Page 4	Mark Scheme: Teachers' version	Syllabus	Paper
	GCE AS/A LEVEL – May/June 2012	9709	33

1 *EITHER*: Obtain a correct unsimplified version of the x or x^2 term of the expansion of $(4+3x)^{-\frac{1}{2}}$ or $(1+\frac{3}{4}x)^{-\frac{1}{2}}$ M1

State correct first term $\frac{1}{2}$ B1

Obtain the next two terms $-\frac{3}{16}x+\frac{27}{256}x^2$ A1 + A1

OR: Differentiate and evaluate f(0) and f′(0), where $f'(x)=k(4+3x)^{-\frac{3}{2}}$ M1

State correct first term $\frac{1}{2}$ B1

Obtain the next two terms $-\frac{3}{16}x+\frac{27}{256}x^2$ A1 + A1 [4]

[Symbolic coefficients, e.g. $\binom{-\frac{1}{2}}{2}$ are not sufficient for the M or B mark.]

2 Use law of the logarithm of a power and a product or quotient and remove logarithms M1

Obtain a correct equation in any form, e.g. $\frac{2x+3}{x^2}=3$ A1

Solve 3-term quadratic obtaining at least one root M1

Obtain final answer 1.39 only A1 [4]

3 Obtain $\frac{dx}{d\theta}=2\cos 2\theta-1$ or $\frac{dy}{d\theta}=-2\sin 2\theta+2\cos\theta$, or equivalent B1

Use $\frac{dy}{dx}=\frac{dy}{d\theta}\div\frac{dx}{d\theta}$ M1

Obtain $\frac{dy}{dx}=\frac{-2\sin 2\theta+2\cos\theta}{2\cos 2\theta-1}$, or equivalent A1

At any stage use correct double angle formulae throughout M1

Obtain the given answer following full and correct working A1 [5]

4 **(i)** Use correct quotient or product rule M1

Obtain correct derivative in any form, e.g. $\frac{2e^{2x}}{x^3}-\frac{3e^{2x}}{x^4}$ A1

Equate derivative to zero and solve a 2-term equation for non-zero x M1

Obtain $x=\frac{3}{2}$ correctly A1 [4]

(ii) Carry out a method for determining the nature of a stationary point, e.g. test derivative either side M1

Show point is a minimum with no errors seen A1 [2]

5 **(i)** Substitute for x, separate variables correctly and attempt integration of both sides — M1
Obtain term $\ln y$, or equivalent — A1
Obtain term e^{-3t}, or equivalent — A1
Evaluate a constant, or use $t = 0$, $y = 70$ as limits in a solution containing terms $a\ln y$ and be^{-3t} — M1
Obtain correct solution in any form, e.g. $\ln y - \ln 70 = e^{-3t} - 1$ — A1
Rearrange and obtain $y = 70\exp(e^{-3t} - 1)$, or equivalent — A1 [6]

(ii) Using answer to part (**i**), either express p in terms of t or use $e^{-3t} \to 0$ to find the limiting value of y — M1
Obtain answer $\frac{100}{e}$ from correct exact work — A1 [2]

6 **(i)** Use tan $(A + B)$ and tan $2A$ formulae to obtain an equation in tan x — M1
Obtain a correct equation in tan x in any form — A1
Obtain an expression of the form $a\tan^2 x = b$ — M1
Obtain the given answer — A1 [4]

(ii) Substitute $k = 4$ in the given expression and solve for x — M1
Obtain answer, e.g. $x = 16.8°$ — A1
Obtain second answer, e.g. $x = 163.2°$, and no others in the given interval — A1 [3]
[Ignore answers outside the given interval. Treat answers in radians as a misread and deduct A1 from the marks for the angles.]

(iii) Substitute $k = 2$, show $\tan^2 x < 0$ and justify given statement correctly — B1 [1]

7 **(i)** Substitute for x and dx throughout the integral — M1
Obtain $\int 2u\cos u \, du$ — A1
Integrate by parts and obtain answer of the form $au\sin u + b\cos u$, where $ab \neq 0$ — M1
Obtain $2u\sin u + 2\cos u$ — A1
Use limits $u = 0$, $u = p$ correctly and equate result to 1 — M1
Obtain the given answer — A1 [6]

(ii) Use the iterative formula correctly at least once — M1
Obtain final answer $p = 1.25$ — A1
Show sufficient iterations to 4 d.p. to justify its accuracy to 2 d.p., or show there is a sign change in the interval (1.245, 1.255) — A1 [3]

8 **(i)** State or imply the form $A+\frac{B}{x+1}+\frac{C}{2x-3}$ B1

State or obtain $A = 2$ B1

Use a correct method for finding a constant M1

Obtain $B = -2$ A1

Obtain $C = -1$ A1 [5]

(ii) Obtain integral $2x-2\ln(x+1)-\frac{1}{2}\ln(2x-3)$ B3√

(Deduct B1√ for each error or omission. The f.t. is on A, B, C.)

Substitute limits correctly in an expression containing terms $a\ln(x+1)$ and $b\ln(2x-3)$ M1

Obtain the given answer following full and exact working A1 [5]

[SR: If A omitted from the form of fractions, give B0B0M1A0A0 in (**i**); B1√B1√M1A0 in (**ii**).]

[SR: For a solution starting with $\frac{B}{x+1}+\frac{Dx+E}{2x-3}$, give M1A1 for one of $B = -2$, $D = 4$, $E = -7$ and A1 for the other two constants; then give B1B1 for $A = 2$, $C = -1$.]

[SR: For a solution starting with $\frac{Fx+G}{x+1}+\frac{C}{2x-3}$ or with $\frac{Fx}{x+1}+\frac{C}{2x-3}$, give M1A1 for one of $C = -1$, $F = 2$, $G = 0$ and A1 for the other constants or constant; then give B1B1 for $A = 2$, $B = -2$.]

9 **(i)** Express general point of l or m in component form, i.e. $(3-\lambda,-2+2\lambda,1+\lambda)$ or $(4+a\mu,4+b\mu,2-\mu)$ B1

Equate components and eliminate either λ or μ from a pair of equations M1

Eliminate the other parameter and obtain an equation in a and b M1

Obtain the given answer A1 [4]

(ii) Using the correct process equate the scalar product of the direction vectors to zero M1*

Obtain $-a+2b-1=0$, or equivalent A1

Solve simultaneous equations for a or for b M1(dep*)

Obtain $a = 3$, $b = 2$ A1 [4]

(iii) Substitute found values in component equations and solve for λ or for μ M1

Obtain answer $\mathbf{i}+2\mathbf{j}+3\mathbf{k}$ from either $\lambda = 2$ or from $\mu = -1$ A1 [2]

10 (a) EITHER: Eliminate u or w and obtain an equation in w or in u — M1

Obtain a quadratic in u or w, e.g. $u^2 - 4iu - 5 = 0$ or $w^2 + 4iw - 5 = 0$ — A1

Solve a 3-term quadratic for u or for w — M1

OR1: Having squared the first equation, eliminate u or w and obtain an equation in w or u — M1

Obtain a 2-term quadratic in u or w, e.g. $u^2 = -3 + 4i$ — A1

Solve a 2-term quadratic for u or for w — M1

OR2: Using $u = a + ib$, $w = c + id$, equate real and imaginary parts and obtain 4 equations in a, b, c and d — M1

Obtain 4 correct equations — A1

Solve for a and b, or for c and d — M1

Obtain answer $u = 1 + 2i$, $w = 1 - 2i$ — A1

Obtain answer $u = -1 + 2i$, $w = -1 - 2i$ and no other — A1 [5]

(b) (i) Show point representing $2 - 2i$ in relatively correct position — B1

Show a circle with centre $2 - 2i$ and radius 2 — B1√

Show line for $\arg z = -\frac{1}{4}\pi$ — B1

Show line for $\mathrm{Re}\, z = 1$ — B1

Shade the relevant region — B1 [5]

(ii) State answer $2 + \sqrt{2}$, or equivalent (accept 3.41) — B1 [1]