A2 Assignment Mu Cover Sheet **Name:**

Question		Done	BP	Ready	Topic	Comment
Drill	Aa				C4 Integration – Repeated linear factors	$-\frac{3}{(x-2)}-\frac{3}{(x-2)^2}+c$
	Ab				C4 Integration – cos^2 conversion	$x+sinx+c$
	Ac				C4 Integration – sin^2 conversion	$\frac{3}{2}x-\frac{3}{16}sin8x+c$
	Ba				C4 Integration – R method x solve	1.17^c, 3.26^c
	Bb				C4 Integration – R method 2x solve	1.13^c , 3.18^c, 4.28^c
	Bc				C4 Integration – R method x/2 solve	0^c, π^c
	Ca				C3 Num Meth – confirm root in interval	Use a change of sign argument. Remember to say that *f*(*x*) is continuous on the interval!
	Cb				C3 Num Meth – confirm root in interval	Use a change of sign argument. Remember to say that *f*(*x*) is continuous on the interval!
	Cc				C3 Num Meth – confirm root in interval	Use a change of sign argument. Remember to say that *f*(*x*) is continuous on the interval!
	Da				C3 MOD – sketch & define range	$f(x)\geq 0$
	Db				C3 MOD – sketch & define range	$f(x)\geq -2$
	Dc				C3 MOD – sketch & define range	$f(x)\neq 2$
Tracking Test 3	TT3Ai				R, α transformations	$R = 25$
	TT3Aii				R, α transformations	-25
	TT3Aiii				R, α transformations	1.85
	TT3Aiv				R, α transformations	3.84, 6.16
	TT3B				Implicit differentiation	$9y+7x=23$
Current work	1a				C4 Integration – sin(3x+1)	$\frac{1}{3}\cos(3x+1)+c$
	1b				C4 Integration – cos(x/2)	$8\sin\left(\frac{x}{2}\right)+c$
	1c				C4 Integration – tanx	$-\ln(cosx)+c$
	1d				C4 Integration – cot4x	$\frac{1}{4}\ln(sin4x)+c$
	1e				C4 Integration – trig reverse chain	$\frac{1}{10}\sec^5 2x+c$
	1f				C4 Integration – tan5x	$-\frac{1}{5}\ln(cos5x)+c$
	1g				C4 Integration – sin^2 conversion	$\frac{1}{2}x-\frac{1}{24}sin12x+c$

	1h				C4 Integration – cos^2 conversion	$\frac{3}{2}x+\frac{3}{8}sin4x+c$
	1i				C4 Integration – tan^2 conversion	$\frac{3}{4}tan4x-3x+c$
	1j				C4 Integration – trig reverse chain	$\frac{1}{6}\tan^6 y+c$
	1k				C4 Integration – cosec3u cot3u	$-\frac{1}{3}cosec3u+c$
	1l				C4 Integration – reverse chain	$\frac{2}{21}(3x^2+1)^7+c$
	1m				C4 Integration – trig fraction	$\frac{1}{3}ln(2+tan3x)+c$
	1n				C4 Integration – partial fractions	$\ln\lvert x-3\rvert-2\ln\lvert x-2\rvert+c$
	2				C4 Integration – definite case 3 partial fract	Proof
	3a				C3 Trig Proof	Proof
	3b				Hence C4 Integral	$\frac{\pi}{3}+\frac{1}{4}$
	4a				C3 Trig Proof	Proof
	4b				Hence C4 Integral	0
	5				C4 Integral – definite trig	$\frac{\sqrt{3}}{4}+\frac{1}{3}$
	6a				C4 integral – definite sin^2 conversion	$\frac{\pi}{2}-1$
	6b				C4 Integral – definite cos^2 conversion	$\frac{3\pi}{2}+\frac{9\sqrt{3}}{4}$
	7a				C4 Binomial – expand 2/root(2-3x)	$\sqrt{2}+\left(\frac{3\sqrt{2}x}{4}\right)+\left(\frac{27\sqrt{2}x^2}{32}\right)+\left(\frac{135\sqrt{2}x^3}{128}\right)+\cdots$
	7b				C4 Binomial – state validity	Valid |x| < 2/3
	7c				C4 Binomial – estimate 2/root170	0.1534
Consolidation	8a				M2 Kinematics – find velocity given displace	56ms^{-1}
	8b				M2 Kinematics –find acc given displacement	28 ms^{-2}
	9a				M2 Kinematics – find position given velocity	29m
	9b				M2 Kinematics – find accel given velocity	-6 ms^{-2}

	9c				M2 Kinematics – find max velocity	13.5 ms^{-1}
	9d				M2 Kinematics – find distance @ max velocity	15.5 m
	10a				M2 Kinematics – acc vector find velocity	0.5**i** – 2**j** ms^{-1}
	10b				M2 Kinematics – acc vector find speed	1.3 ms^{-1}
	10c				M2 Kinematics – find position given acc vect	**i** – 0.4**j** m
	10d				M2 Kinematics – find displace @ t = 4	2.56m
	11a				M2 Projectiles – find speed & direction	13 m s^{-1}, 39° above horizontal
	11b				M2 Projectiles – find speed & direction	11 m s^{-1}, 7.7° below horizontal
	12a				C3 Identities – which is true?	D
	12b				C3 Identities – which is true?	A

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

"One of the most endearing things about mathematicians is the extent to which they will go to avoid doing any work." M Pardage

A2 Maths with Mechanics Assignment μ (mu)
12/12

Drill

Part A Integrate the following functions

$a)\ \int \frac{3x}{(x-2)^3}\,dx$

(b) $\int 2\cos^2\frac{x}{2}\,dx$

(c) $\int 3\sin^2 4x\,dx$

Part B Write in form indicated and hence solve for *x* (in radians to 2dp) in the interval [0, 2π]:

(a) $4\sin x - 3\cos x = 2.5$ $\quad R\sin(x-\alpha)$

(b) $5cos2x + 12sin2x = 6$ $\quad Rcos(2x-\alpha)$

(c) $\cos\left(\frac{x}{2}\right) + sin\left(\frac{x}{2}\right) = 1$ $\quad Rcos\left(\frac{x}{2}-\alpha\right)$

Part C By first defining *f(x)* show that each of the following functions has a root on the interval given:

(a) $x^3 + 6x^2 = 9x - 2$ on (0, 0.5) (b) $1 + x^2 = x^3$ on (1, 2) (c) $x^2 = \sin x$ on (0.5, 1)

Part D For each of the following functions, with domain $x \in$ R, sketch its graph and state its range: mark any asymptotes

(a) $f(x) = |3x-2|$ (b) $f(x) = |x| - 2$ (c) $f(x) = 2 + \frac{3}{x}$

Focus from Tracking Test 3

TT3A $f(x) \equiv 7\cos x - 24\sin x$

Given that $f(x) \equiv R\cos(x + \alpha)$, where $R \geq 0, 0 \leq \alpha \leq \frac{\pi}{2}$, and x and α are measured in radians,

i) find R and show that $\alpha = 1.29$ to 2 decimal places.

Hence write down

ii) the minimum value of f (x),

iii) the value of x in the interval $0 \leq x \leq 2\pi$ which gives this minimum value.

iv) Find the smallest two positive values of x for which $7\cos x - 24\sin x = 10$

TT3B Find the equation of the tangent to the curve with implicit equation $x^2 + 3xy^2 - y^3 = 9$ at the point (2, 1).

Current work

Learning formulae * you will need these in C4 integration

Complete the following:

sin(A+B) ≡
sin(A–B) ≡
cos (A+B) ≡
cos (A–B) ≡
tan(A+B) ≡
tan(A–B) ≡
sin2A ≡
cos2A ≡
or ≡
or ≡
tan2A ≡
$\sin^2 x + \cos^2 x =$
$1 + \cot^2 x \equiv$
$\tan^2 x + 1 \equiv$
***2sinAcosB ≡**
***2cosAsinB ≡**
***2cosAcosB ≡**
***2sinAsinB ≡**

*factor formulae express as sum or difference of sines and cosines

Complete the table: you will feel more confident about integration if you learn these

f(x)	∫f(x)	f(x)	∫f(x)
x^n		cosecx	
e^x		secx	
1/x		cotx	
sinx		$sec^2 x$	
cosx		–cosecxcotx	
tanx		secxtanx	
		$–cosec^2x$	

1. Integrate the following functions using an appropriate method when required

(a) ∫ -sin(3x +1) dx (b) ∫ $4\cos\left(\frac{x}{2}\right)$ dx (c) ∫ tanx dx

(d) ∫ cot4x dx (e) ∫ $\sec^5 2x\, tan2x$ dx (f) ∫ tan5x dx

(g) ∫ $\sin^2 6x$ dx (h) ∫ $3\cos^2 2x$ dx (i) ∫ $3\tan^2 4x$ dx

(j) ∫ $\sec^2 y \tan^5 y$ dy (k) ∫ cosec3ucot3u du (l) ∫ $4x(3x^2 +1)^6$ dt

(m) $\int \frac{\sec^2 3x}{2+tan3x}$ dy (n) $\int \frac{4-x}{(x-2)(x-3)}$ dx

2. Show that $\int_0^2 \frac{x^2+6x+7}{(x+2)(x+3)}dx = 2+\ln\left(\frac{25}{18}\right)$

For the following definite integrations with limits give an exact answer in terms of π.

3. a) Show that $\sin^2 x + 3\cos^2 x \equiv 2+\cos 2x$.

b) Hence evaluate * check using your calculator to see if you're right !!! *

$$\int_{\pi/12}^{\pi/4} (\sin^2 x + 3\cos^2 x)dx$$

4. a) Show that $\frac{4\cos 2x}{\sin^2 2x} \equiv \cos ec^2 x - \sec^2 x$.

b) Hence evaluate $\int_{\pi/6}^{\pi/3} \frac{4\cos 2x}{\sin^2 2x}dx$ * check using your calculator to see if you're right !!! *

5. Evaluate $\int_0^{\pi/6} (\sin 3x + \cos 2x)dx$ * check using your calculator to see if you're right !!! *

6. Evaluate and check using your calculator to see if you're right !!!

(a) $\int_0^{\pi} \sin^2 \frac{1}{4}x dx$ (b) $\int_0^{\pi} 3\cos^2\left(\frac{x}{6}\right)dx$

7. a) Expand, in ascending powers of x up to x^3, $\frac{2}{\sqrt{2-3x}}$

b) State the validity of your expansion

c) Use your expansion to estimate $\frac{2}{\sqrt{170}}$ correct to 4.d.p (check this on your calculator !!)

Mechanics

Use differentiation and integration for questions where the acceleration is not constant

8 A particle P moves in a straight line such that at time t its displacement from a fixed point O is given by $x = 4t^3 + 2t^2$.

(a) Find the velocity when t = 2

(b) Find the acceleration when t = 1

9 A particle P is moving along the x-axis with velocity $v = (18t – 6t^2)\ ms^{-1}$.

When t = 0, P is at x = 2m.

(a) Find the position of P when t = 3.

(b) Find the acceleration when t = 2.

(c) Find the maximum velocity.

(d) Find the distance OP when the velocity is a maximum.

10 Given that the acceleration vector of an object is $\mathbf{a} = –0.2\mathbf{j}\ ms^{-2}$,with initial velocity $0.5\mathbf{i}\ ms^{-1}$, and that the object starts at the origin, find:

(a) The velocity at time t = 10

(b) The speed when t = 6

(c) The position vector at t = 2

(d) The displacement from the origin at t = 4

11 A particle is projected with a speed of 21 m s^{-1} at an angle of elevation 60^{o}. Find its

i) speed

ii) and direction of motion after

a) 1 second b) 2 seconds

12. ***For these questions 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

a)

$x = 1 + \cos^2\theta - \cos^4\theta$

$y = 1 + \sin^2\theta - \sin^4\theta$

$1. x - y = 0$

$2. x + y = 2\cos^2\theta \sin^2\theta$

$3. x = 1 + \frac{1}{2}\sin^2 2\theta$

b)

$f(x) = e^{\sin x}$

1. $f(0)=1$
2. $f'(0)=1$
3. $f''(0)=1$