A2 Assignment lambda Cover Sheet **Name:**

Question		Done	BP	Ready	Topic	Comment
Drill	Aa				C4 Integration	$\frac{1}{4}\sin 2x+\frac{1}{2}x+c$
	Ab				C4 Integration	$\frac{1}{3}e^{3x-2}+c$
	Ac				C4 Integration	$\frac{1}{2}\ln\lvert 2x-5\rvert+c$
	Ba				C3 Show root	*change of sign*
	Bb				C3 Show root	*change of sign*
	Bc				C3 Show root	*f(x) is not continuous on the interval, and f(0) and f(2) will both be positive i.e. there will be no change in sign. Have a look at it in your graphics or on Autograph*
	Ca				C3 Log equations	4 , 12
	Cb				C3 Log equations	$\frac{1}{e-1}$
	Da				C4 Implicit Differentiation	$\frac{dy}{dx}=\frac{2x+3y}{2y-3x}$
	Db				C4 Implicit Differentiation	$\frac{dy}{dx}=\frac{4x-y}{x-3y}$
	Dc				C4 Implicit Differentiation	$\frac{dy}{dx}=\frac{2}{3}\tan 2x\cot 3y$
	Dd				C4 Implicit Differentiation	$\frac{dy}{dx}=\frac{e^y}{1-xe^y}$
	De				C4 Implicit Differentiation	$\frac{dy}{dx}=-\frac{y\ln y}{2y^2+x}$
	Df				C4 Implicit Differentiation	$\frac{dy}{dx}=\frac{\sin y+2x\cos y}{x^2\sin y-x\cos y}$
Mock Exam	MEAi				Trig	$\cos x\equiv 2\cos^2\frac{x}{2}-1$ $\Rightarrow 2\cos^2\frac{x}{2}\equiv 1+\cos x\Rightarrow\cos^2\frac{x}{2}\equiv\frac{1+\cos x}{2}$
	MEAii				Trig	$\cos x\equiv 1-2\sin^2\frac{x}{2}$ $\Rightarrow 2\sin^2\frac{x}{2}\equiv 1-\cos x\Rightarrow\sin^2\frac{x}{2}\equiv\frac{1-\cos x}{2}$
	MEBi				Trig	$\frac{2\sqrt{5}}{5}$
	MEBii				Trig	$\frac{\sqrt{5}}{5}$
	MEBiii				Trig	$\frac{1}{2}$

	MEC				Trig	$\cos^4\frac{A}{2} \equiv \left(\frac{1+\cos A}{2}\right)^2 \equiv \frac{1+2\cos A+\cos^2 A}{4}$ $\equiv \frac{1+2\cos A+\left(\frac{1+\cos 2A}{2}\right)}{4}$ $\equiv \frac{2+4\cos A+1+\cos 2A}{8}$ $\equiv \frac{3+4\cos A+\cos 2A}{8}$
Current work	1a				C4 Trig integration	$\tan x - x + c$
	1b				C4 Trig integration	$-\frac{1}{3}\cot 3x - x + c$
	1c				C4 Trig integration	$\frac{1}{2}x - \frac{1}{8}sin4x + c$
	1d				C4 Trig integration	$-\frac{1}{2}cosec\ 2x + c$
	1e				C4 Trig integration	$3x - 4\cos x - \sin 2x + c$
	1f				C4 Trig integration	$-\frac{1}{8}\cos 4x - \frac{1}{4}\cos 2x + c$
	2				C3 natural log knowledge	Think about what values x can take in for ln x to exist, and what the modulus does
	3a				C4 Integration using partial fractions	$\frac{1}{4}\ln\left\|\frac{x-2}{x+2}\right\| + c$
	3b				C4 Integration using partial fractions	$2\ln\|x-2| - 2\ln|x-3| - \frac{1}{x-3} + c$
	3c				C4 Integration using partial fractions	$-x + \ln\|x-1| - \frac{3}{2}\ln|2x+1| + c$
	4a				C4 Trapezium rule	3.983 (3dp)
	4b				C4 Integration	4.047 (3dp)
	4c				C4 Percentage error	1.58%
	5				M2 Projectiles – perpendicular to original	t = 0.638
	6				M2 Projectiles – horizontal, find height	31m
	7				M2 Projectiles – find needed angle of projection	24 degrees
	8a				C3 Trig proof	Proof
	8b				C3 Trig solve	$0.333^c, 1.24^c, 3.47^c, 4.38^c$
	9a				C3 Binomial expansion –compare coefficients	$a = 2, b = -3$
	9b				C3 Binomial expansion – find coefficient	-80
Consolidation	10a				C4 Implicit Differentiation & coordinate geom.	y = 18 – 4x
	10b				C4 Coordinate geom.	Q (-4, -2)
	11a				C3 Modulus Sketching	Sketch
	11b				C3 Graph Sketching	Sketch
	11c				C3 Solutions vs sketch	one point of intersection
	11d				C3 Modulus solve	½
	12ai				C3 Inverse functions	$f^{-1}: x \to \frac{x-2}{5}, x \in \mathbb{R}$
	12aii				C3 Composite functions	$fg: x \to \frac{5}{x} + 2, x \in \mathbb{R}, x \neq 0$

	12aii				C3 Inverse and composite functions	$(fg)^{-1}: x \to \frac{5}{x-2}, x \in \mathbb{R}, x \neq 2$
	12b				C3 function solve	x = -1.81, 13.81
	13				Challenge	√6 / 3
C						

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

"The mathematician is fascinated with the marvellous beauty of the forms he constructs, and in their beauty he finds everlasting truth"

J B Shaw

A2 Maths with Mechanics Assignment λ (lambda) due in w/b 5/12

Drill

Part A: Integrate with respect to *x* (use the correct notation $\int(..)\,dx=$ etc)

(a) $\cos^2 x$ (*hint write in terms of cos2x first)* (b) e^{3x-2} (c) $\dfrac{1}{2x-5}$

Part B: Show that each of the following functions has a root on the interval given:

(a) $x^3 - x + 3 = 0$ $(-3, 3)$ (b) $3 + 4x - x^4 = 0$ $(1, 2)$

(c) Explain why we cannot use a change of sign to show there is a root in the following equation:

tan 2*x*+1=0 on the interval (0^c, 2^c).
You may want to look at the graph to answer this.

Part C: Solve the following equations give an exact answer

(a) $2\ln 2x - 6\ln 2 = \ln(x-3)$ (b) $\ln(x+1) - \ln x = 1$

Part D: Find $\frac{dy}{dx}$ in terms of *x* and *y*.

(a) $x^2 + 3xy - y^2 = 0$ (b) $4x^2 - 2xy + 3y^2 = 8$ (c) $\cos 2x \sec 3y + 1 = 0$

(d) $xe^y - y = 5$ (e) $y^2 + xlny = 3$ (f) $x \sin y = 1 - x^2 \cos y$

Focus from C3 Mock Exam

MEA) Using $\cos 2A \equiv 2\cos^2 A - 1 \equiv 1 - 2\sin^2 A$, show that:

(i) $\cos^2 \dfrac{x}{2} \equiv \dfrac{1+\cos x}{2}$ (ii) $\sin^2 \dfrac{x}{2} \equiv \dfrac{1-\cos x}{2}$

MEB) Given that $\cos\theta = 0.6$ and that θ is acute, write down the values of:

(i) $\cos\dfrac{\theta}{2}$ (ii) $\sin\dfrac{\theta}{2}$ (iii) $\tan\dfrac{\theta}{2}$

MEC) Show that $\cos^4 \dfrac{A}{2} \equiv \frac{1}{8}\left(3 + 4\cos A + \cos 2A\right)$

Current work 1: C4 Integration

1. Integrate the following functions with respect to *x*:

(a) $\int \tan^2 x\,dx$ *(hint write in terms of sec²x)* (d) $\int \frac{\cos 2x}{\sin^2 2x}\,dx$

(b) $\int \cot^2 3x\,dx$ (e) $\int (1 - 2\sin x)^2 dx$

(c) $\int \sin^2 x dx$ (f) $\int \sin 3x \cos x\,dx$

2. Question: Why do we put modulus signs around ln when integrating?

3. Integrate the following functions using partial fractions:

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

4. The area under the curve $y = \ln x$, is bounded by the x – axis and the line $x = 5$.

(a) Estimate the area of the shaded region to 3 decimal places using the trapezium rule with 4 strips.

(b) Given that $\int \ln x \, dx = x \ln x - x + c$, find the true value of the area correct to 3 decimal places. (extension – find out why this is the integral!)

(c) Calculate the percentage error of the trapezium rule approximation.

Current work M2:

5. A particle is projected from a height of 30m above the ground, with initial velocity 3i + 4j. Find the time it takes for the particle to be travelling perpendicular to its original projection

6. A particle is projected horizontally with speed 40m/s from a point A. It hits the ground 100m horizontally from A. Find the height of A

7. A field 100m in length has two barriers of height 2m at a distance of 5m from both ends. A ball is kicked with speed 25m/s. What is the minimum angle the ball would need to be kicked at to the horizontal to clear both walls.

Consolidation

8. (a) Prove the following identity: set out proof correctly
$\sec^2 x - \operatorname{cosec}^2 x \equiv \tan^2 x - \cot^2 x$

(b) Solve the following equation on the interval $0 \le \theta \le 2\pi$. Give answers to 3sf.
$\cos 2\theta = \tan 2\theta$

9. The first three terms in the expansion of $(1 + ax)^b$, in ascending powers of x, for $|ax| < 1$, are
$$1 - 6x + 24x^2.$$
(a) Find the values of the constants a and b.

(b) Find the coefficient of x^3 in the expansion.
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10. A curve has the equation $x^2 + 4xy - 3y^2 = 36$.

(a) Find an equation for the tangent to the curve at the point P (4, 2).

Given that the tangent to the curve at the point Q on the curve is parallel to the tangent at P,

(b) find the coordinates of Q.

11. (*a*) Sketch the graph of $y = |2x + a|$, $a > 0$, showing the coordinates of the points where the graph meets the coordinate axes.

(*b*) On the same axes, sketch the graph of $y = \frac{1}{x}$.

(*c*) Explain how your graphs show that there is only one solution of the equation

$$x\left|2x + a\right| - 1 = 0.$$

(*d*) Find, using algebra, the value of x for which $x\left|2x + 1\right| - 1 = 0$.

12. The functions f and g are defined by

$$f: x \to 5x + 2,\ x \in \mathbb{R} \qquad g: x \to \frac{1}{x},\ x \in \mathbb{R}, x \neq 0$$

(a) Find the following functions stating the domain in each case.
(i) $f^{-1}(x)$ (ii) $fg(x)$ (iii) $(fg)^{-1}(x)$

(b) Solve the equation $f^{-1}(x) = fg(x)$, giving your answers to 2 decimal places.

Challenge

A cube ABCDEFGH has the square ABCD as its base with EFGH above ABCD respectively. What is the cosine of the angle CAG?

Preparation:

More integration! Read about integrating by substitution and by parts in the new textbook p101-108 and the old textbook p95-102.