A2 Assignment gamma Cover Sheet **Name:**

Question		Done	Back pack		Topic	Answers
Drill	Aa)				C3 Differentiation trig – given x =, find dy/dx	$\frac{dy}{dx} = \frac{1}{secytany}$
	Ab)				C3 Differentiation trig – given y =, find dy/dx	$\frac{dy}{dx} = \sec^2 x - cosec^2 x$
	Ac)				C3 Differentiation trig – given x =, find dy/dx	$\frac{dy}{dx} = \frac{1}{2ycosy - y^2 siny}$
	Ad)				C3 Differentiation trig – given y =, find dy/dx	$\frac{dy}{dx} = \frac{\sin x - x\cos x}{\sin^2 x}$
	Ba)				C3 Algebraic Long Division	$x^2 + 3x + 6 + \frac{2}{x-1}$
	Bb)				C3 Algebraic Long Division	$2x^2 - 3x + 5 - \frac{10}{x+3}$
	Bc)				C3 Algebraic Long Division	$x^2 + 2 - \frac{6}{x^2+1}$
	Ca)				C3 Functions - Graph Transformations/Sketching	Check using google – inc asymptotes
	Cb)				C3 Functions - Graph Transformations/Sketching	Check using google – inc asymptotes
	Cc)				C3 Functions - Graph Transformations/Sketching	Check using google – inc asymptotes
	Da)				C4 Integration – Reverse Chain Rule	$\frac{1}{5}(x-3)^5 + c$
	Db)				C4 Integration – Reverse Chain Rule	$\frac{3}{2}\sin(2x+4) + c$
	Dc)				C4 Integration – Reverse Chain Rule	$\cos(\pi - x) + c$
Current Work	1a				C3 Functions – Graph Sketching with domain/range	Check using google – inc asymptotes
	1b				C3 Functions – Graph Sketching with domain/range	Check using google – inc asymptotes
	2a				C3 Functions – Composite Functions	10
	2b				C3 Functions – Composite Functions	17
	2c				C3 Functions – Composite Functions	26
	2d				C3 Functions – Composite Functions	$(x+3)^2 + 1$
	2e				C3 Functions – Composite Functions	$x^2 + 4$
	2f				C3 Functions – Composite Functions	$(x^2+1)^2 + 1$
	3a				C3 Functions – Composite Functions working backwards	gf(x)
	3b				C3 Functions – Composite Functions working backwards	hg(x)
	3c				C3 Functions – Composite Functions working backwards	gf(x)
	3d				C3 Functions – Composite Functions working backwards	fh(x)
	3e				C3 Functions – Composite Functions working backwards	$f^2(x)$
	3f				C3 Functions – Composite Functions working backwards	$h^2(x)$
	3g				C3 Functions – Composite Functions working backwards	$g^2(x)$
	3h				C3 Functions – Composite Functions working backwards	hgf(x)
	4a				C3 Functions – quadratic find range	Range f: $f(x) \geq -1$
	4b				C3 Functions – quadratic find range	Range g: $g(x) \geq -3$

	4c				C3 Functions – quadratic, find domain/range to make one to one	One to one from max point. Domain h: $x \geq \frac{5}{2}$ $Range\ h: h(x) \leq \frac{25}{4}$
	5a				C3 Differentiation trig – given x =, find dy/dx	$\frac{dy}{dx} = -\text{cosec}y$
	5b				C3 Differentiation trig – given x =, find dy/dx	$\frac{dy}{dx} = \frac{1}{2}\cos 2y \cot 2y$
	5c				C3 Differentiation trig – given x =, find dy/dx	$\frac{dy}{dx} = \frac{2\sqrt{y}}{1+2\sqrt{y}}$
	6a				C4 Integration – Reverse Chain Rule	$\tan 3x + c$
	6b				C4 Integration – Reverse Chain Rule	$\frac{-1}{2}(2x-1)^{-1} + c$
	6c				C4 Integration – Reverse Chain Rule	$-\frac{1}{2}\cot 2x + c$
	7a				C3 Trig Proof	PROOF
	7b				C3 Trig Proof	PROOF
	8				Find distance of point from tangent to axes	Use Sketch to help!
M 1	9				M1 SUVAT with friction	4.3
C ha	10				Cube inscribed inside Sphere.	$2m^2$

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

"Mathematics is indeed dangerous in that it absorbs students to such a degree that it dulls their senses to everything else"
P Kraft

A2 Maths with Mechanics Assignment γ (gamma)

due w/b 3/10

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 Find dy/dx of the following functions, using appropriate notation:

(a) x = sec *y* (b) y = $\sec x \operatorname{cosec} x$ (c) $x = y^2 cosy$ (d) y = $\dfrac{x}{\sin x}$

Part B Use algebraic division to express these improper fractions in the form

$$ax^2 + bx + c + \frac{R}{\text{divisor}}$$

(a) $\dfrac{x^3+2x^2+3x-4}{x-1}$ (b) $\dfrac{2x^3+3x^2-4x+5}{x+3}$ (c) $\dfrac{x^4+3x^2-4}{x^2+1}$

Part C Sketch these curves (*a* is an arbitrary constant):

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

Part D Integrate the following with respect to *x* using appropriate notation:

(a) $(x-3)^4$ (b) $3\cos(2x+4)$ (c) $\sin(\pi - x)$

Current work

1. On the same set of axes, sketch the following functions (with their domains restricted as required) and state their ranges:

   (a) $f(x) = 2x+1$ $x \in \mathbb{R}$ (b) $g(x) = (x-2)^2$ $x \in \mathbb{R}, x > 2$

2. The functions *f* and *g* are defined on the whole of $\mathbb{R}$ by $f(x) = x^2 + 1,\ g(x) = x + 3.$
   Find:
   (a) *fg*(0) (b) *fg*(1) (c) f^2 (2)

   (d) *fg*(*x*) (e) *gf*(*x*) (f) *ff* (*x*)

3. For the functions $f(x) = x+2,\ g(x) = x^{-1},\ h(x) = x^2$ defined on $x \in \mathbb{R}$ $x \neq 0$, state the compositions of functions which correspond to:

   (a) $\dfrac{1}{x} + 2$ (b) $\dfrac{1}{x^2}$ (c) $\dfrac{1}{x+2}$ (d) $x^2 + 2$

(e) $x+4$ (f) x^4 (g) x (h) $\dfrac{1}{(x+2)^2}$

4. Sketch the following functions on the given domain and hence find their ranges:

(a) $f(x)=x^2+4x+3$ Domain f: $x \in \mathbb{R}$

(b) $g(t)=2t^2-4t-1$ Domain g: $t \in \mathbb{R}$

Make the following a one to one function and state its domain and range and sketch it.

(c) $h(x)=5x-x^2$

Consolidation

5. Find $\dfrac{dy}{dx}$ in terms of y.

(a) $x=\cos y$ (b) $x=\sec 2y$ (c) $x=y+\sqrt{y}$

6. Integrate the following functions by working out what has been differentiated:

(a) $\int 3\sec^2 3x\,dx$ (b) $\int (2x-1)^{-2}\,dx$ (c) $\int \operatorname{cosec}^2 2x\,dx$

7. Prove the following identities

(a) $(1+\tan x)\left(1+\tan\left(\dfrac{\pi}{4}-x\right)\right)\equiv 2$ (b) $\sec^2 x-\operatorname{cosec}^2 x\equiv \tan^2 x-\cot^2 x$

8. The tangent to the curve with equation $y=\tan 2x$ at the point $x=\dfrac{\pi}{8}$ meets the y axis at the point Y. Show that the exact distance OY (where O is the origin) is $\dfrac{\pi}{2}-1$.

M1 (Practice for M2)

9. A particle of mass 1kg is projected at 5 ms^{-1} along a rough horizontal surface. The coefficient of friction is 0.3. How far does the particle move before coming to rest?

Challenge Question

10. A cube is inscribed inside a sphere of diameter $1m^2$. What is the surface area of the cube?

Preparation: Read* about e^x and $\ln x$.
Chapter 3 C3 new textbook pages 31-43. C3 old textbook pages 29-40,

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