A2 Assignment iota Cover Sheet **Name:**

Question		Done	BP	Ready	Topic	Comment
Drill	Aa				C3 Differentiation	$e^x(\sin 2x + 2\cos 2x)$
	Ab				C3 Differentiation	2
	Ac				C3 Differentiation	$-\frac{1}{e^x}(\operatorname{cosec}^2 x + \cot x)$
	Ad				C3 Differentiation	$\frac{(e^x+2)\sec^2 x - e^x \tan x}{(e^x+2)^2}$
	Ba				C3 Trig solve	56.6^o, 236.6^o
	Bb				C3 Trig solve	45^o, 225^o
	Ca				C3 Rcos	x = 1.69, 5.88
	Cb				C3 Rcos	x = 1.70, 4.02
	Cc				C3 Rcos	x = 0.28, 1.04, 3.43, 4.18
	Cd				C3 Rcos	x = 0.18, 4.99
	Da				C3 Graph Sketching	Use Autograph, your graphical calculator or Desmos to check
	Db				C3 Graph Sketching	Use Autograph, your graphical calculator or Desmos to check
	Dc				C3 Graph Sketching	Use Autograph, your graphical calculator or Desmos to check
	Dd				C3 Graph Sketching	Use Autograph, your graphical calculator or Desmos to check
Mock Exam	MEA				C3 Trig	2
	MEB				C3 Trig	$q = \frac{p^2}{2} - 1$
	MEC				C3 Trig	L.H.S. $= \cos^2 2\theta + \sin^2 2\sin 2\theta - 2\sin 2\theta \cos 2\theta$ $= 1 - \sin 4\theta$ = R.H.S.
Current work	1a				C4 partial fractions	$\frac{1}{x+1} + \frac{2}{2x-1}$
	1b				C4 partial fractions	$\frac{1}{x-2} - \frac{1}{x+2}$
	1c				C4 partial fractions	$x + \frac{1}{2(x+1)} + \frac{1}{2(x-1)}$
	2				C4 Binomial expansion (simple)	$\frac{1}{27} - \frac{2x}{27} + \frac{8x^2}{81} - \frac{80x^3}{729} \ldots$
	3a				C4 Binomial expansion (simple)	$1 - x - \frac{1}{2}x^2 - \frac{1}{2}x^3 + \ldots$
	3b				C4 Binomial expansion (estimation)	0.9899495
	3c				C4 Binomial expansion (estimation)	1.4142136 (8sf)
	4a				M2 Projectiles – find height given time	0.85m
	4b				M2 Projectiles – find speed hits floor	74 ms^{-1}
	4c				M2 Projectiles – angle makes with horizontal	47.5^o
	5a				M2 Projectiles – horizontal projection initial velocity	24 ms^{-1}
	5b				M2 Projectiles – horizontal projection final speed	25 ms^{-1}
	5c				M2 Projectiles – angular projection, time hit ground	0.51s
	5d				M2 Projectiles – angular projection, horizontal dist	14m

	6				M2 Projectiles – Wall. Does projectile pass over it?	at t = 0.5221s, s = 2.02m, which is 3.02 above ground. 3.02 > 2.5, ball does pass over the wall
Consolidation	7				C3 Differentiation - normals	$x+2y-3=0$
	8a				C3 Trig Solve	$0.644, 4.71$
	8b				C3 Trig Solve	$0, \pi, 2\pi, 1.4^c, 4.88^c$
	9a				C3 Trig proof	PROOF
	9b				C3 Trig proof	PROOF
	10a				C3 Modulus sketch	Use Autograph, your graphical calculator or Desmos to check
	10b				C3 Modulus graph transformation	Use Autograph, your graphical calculator or Desmos to check
	10c				C3 Modulus solve	a = 6 or 10
	11a				C3 Algebraic Fractions	PROOF
	11b				C3 Inverse function	$\frac{(x-8)}{2x-2}$
	12a				C3 Exponential/log equations	-2.36
	12b				C3 Exponential/log equations	0.594
	12c				C3 Exponential/log equations	2.68
	13a				C3 Show root	Continuous, change of sign therefore root
	13b				C3 Numerical methods	PROOF
	13c				C3 Numerical methods	Select x_o =1
	13d				C3 Show root correct	consider upper and lower bounds. Continuous, change of sign therefore root.
	14				C3 Trig formulae	Know the formulae!

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 a dangerous profession; an appreciable number of us go mad"

J E Littlewood

A2 Maths with Mechanics Assignment ι(iota)
Due in the week after Reading week w/b 21/11

Drill

Part A: Differentiate the following functions

(a) $e^x \sin 2x$ (b) $\frac{(2x^2-2)}{x-1}$ (c) $\frac{\cot x}{e^x}$ (d) $\frac{\tan x}{e^x+2}$

Part B: Solve these equations for $0 \leq \theta \leq 360^o$, giving θ to 1 decimal place where appropriate:

(a) $\sin(\theta+15^\circ) = 3\cos(\theta+15^\circ)$ (b) $\sin\theta\cos\theta = \frac{1}{2}$

Part C : Solve the following equations (hint: use Rcos or Rsin):

(a) $6\sin x + 8\cos x = 5$ (b) $7\sin x - 24\cos x - 10 = 0$

(c) $\cos 2x + 4\sin 2x = 3$ (d) $5\sin x - 8\cos x + 7 = 0$

Part D : Sketch the following functions giving the coordinates of any intercepts with the coordinate axes.

(a) $y = 1 - e^{-x}$ (b) $y = 2\ln(x-2)$ (c) $y = (e^x e^2)$ (d) $y = 2 - \ln x$

FOCUS from C3 Mock Exam

MEA) Given that $\sin x(\cos y + 2\sin y) = \cos x(2\cos y - \sin y)$, find the value of $\tan(x+y)$.

MEB) Given that $p = 2\cos\theta$ and $q = \cos 2\theta$, express q in terms of p.

MEC) Prove that $(\cos 2\theta - \sin 2\theta)^2 \equiv 1 - \sin 4\theta$

Current 1: C4 Partial Fractions & Binomial Expansion

1. Put the following into partial fractions:

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

2. $f(x) = (3+2x)^{-3}$, $|x| < \frac{3}{2}$.

Find the binomial expansion of $f(x)$, in ascending powers of x, as far as the term in x^3.

Give each coefficient as a simplified fraction.

3. (a) Expand $(1-2x)^{\frac{1}{2}}, |x| < \frac{1}{2}$, in ascending powers of x up to and including the term in x^3.

(b) By substituting a suitable value of x into your expansion, find an estimate for $\sqrt{0.98}$

(c) Show that $\sqrt{0.98} = \frac{7}{10}\sqrt{2}$ and hence find the value of $\sqrt{2}$ correct to 8 significant figures.

Current work 2: Mechanics M2

Appropriate accuracy for final answer when using g = 9.8 is 2 sig figs For example: from your calculator write answer as 5.43….. and then your final answer as 5.4 stating (to 2sf) with units of course. Give angles in general to 1dp Provide a good sized diagram, use a ruler, avoid units on the diagram

4. An arrow is fired from a bow with a speed of 50 ms $^{-1}$ at an angle of 5^{o} above the horizontal.

(a) Calculate the height of the arrow after 0.6 s.

(b) What is its speed after 6 s?

(c) Find the acute angle that the arrow makes with the horizontal after 6 s?

5. A bowler releases a cricket ball from a height of 2.25 m above a horizontal cricket pitch so that initially its path is horizontal.

(a) Find the speed of delivery if it is to hit the ground a horizontal distance of 16m from the point of release.

(b) Find the speed that the ball hits the ground.

Next ball, the bowler again releases the ball from a height of 2.25m, but at a speed of 28ms^{-1} at an angle of 4^{o} below the horizontal.

(c) Find the time taken for the ball to first hit the ground.

(d) Find the horizontal distance travelled when the ball first hits the ground.

6. Karen is standing 4 m away from a wall which is 2.5 m high. She throws a ball at 10ms^{-1} at an angle of 40^{o} to the horizontal, releasing the ball from a height of 1 m above the ground. Will the ball pass over the wall? Fully justify your answer.

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7. Given that $f(x) = 3\ln x + \frac{1}{x}$, $x > 0$, find the equation of the normal to this curve at $x = 1$.

8. Solve the following equations on the interval $0 \le \theta \le 2\pi$. Where possible, give exact answers. Otherwise give your answers to 3sf:

(*a*) $2\cos x - \sin x = 1$ [Hint: $R\cos(x + \alpha)$] (b) $3\sin 2x = \sin x$

9. Prove the following identities: set these out correctly

(a) $\cot A - \tan A \equiv 2\cot 2A$ (b) $\sin^2 x(1 + \sec^2 x) \equiv \sec^2 x - \cos^2 x$

10. The function f is defined by f : $x \rightarrow |2x - a|$, $x \in \mathbb{R}$, where *a* is a positive constant.

(*a*) Sketch the graph of $y = f(x)$, showing the coordinates of the points where the graph cuts the axes.

(*b*) On a separate diagram, sketch the graph of $y = f(2x)$, showing the coordinates of the points where the graph cuts the axes.

(*c*) Given that a solution of $f(x) = \frac{1}{2}x$ is $x = 4$, find the two possible values of *a*

11. (a) Given $f(x) = \frac{x}{x+3} - \frac{x+24}{2x^2+5x-3}$, show that $f(x) = \frac{2(x-4)}{2x-1}$

(b) Find $f^{-1}(x)$

12. Solve the following functions
(a) $3e^{2x+5} = 4$ (b) $3^x = 5^{1-x}$ (c) $2\ln(2x-1) = 1 + \ln 7$

13. $f(x) = x^3 - \frac{1}{x} - 2, x \neq 0$
(a) Show that the equation has a root between 1 and 2.

(b) Re-arrange $f(x) = 0$ to make an iteration formula in the form $x_{n+1} = \left(a + \frac{b}{x_n}\right)^c$, where a,b,c are rational numbers to be found

(c) Find an approximation of the root by selecting an appropriate value for x_o and calculating x_1, x_2, x_3, x_4 to 4 decimal places.

(d) Show that x = 1.395 is the root correct to 3 decimal places

14. For this question decide which of the responses given is (are) correct then choose
A if 1, 2 and 3 are correct
B if only 1 and 2 are correct
C if only 2 and 3 are correct
D if only 1 is correct
E if only 3 is correct

Given that tan(x/2) = t, then

1. $\cos x = \frac{1-t^2}{1+t^2}$
2. $\sin x = \frac{2t}{1-t^2}$
3. $\frac{dx}{dt} = \frac{2}{1-t^2}$

Preparation: Learning Integration techniques is a vital part of the C4 module
Read about Integration using Trig and Partial Fractions old C4 textbook pages 82-94 and new textbook pages 87-100.