <math>x</math></li> <li>•<sup>4</sup> ic: interpret a zero value of equation</li> <li>•<sup>5</sup> ss: start to factorise</li> <li>•<sup>6</sup> pd: obtain quadratic factor</li> <li>•<sup>7</sup> pd: factorise completely</li> <li>•<sup>8</sup> ic: interpret roots</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>x^3 + 5x^2 - 36x + 32 = -x^2 + x + 2</math></li> <li>•<sup>2</sup> <math>x^3 + 6x^2 - 37x + 30 = 0</math> <i>say</i> <math>f(x) = x^3 + 6x^2 - 37x + 30</math></li> <li>•<sup>3</sup> <i>try evaluating eg</i> <math>f(1) = 1^3 \dots</math></li> <li>•<sup>4</sup> <math>f(1) = 1 + 6 - 37 + 30 = 0</math> <i>so</i> <math>(x - 1)</math> <i>is a factor</i></li> <li>•<sup>5</sup> <math>(x - 1)(x^2 \dots)</math></li> <li>•<sup>6</sup> <math>(x - 1)(x^2 + 7x - 30)</math></li> <li>•<sup>7</sup> <math>(x - 1)(x + 10)(x - 3) = 0</math></li> <li>•<sup>8</sup> <math>x_A = -10, x_B = 1, x_C = 3</math></li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>•<sup>3</sup> <math display="block">\begin{array}{r cccc} 1 &amp; 1 &amp; .. &amp; .. &amp; .. \\ \hline &amp; &amp; &amp; &amp; \end{array}</math></li> <li>•<sup>4</sup> <math display="block">\begin{array}{r cccc} 1 &amp; 1 &amp; 6 &amp; -37 &amp; 30 \\ &amp; &amp; 1 &amp; 7 &amp; -30 \\ \hline &amp; &amp; 1 &amp; 7 &amp; -30 &amp; 0 \end{array}</math></li> <li>•<sup>5</sup> <i>rem. = 0 so</i> <math>x - 1</math> <i>is factor</i></li> <li>•<sup>6</sup> <math>x^2 + 7x - 30</math></li> </ul>
24	<p style="text-align: right;"><b>5 marks</b></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> ss: know to substitute for <math>\cos^2 x</math></li> <li>•<sup>2</sup> pd: express in “standard form”</li> <li>•<sup>3</sup> pd: factorise</li> <li>•<sup>4</sup> pd: solve for <math>\sin p</math></li> <li>•<sup>5</sup> ic: solve for <math>p</math></li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>\sin^2 p - \sin p + 1 = 1 - \sin^2 p</math></li> <li>•<sup>2</sup> <math>2\sin^2 p - \sin p = 0</math></li> <li>•<sup>3</sup> <math>\sin p(2\sin p - 1) = 0</math></li> <li>•<sup>4</sup> <math>\sin p = \frac{1}{2}, \quad \text{or } \sin p = 0</math></li> <li>•<sup>5</sup> <math>p = \frac{5\pi}{6}, \quad \text{no solution in given interval}</math></li> </ul>

[END OF SECTION B]

[END OF SPECIMEN MARKING INSTRUCTIONS]