A2 Assignment delta Cover Sheet **Name:**

Question		Done	Backpack		Topic	Comment
Drill	1i				C3 Differentiation trig	$-5\cos^4 x\sin x$
	1ii				C3 Differentiation trig	$\sec x\tan x$
	1iii				C3 Differentiation trig	$-\text{cosec}^2 x$
	2i				C4 Integration Reverse chain	$\frac{2}{15}(3x-3)^5+c$
	2ii				C4 Integration Reverse chain	$\frac{3}{2}\tan 2x+c$
	2iii				C4 Integration Reverse chain	$\cot(\pi-x)+c$
	3i				C3 Sketching modulus function	Check on google inc asymptotes
	3ii				C3 Sketching modulus function	Check on google inc asymptotes
	3iii				C3 Sketching modulus function	Check on google inc asymptotes
	4i				C3 Sketch and give range	$0\le f(x)\le 16$
	4ii				C3 Sketch and give range	$\frac{1}{10}\le f(x)\le\frac{1}{2}$
	4iii				C3 Sketch and give range	$\frac{1}{4}\le f(x)\le 16$
	TT1A				C3 Differentiation	$\frac{2}{x}$
	TT1B				C3 Differentiation	$2x\sin 3x+3x^2\cos 3x$
	TT1C				C3 Trig proofs	Proof
	TT1D				C3 Trig proofs	Proof
oli	1a				C3 Sketching modulus function	Check on google inc asymptotes
	1b				C3 Sketching modulus function	Check on google inc asymptotes
	1c				C3 Sketching modulus function	Check on google inc asymptotes
	1d				C3 Sketching modulus function	Check on google inc asymptotes
	2				C3 Sketch and solve modulus equation with unknown	$x=3a$ or $\frac{3}{2}a$
	3ai				C3 Inverse function and domain	$f^{-1}(x)=5x-6$, $x\in\mathbb{R}$
	3aii				C3 Inverse function and domain	$f^{-1}(x)={}^{5}/_{x}$, $\{x\in\mathbb{R}: x\neq 0\}$
	3aiii				C3 Inverse function and domain	$f^{-1}: x\to x^2-4$, $\{x\in\mathbb{R}: x\ge 0\}$
	3aiv				C3 Inverse function and domain	$f^{-1}: x\to {}^{(x+2)}/_{(x-3)}$, $\{x\in\mathbb{R}: x\neq 3\}$

	3bi				C3 Conditions for inverse function	The inverse is a 1 to many function (3bii) $x \in \mathbb{R}, x \geq 3$
	3bii				C3 Changing domain to create inverse function	$X \geq 3$
	4a				C3 Inverse and composite functions	$f^{-1}(x) = {}^1/_3(x-2)$, $g^{-1}(x) = {}^1/_x$, $x \neq 0$, $gf(x) = {}^1/_{(3x+2)}$, $x \neq -{}^2/_3$
	4b				C3 Inverse and composite functions	PROOF
	5a				C4 dx/dy in terms of y	$\frac{dx}{dy} = \sec^2 y$
	5b				C4 using dx/dy to find dy/dx in terms of x	PROOF
	6a				C3 Solving equations using composite functions	3
	6b				C3 Solving equations using composite functions	2
	6c				C3 Solving equations using composite functions	$\frac{109}{4}(27.25)$
	7				C3 Find normal	$\left(\frac{1}{5}\left(\frac{\pi}{4}+8\right), \frac{1}{5}\left(\frac{\pi}{4}+8\right)\right)$
	8a				C2 Solve trig equations	$0.424^c, 1.15^c, 3.57^c, 4.29^c$
	8b				C2 Solve trig equations	$\pi/3$, $5\pi/3$
M1	9				M1 Force diagrams	34 N
	10				C4 Parametric differentiation	$\frac{1}{3}\cos t$

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

"Logic is the art of going wrong with confidence" M Kline

A2 Maths with Mechanics Assignment δ (delta)

due w/b 10/10

Maths Trip: Maths In Action University Lectures in London. £20 a ticket (10 tickets available) 15th November
Maths Trip: Maths In Action University Lectures in London. £20 a ticket (10 tickets available) 14th December

Drill

Part A Differentiate the following functions with respect to x:

(a) $\cos^5 x$ (b) $\dfrac{1}{\cos x}$ (c) $\dfrac{1}{\tan x}$

Part B Integrate the following with respect to x:

(a) $2(3x-3)^4$ (b) $3\sec^2 2x$ (c) $\operatorname{cosec}^2(\pi - x)$

Part C For each of the following function sketch $\mathrm{f}(x)$, $\mathrm{f}(|x|)$ and $|\mathrm{f}(x)|$

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

Part D Sketch the following functions where each function is defined $x \in \mathbb{R}$. on its given domain, State the range of each function.

(a) $f(x)=x^2, -4 \le x \le 4$ (b) $f(x)=\dfrac{1}{x}, \quad 2 \le x \le 10$

(c) $f(x)=2^x, \quad -2 \le x \le 4$

TT1 FOCUS:

A) Differentiate $ln\, x^2$

B) Differentiate $x^2 sin\, 3x$

C) Prove that $1 + cos2\theta + cos4\,\theta \equiv (4cos^2\theta - 1)cos2\theta$

D) Prove that $sin(x+y)sin(x-y) \equiv cos^2y - cos^2x$

Current work

1. For each of the following functions, sketch $f(x)$, $f(|x|)$ and $|f(x)|$ on separate axes.

(a) $f(x)=2x-4$ (b) $f(x)=-x$

(c) $f(x)=\sin x$ (d) $f(x)=(x-2)^2$

2. Sketch the graph of $y = |x - 2a|$ (where a is a positive constant) showing the points of q intersection with the coordinate axes. Solve $|x - 2a| = \frac{1}{3}x$ for x in terms of a.

3. (a) For each of these functions, find the inverse function, $f^{-1}(x)$ and state its domain.

(i) $f(x) = \dfrac{x+6}{5}$, $x \in \mathbb{R}$ (ii) $f(x) = \dfrac{5}{x}$, $\{x \in \mathbb{R}: x \neq 0\}$

(iii) $f: x \to \sqrt{x+4}$, $\{x \in \mathbb{R}: x \geq -4\}$ (iv) $f: x \to \dfrac{3x+2}{x-1}$, $\{x \in \mathbb{R}: x \neq 1\}$

(b) (i) State why the inverse $f^{-1}(x)$ does not exist for $f: x \to 2(x-3)^2 - 5$, $\{x \in \mathbb{R}\}$

(ii) Change the domain of the above function so that the inverse does exist.

4. $f(x) = 3x + 2$ and $g(x) = \dfrac{1}{x}$ with $x \neq 0$.

(a) Find $f^{-1}(x), g^{-1}(x)$ and $gf(x)$. (b) Show that $(gf)^{-1}(x) = f^{-1}g^{-1}(x) = \dfrac{1}{3}\left(\dfrac{1}{x} - 2\right)$.

Note: you will need to show *both* that $f^{-1}g^{-1}(x) = \dfrac{1}{3}\left(\dfrac{1}{x} - 2\right)$ <u>and</u> that $(gf)^{-1}(x) = \dfrac{1}{3}\left(\dfrac{1}{x} - 2\right)$.

Consolidation

5. Given that $x = \tan y$

(a) find $\dfrac{dx}{dy}$ in terms of y

(b) hence show $\dfrac{dy}{dx} = \dfrac{1}{1+x^2}$

6. The functions f, g and h each have the set of real numbers as their domain and are defined as follows:

$f(x) = 7 - 2x$ $g(x) = 4x - 1$ $h(x) = 3(x-1)$

Find $fg(x)$, $gh(x)$ and $ff(x)$ and hence find the values of x for which:

(a) $fg(x) = -15$ (b) $gh(x) = 11$ (c) $ff(x) = 102$

7. The normal to the curve $y = \sec^2 x$ at the point $P\left(\dfrac{\pi}{4}, 2\right)$ meets the line $y = x$ at the point Q. Find the exact coordinates of Q.

8. Solve the following equations on the interval $0 \leq x \leq 2\pi$. Give exact answers where you can, but otherwise give your answers to 3sf:

(a) $8\sin x \cos x = 3$ (b) $10\cos x = 2(1 + 2\sin^2 x)$

M1 (Preparation of M2)

9. A mass of 10 kg rests in equilibrium on a rough plane inclined at θ to the horizontal.

a) Draw a force diagram and find the magnitude of the frictional force when θ = 20°.

b) If R is the magnitude of the normal contact force, show that $F = R\tan\theta$.

10. Use the chain rule $\frac{dy}{dx} = \frac{dy}{dt} \times \frac{dt}{dx}$

to find $\frac{dy}{dx}$ in terms of t for the curve defined by the parametric equations

$x = 3\cot t, y = \operatorname{cosec} t$

Preparation: Read* about $\mathrm{R}\sin(\theta \pm \alpha)$, $\mathrm{R}\cos(\theta \mp \alpha)$.

C3 new textbook pages 120-124,old C3 textbook pages 108-112

* you are not expected to work through questions in this preparation section but read the textbook, making notes if you wish, to help you to understand the topic.