

**NOVEMBER 2002**

**GCE Advanced Subsidiary Level**

**MARK SCHEME**

**MAXIMUM MARK : 50**

**SYLLABUS/COMPONENT :9709 /2**

**MATHEMATICS**  
**(Pure 2)**



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1	<p><i>EITHER:</i> State or imply non-modular inequality <math>(2x - 1)^2 &lt; (3x)^2</math>, or corresponding equation Expand and make reasonable solution attempt at <del>2/3</del> 3-term quadratic, or equivalent Obtain critical values <math>-1</math> and <math>\frac{1}{5}</math> State correct answer <math>x &lt; -1, x &gt; \frac{1}{5}</math></p> <p><i>OR:</i> State <del>one</del> correct equation for a critical value e.g. <math>2x - 1 = 3x</math> State two relevant equations separately e.g. <math>2x - 1 = 3x</math> and <math>2x - 1 = -3x</math> Obtain critical values <math>-1</math> and <math>\frac{1}{5}</math> State correct answer <math>x &lt; -1, x &gt; \frac{1}{5}</math></p> <p><i>OR:</i> State one critical value (probably <math>x = -1</math>), from a graphical method or by inspection or by solving a linear inequality State the other critical value correctly State correct answer <math>x &lt; -1, x &gt; \frac{1}{5}</math> [The answer <math>\frac{1}{5} &lt; x &lt; -1</math> scores B0.]</p>	<p>B1 M1 A1 A1 M1 A1 A1 A1 B1 B2 B1</p>	<p>⊕ ⊖ 4</p>
2	<p>State or obtain <math>-2 + a + b = 0</math>, or equivalent Substitute <math>x = -2</math> and equate to <math>-5</math> Obtain 3-term equation, or equivalent Solve a relevant pair of equations, obtaining <math>a</math> or <math>b</math> Obtain both answers <math>a = 3</math> and <math>b = -1</math></p>	<p>B1 M1 A1 M1 A1</p>	<p>5</p>
3	<p>(i) State or imply that <math>9^x = y^2</math> (ii) Carry out recognisable solution method for quadratic in <math>y</math> Obtain <math>y = \frac{1}{2}</math> and <math>y = 3</math> from <math>2y^2 - 7y + 3 = 0</math> Use log method to solve an equation of the form <math>3^x = k</math> Obtain answer <math>x = -\frac{\ln 2}{\ln 3}</math>, or exact equivalent {to any base} State exact answer <math>x = 1</math> (no penalty if logs used)</p>	<p>B1 M1 A1 M1 A1 B1</p>	<p>1 ⊕ 5</p>
4	<p>(i) Make recognisable sketches over the given range of a suitable pair of graphs e.g. <math>y = \sin x</math> and <math>y = \frac{1}{x^2}</math> State or imply connection between intersections and roots and justify given statement (ii) Calculate values (or signs) of <math>\sin x - \frac{1}{x^2}</math> at <math>x = 1</math> and <math>x = 1.5</math> Derive given result correctly (iii) Rearrange <math>\sin x = \frac{1}{x^2}</math> and obtain given answer (iv) Use the iterative formula correctly with <math>1 \leq x_n \leq 1.5</math> Obtain final answer 1.07 Show sufficient iterations to justify its accuracy to 3d.p., or show there is a sign change in the interval (1.065, 1.075)</p>	<p>B1 B1 M1 A1 B1 M1 A1 A1</p>	<p>2 2 1 3</p>

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- 5 (i) Use relevant formulae for  $\cos(x - 30^\circ)$  and  $\sin(x - 60^\circ)$  { allow one sign error } M1\* ①  
 Use  $\sin 30^\circ = \cos 60^\circ = \frac{1}{2}$  and  $\sin 60^\circ = \cos 30^\circ = \frac{\sqrt{3}}{2}$  M1(dep\*)  
 Collect terms and obtain given answer correctly A1 3  
 (ii) Carry out correct processes to evaluate a single trig ratio M1  
 Obtain answer  $73.9^\circ$  A1  
 Obtain second answer  $253.9^\circ$  and no others A1✓ 3  
 (iii) State or imply that  $\cos^2 x = \frac{1}{13}$  or  $\sin^2 x = \frac{12}{13}$  B1  
 Use a relevant trig formula to evaluate  $\cos 2x$  M1  
 Obtain exact answer  $-\frac{11}{13}$  correctly A1 3  
 [Use of only say  $\cos x = +\frac{1}{\sqrt{13}}$ , probably from a right triangle, can earn B1M1A0.]
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- 6 (a) Obtain indefinite integral  $-\frac{1}{2} \cos 2x + \sin x$  B1 + B1  
 Use limits with attempted integral M1  
 Obtain answer 2 correctly with no errors A1 4  
 (b) (i) Identify  $R$  with correct definite integral and attempt to integrate M1  
 Obtain indefinite integral  $\ln(x+1)$  B1  
 Obtain answer  $R = \ln(p+1) - \ln 2$  A1 3  
 (ii) Use exponential method to solve an equation of the form  $\ln x = k$  M1  
 Obtain answer  $p = 13.8$  A1 2
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- 7 (i) State  $6y \frac{dy}{dx}$  as the derivative of  $3y^2$  B1  
 State  $\pm 2x \frac{dy}{dx} \pm 2y$  as the derivative of  $-2xy$  (allow any combination of signs here) B1  
 Equate attempted derivative of LHS to 0 (or 10) and solve for  $\frac{dy}{dx}$  M1  
 Obtain the given answer correctly A1 4  
 [The M1 is dependent on at least one of the B marks being earned.]  
 (ii) State or imply the points lie on  $y - 2x = 0$  or  $(y - 2x)/(3y - x) = 0$  B1 ①  
 Carry out complete method for finding one coordinate of a point of intersection of  $y = kx$  with the given curve M1  
 Obtain  $10x^2 = 10$  or  $2\frac{1}{2}y^2 = 10$  or 2-term equivalent A1  
 Obtain one correct point e.g. (1, 2) or 2 values of  $x$  (or  $y$ ) A1  
 Obtain a second correct point e.g. (-1, -2) A1 5 ②
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