A2 Assignment alpha Cover Sheet **Name:**

Question		Done	Backpack		Topic	Comment
Drill	1i				C3 Differentiation trig	$\frac{dy}{dx} = 4\cos 4x$
	1ii				C3 Differentiation trig	$\frac{dy}{dx} = -6\sin 6x$
	1iii				C3 Differentiation trig	$\frac{dy}{dx} = \frac{1}{2}\sec^2 \frac{x}{2}$
	2i				C3 Differentiation trig chain	$f'(x) = 4\sin^3 x\cos x$
	2ii				C3 Differentiation trig chain	$f'(x) = -6\cos^5 x\sin x$
	2iii				C3 Differentiation trig chain	$f'(x) = \frac{1}{2}\tan^{-\frac{1}{2}} x\sec^2 x$
	3i				C4 Integration Reverse chain	$-\frac{1}{4}\cos 4x + c$
	3ii				C4 Integration Reverse chain	$\frac{1}{18}(3x+2)^6 + c$
	3iii				C4 Integration Reverse chain	$\sin(x+2) + c$
	4(a)(i)				C2 Solve exponential eq.	-3
	4(a)(ii)				C2 Solve ln equation	-1/3
	4(b)(i)				C3 Differentiate ln	1/3
Consolidation	1a				C3 Differentiation all & factorising to simplify	$6x\left(x^2-5\right)^2$
	1b				C3 Differentiation all & factorising to simplify	$20\sin^3 5x\cos 5x$
	1c				C3 Differentiation all & factorising to simplify	$x\left(5x^3-3x+6\right)$
	1d				C3 Differentiation all & factorising to simplify	$\frac{1}{2}(x-1)^{-\frac{1}{2}}(3x-1)$
	1e				C3 Differentiation all & factorising to simplify	$-2(3x-1)^{-2}$
	1f				C3 Differentiation all & factorising to simplify	$\frac{x^2(x^2+3)}{\left(x^2+1\right)^2}$
	2				C3 Find normal	$4x+3y-10=0,\quad 10x+3y-95=0$
	3				C3 Stationary Points	(1, 1) max, $(-1,-1)$ min
	4a(i)				C2 log solves, no calc	Max at $\left(\frac{1}{2}, \frac{1}{2e}\right)$
	4a(ii)				C2 log solves, no calc	Min at (0, 0), max at $(2, 4e^{-2})$
	4b				C2 log solves, no calc	$-\frac{1}{3e}$
	5a				C3 Sketch exponentials	Check with google – inc asymptotes
	5b				C3 Sketch exponentials	Check with google – inc asymptotes
	5c				C3 Sketch exponentials	Check with google – inc asymptotes

	6				C1 Sketch quadratic	Check with google – inc asymptotes
	7a				C3 reciprocal trig solve	$\frac{\pi}{12}, \frac{11\pi}{12}, \frac{13\pi}{12}, \frac{23\pi}{12}$
	7c				C3 reciprocal trig solve	$0, \frac{3\pi}{4}, \pi, \frac{7\pi}{4}, 2\pi$
	8a				C3 Trig Proof Pythagorean Identities	PROOF
	8b				C3 Trig Proof Pythagorean Identities	PROOF
	9				M1 Moments	1/3
	10				C4 Parametric to Cartesian conversion	$x = \frac{2}{y^2} - 1$

α	β	γ	δ	ε	ζ	η	θ	ι	κ	λ	μ	ν	ξ	o	π	ρ	σ	τ	υ	φ	χ	ψ	ω

"A mathematician is a machine for turning coffee into theorems" P Erdos

A2 Maths with Mechanics Assignment α (alpha)
due 25/9

Assignments explained

Drill section contains short questions to improve your speed and accuracy

Drill

Part A Differentiate the following using the correct notation

(a) $y = \sin 4x$ **(b)** $y = \cos 6x$ **(c)** $y = \tan\frac{x}{2}$

Part B Differentiate the following using the correct notation

(a) $f(x) = \sin^4 x$ **(b)** $f(x) = \cos^6 x$ **(c)** $f(x) = \sqrt{\tan x}$

Part C Integrate the following functions by working out what has been differentiated:

(a) $\int \sin 4x\, dx$ (b) $\int (3x+2)^5\, dx$ (c) $\int \cos(x+2)\, dx$

Part D Without a calculator, find the values of these logarithms (showing your method):

(a) $\log_2 \frac{1}{8}$ (b) $\log_8 0.5$ (c) $\log_{27} 3$

Current Work

Do your corrections and find similar questions to practise to strengthen weaknesses from your work in the Continuing with Confidence booklet

Consolidation

1. Differentiate the following functions: hint use the chain, product and quotient rules

   (a) $y = (x^2-5)^3$ (b) $y = \sin^4 5x$

   (c) $y = (x^2-1)(x^3+3)$ (d) $f(x) = (x+1)(x-1)^{\frac{1}{2}}$

   (e) $f(x) = \frac{2x}{3x-1}$ (f) $f(x) = \frac{x^3}{x^2+1}$

2. On the curve with equation $y = (3x+1)^{1/2}$, the points *P* and *Q* have *x* coordinates of 1 and 8 respectively. Find equations of the normals to the curve at *P* and *Q*.

3. For the curve with equation $y = \frac{2x}{1+x^2}$ show that $\frac{dy}{dx} = \frac{2(1-x^2)}{(1+x^2)^2}$. Find the coordinates of the stationary points and distinguish between them.

4. (a) Determine the nature of any stationary points on these curves.

(i) $y = x\mathrm{e}^{-2x}$ (ii) $y = x^2\mathrm{e}^{-x}$

(b) Find the minimum value of $\mathrm{f}(x) = x^3 \ln x$

5. Sketch the following functions showing clearly any asymptotes:

(a) $y = 2^{-x}$ (b) $y = 1 - 4^x$ (c) $y = 3^{x+1}$

6. Sketch the quadratic $y = -3x^2 + 6x - 9$ indicating any intercepts and the turning point. Show your working clearly.

7. Solve the following equations on the interval $0 \le \theta \le 2\pi$. Give exact answers.

(a) $\sqrt{3}\sec 2\theta = 2$ (b) $\sec^2 x + \tan x - 1 = 0$

8. Prove the following identities, setting out your proof clearly:

(a) $\dfrac{1-\tan^2\theta}{1+\tan^2\theta} \equiv \cos 2\theta$ (b) $\dfrac{\sin\theta}{1+\cos\theta} + \dfrac{1-\cos\theta}{\sin\theta} \equiv \dfrac{2\sin\theta}{1+\cos\theta}$

M1 moments

9. A uniform rod AB of length 4m and mass 2kg is suspended in a horizontal position by two vertical strings attached at points P and Q where AP=1m and AQ=3m.When a particle of mass 3kg is attached at point R of the rod, the rod is on the point of turning about P. Calculate the distance AR

10. Eliminate θ from the equations $x = \cos 2\theta, y = \sec\theta$