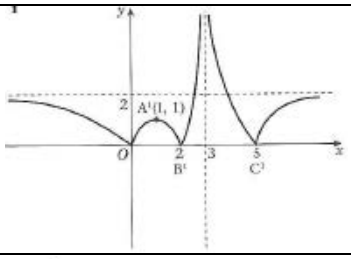
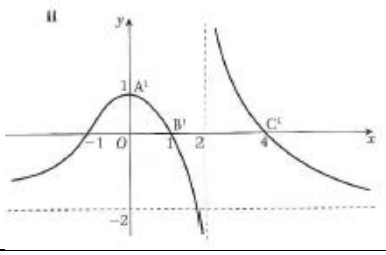
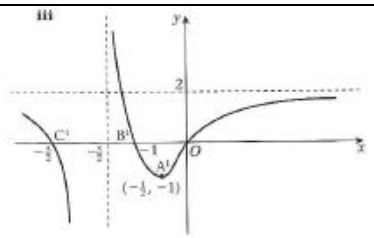
A2 Assignment iota Cover Sheet **Name:**

Question		Done	BP	Ready	Topic	Comment
Drill	Aa				C4 Integration as the reverse of differentiation	$\frac{1}{4}e^x+\frac{3}{4}x+c$
	Ab				C4 Integration as the reverse of differentiation	$3e^x-2\ln\lvert x\rvert+c$
	Ac				C4 Integration as the reverse of differentiation	$-\frac{3}{4}\ln\lvert x\rvert$ +c
	Ba				C3 Rcos	R = 5, α = 0.64
	Bb				C3 Rcos	R = 13, α = 0.39
	Bc				C3 Rcos	R = √2, α = 0.79
	Ca				C3 Sketch, domain and range	f ∈ R: f≠1
	Cb				C3 Sketch, domain and range	g ∈ R: g<1
	Cc				C3 Sketch, domain and range	$h \in R$
	Da				C3 Sketching arccos, arcsin, arctan, domain and range	Use Autograph, your graphical calculator or Desmos to check
	Db				C3 Sketching arccos, arcsin, arctan, domain and range	Use Autograph, your graphical calculator or Desmos to check
	Dc				C3 Sketching arccos, arcsin, arctan, domain and range	Use Autograph, your graphical calculator or Desmos to check
Current work	1a				C4 partial fractions	$\frac{4}{(2x+1)}-\frac{1}{(x-3)}$
	1b				C4 partial fractions	$\frac{1}{(x+2)}+\frac{1}{(x+2)^2}+\frac{1}{(x+2)^3}$
	1c				C4 partial fractions	$1-\frac{2}{(x-2)}+\frac{3}{(x+1)}$
	2				C4 Binomial expansion (simple)	$2-\frac{9}{4}x-\frac{81}{64}x^2-\frac{729}{512}x^3$
	3a				C4 Binomial expansion (simple)	$\frac{1}{2}[1+\frac{3}{8}x+\frac{27}{128}x^2+...]$
	3b				C4 Binomial expansion (multiply with other function)	$4+2x+\frac{33}{32}x^2$
Consolidation	4a				C3 Trig proof	PROOF
	4b				C3 Trig proof	PROOF
	5				C3 Algebraic Fractions, discriminant	Show that $b^2-4ac\le 0$
	6ai				C3 Graph transformations	
	6aii				C3 Graph transformations	

	6aiii				C3 Graph transformations	
	6bi				C3 Graph transformations	6
	6bii				C3 Graph transformations	4
	7				C3 Differentiation - coordinate geometry	tangent: $y = 4x - 1$; normal: $2x + 8y = 9$;meets again at $\left(9, -\frac{9}{8}\right)$
	8				C3 Differentiation – stationary points	(1/2, 6561/256), (2,0), (–1,0)
	9				C3 Differentiation – stationary points	$\left(-\frac{1}{2}, -\frac{1}{2e}\right)$ min
	10				C3 Differentiation - coordinate geometry	$\frac{-3 \pm \sqrt{35}}{2}$
	11a				C4 Implicit Differentiation	PROOF
	11b				C4 Implicit Differentiation – coordinate geometry	y = 5-8x
M1 Practice	12				M1 suvat	
Challenge					Challenge!	$\frac{\left(\pi\left(2+\sqrt{2}\right)\right)}{2} - 2\sqrt{2}$

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

"Music is the pleasure the human soul experiences from counting without being aware that it is counting"
G W Leibnitz

A2 Maths with Mechanics Assignment ι (iota)

Drill

Part A Integrate* the following functions with respect to x:

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

*always use the correct notation when integrating and the constant for indefinite integration

Part B Write in the form indicated giving α as an acute angle in radians to 2dp:

(a) $4\sin x - 3\cos x$ $R\sin(x-\alpha)$ (b) $12\sin x + 5\cos x$ $R\sin(x+\alpha)$ (c) $\cos x + \sin x$ $R\cos(x-\alpha)$

Part C Sketch and state the ranges of the following functions (defined on $\mathbb{R}$): show asymptotes clearly

(a) $f(x)=\frac{1}{x+2}+1$ (b) $g(x)=1-e^{2x}$ (c) $h(x)=\ln(1+x)$

Part D Sketch the following functions stating the domain and range in each case.

(a) $y=2-\arcsin(3x)$ (b) $y=3+2\arccos x$ (c) $y=-\arctan\left(\frac{1}{2}x\right)$

*note in the specifications **arcsin** is used, not **sin^{-1}x** as on your calculators

1. Express the following as partial fractions

(a) $f(x)=\frac{2x-13}{(2x+1)(x-3)}$ (b) $f(x)=\frac{x^2+5x+7}{(x+2)^3}$ (c) $f(x)=\frac{x^2-10}{(x-2)(x+1)}$*

* this is an improper fraction

2. Use the binomial theorem to expand

$$\sqrt{(4-9x)}, \quad |x| < \tfrac{4}{9},$$

in ascending powers of x, up to and including the term in x^3, simplifying each term.

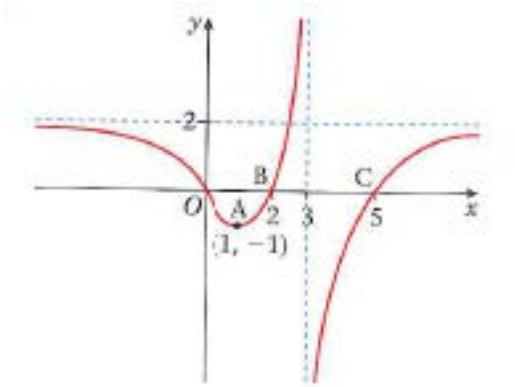
3. (*a*) Expand $\frac{1}{\sqrt{4-3x}}$, where $|x| < \frac{4}{3}$, in ascending powers of x up to and including the term in x^2. Simplify each term.

(*b*) Hence, or otherwise, find the first 3 terms in the expansion of $\frac{x+8}{\sqrt{4-3x}}$ as a series in ascending powers of x.

4. a) $\frac{\cos A}{\sin B}-\frac{\sin A}{\cos B}\equiv\frac{2\cos(A+B)}{\sin 2B}$ b) $\tan\frac{A}{2}+\cot\frac{A}{2}\equiv 2\operatorname{cosec} A$

5. Prove that the equation $\frac{4x+3}{2x-1}+\frac{6x+1}{2x+1}=3$ has no real solutions.

6.



The diagram shows a sketch of the graph of $y = f(x)$.

The curve has a minimum at the point A (1, -1) passed through x-axis at the origin, and the points B (2, 0) and C (5, 0); the asymptotes have equations $x = 3$ and $y = 2$.

(a) Sketch on separate axes, the graph of

(i) $y = |f(x)|$

(ii) $y = -f(x+1)$

(iii) $y = f(-2x)$

(b) State the number of solutions to the equation

(i) $3|f(x)| = 2$

(ii) $2|f(x)| = 3$

7. Find the equations of the tangent and the normal to $y = \dfrac{x}{1-x}$ at the point $\left(\dfrac{1}{2}, 1\right)$. Where does the normal meet the curve again?

8. Find the coordinates of the stationary points on $y = \left(x^2 - x - 2\right)^4$

9. Given that $y = xe^{2x}$, show that this curve has only one stationary point, find its coordinates and determine its nature.

10. Find the x coordinate of points on the curve $y = \frac{3x^2+2}{2x-3}$, where the gradient at these points is parallel to the line $y - x = 0$.

11. A curve has the equation $x^2 + 2y^2 - x + 4y = 6$

a) Show that $\frac{dy}{dx} = \frac{1-2x}{4(y+1)}$

b) Find an equation for the normal to the curve at the point (1, -3)

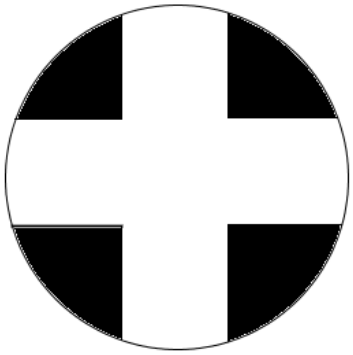
Mechanics : M1 Practice (Preparation for M2)

12. A ball is thrown vertically upwards from a height 1.6m above the ground, with a speed of 7 m s^{-1}. Find:

    a) The maximum height above the ground.

    b) The speed when it hits the ground.

Challenge Question



A company logo has centrally-symetric white cross of width $\sqrt{2}$ on a dark circle. The dark corner pieces have side length 1 as indicated. What is the total area of the corners?