A2 Assignment Xi Cover Sheet **Name:**

Question		Done	BP	Ready	Topic	Comment
Drill	Aa				C4 Parametrics – Make Cartesian	$y = \frac{2}{x} + 4$
	Ab				C4 Parametrics – Make Cartesian	$y = \frac{x^2}{9} + 1$
	Ac				C4 Parametrics – Make Cartesian	$y = \frac{3}{x} - 10$
	Ba				C4 Integral – sin^2	$\frac{\pi}{6} - \sqrt{3} + \sqrt{2}$
	Bb				C4 Integral – ln	$\frac{64}{3} ln8 - \frac{8}{3} ln4 - \frac{56}{9}$
	Bc				C4 Integral – e reverse chain	$-\frac{3}{2} e^{25} + \frac{3}{2} e$
	Ca				C3 Functions – sketch & range involving e^x	$f(x) > k, f(x) \in R$
	Cb				C3 Functions – sketch & range involving ln	$f(x) \in R$
	Cc				C3 Functions – sketch & range split function	$g(x) \leq 8, g(x) \in R$
	Da				C4 Implicit Diff – find dy/dx	$\frac{dy}{dx} = \frac{-x - y}{x + 3y}$
	Db				C4 Implicit Diff – find dy/dx $\frac{dy}{dx} = \frac{28x^6y^3 + 2\cos(2x - y)}{3e^{3y} - 12x^7y^2 + \cos(2x - y)}$	
	Dc				C4 Implicit Diff – find dy/dx	$\frac{dy}{dx} = -\frac{y}{3x + 4y}$
Current Work	1a				M2 COM – Particles on light frame	1g
	1b				M2 COM – Particles on light frame	5cm
	2a				M2 COM – Triangular frame	0.75cm
	2b				M2 COM – Triangular frame	0.5cm
	3				M2 COM – Composite lamina	Proof
	4				M2 COM – Composite lamina remove shape	6.86 cm
	5				M2 COM – Ratio mass attached to sector	3π : (3π–8)
Consolidation	6a				M2 Kinematics – vectors given force find $\underline{v}$	13**i** + 38**j** ms^{-1}
	6b				M2 Kinematics – vectors given force find v	13.6 ms^{-1}
	6c				M2 Kinematics – vectors given force find $\underline{x}$	15**i** + 28**j** m
	6d				M2 Kinematics – vectors given force find x	7.67m
	7a				M2 Projectiles – show tanα = 7/4	Proof
	7b				M2 Projectiles – find V	40.3 ms^{-1}
	7c				M2 Projectiles – find greatest height	62.5m
	7d				M2 Projectiles – find speed after 7 seconds	39.1 ms^{-1}
	8				C4 Integral – sin3x ln(cos3x)	-0.01281
	9a				C4 Integral – Substitution	8/3

	9b				C4 Integral - Substitution	$\ln(1+2x) + \frac{1}{1+2x} + c$
	10a				C3 Functions – Find range of f plus sketch	$1 \leq f(x) < 25$
	10b				C3 Functions – Find f^{-1} , state domain	$f^{-1} : x \mapsto \frac{25+2x}{3x}$ $x \in \mathbb{R} \quad 1 \leq x < 25$
	10c				C3 Functions – Find fg, state domain	$fg : x \mapsto \frac{25}{3x^2-2}$ $x \in \mathbb{R} \quad 1 < x \leq 3$
	10d				C3 Functions – Solve fg(x) = 2/(x-1)	$x = \frac{7}{6}$ or $x = 3$

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 not a careful march down a well cleared highway, but a journey into a strange wilderness, where the explorers often get lost." W. S. Anglin

A2 Maths with Mechanics Assignment ξ (xi)
due w/b 9/1
You are now over halfway through the course only
10 assignments to do after this one! ☺

Drill

Part A By making *t* the subject of one equation and substituting it into the other, eliminate *t* from the following pairs of equations to obtain the Cartesian equation in x and y in the form y = f(x):

(a) $y = 2t, \quad x = \dfrac{1}{t-2}$ (b) $y = t^2 + 1, \quad x = 3t$ (c) $y = 3t - 1, \quad x = \dfrac{1}{t+3}$

Part B Evaluate: (give an exact answer)

(a) $\int_{\frac{\pi}{4}}^{\frac{\pi}{3}} 4sin^2\left(\frac{x}{2}\right) dx$ (b) $\int_2^4 x^2 ln2x \, dx$ (c) $\int_1^5 -3xe^{x^2} \, dx$

Part C For each of the following functions, sketch its graph and state its range:

(a) $f : x \to e^x + k, x \in \Re$ (*k* is a positive constant)

(b) f : x→ ln(4 - 2x), x∈ R, x < 2 (c) $g(x) = \begin{cases} 3x - 1, & x \leq 3 \\ -x^2 + 2, & x > 3 \end{cases}$

Part D Use implicit differentiation to find $\dfrac{dy}{dx}$ for each of these relations, look out for products and use the product rule!

(a) $x^2 + 2xy + 3y^2 = 6$ (b) $e^{3y} - 4y^3x^7 = \sin(2x - y) + \frac{1}{2}$ (c) $4y^3(x + y) = 12$

Current Work : Mechanics

1. PQRS is a light rectangle with PQ = 8cm and PS = 6cm. Particles of mass 2g, 2g, and 3g are placed at points P, Q and R respectively.

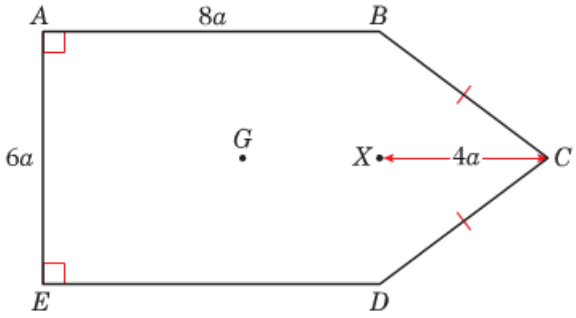
   (a) Find the mass that must be placed at S, for the centre of mass of the entire system to lie 3cm from the line PQ.

   (b) With this mass in place, find the distance of the centre of mass of the system from the line PS.

2. A uniform wire of length 6m is bent to form a triangle ABC where AB is 1.5m and BC is 2.5m. * HINT – think about what type of triangle this is !!! *

   Calculate the distance of the centre of mass of the triangle from (a) AB and (b) AC

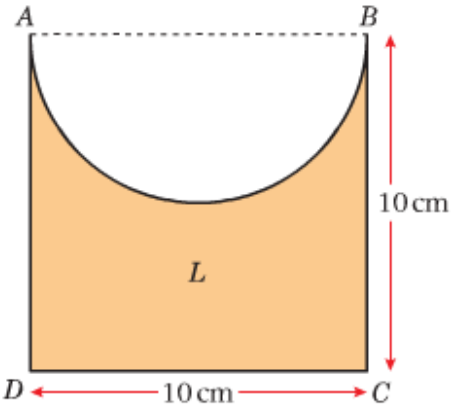
3.



The figure shows a uniform lamina $ABCDE$ such that $ABDE$ is a rectangle, $BC = CD$, $AB = 8a$ and $AE = 6a$. The point X is the mid-point of BD and $XC = 4a$. The centre of mass of the lamina is at G.

Show that $GX = \frac{44a}{15}$

4.



A uniform lamina L is formed by taking a uniform square sheet of material $ABCD$ of side 10 cm and removing a semicircle with diameter AB from the square, as shown in the figure.

Find in cm to 2.d.p the distance of the centre of mass of the lamina from the mid-point of AB.

5. A semicircular lamina has mass M. A is the midpoint of the diameter and B is the point on the circumference at the other end of the axis of symmetry. A particle of mass m is attached to the lamina at B. the centre of mass of the loaded lamina is at the midpoint of AB. Find, in terms of π, the ratio M:m.

Consolidation : Mechanics

6. A force $\mathbf{F} = (2t - 1)\mathbf{i} + 2t^2\mathbf{j}$ acts on a mass of 0.5kg. Initially, the mass has a velocity of $\mathbf{i} + 2\mathbf{j}$ ms^{-1} and has position vector $3\mathbf{i} - 5\mathbf{j}$ m relative to the origin.

(a) Find the velocity of the mass at t = 3 seconds.

(b) Find the speed of the mass at t = 2 seconds.

(c) Find the position of the mass at t = 3 seconds.

(d) Find the distance of the mass from the origin at t = 2 seconds.

7. A particle P is projected from a point O on horizontal ground with speed V metres per second and angle of elevation α. The particle moves freely under gravity. After 5 seconds the components of the velocity of P are 20 ms^{-1} horizontally, and 14 ms^{-1} vertically ***downwards***.

a) Show that tan α = 7/4

b) Calculate, to one decimal place, the value of V

c) Find the greatest height above the ground reached by P

d) Calculate the speed of P, to one decimal place, 7 seconds after leaving O.

Consolidation : Pure

8. Evaluate to 5 d.p:

$$\int_{\frac{\pi}{18}}^{\frac{\pi}{12}} sin3x \ln(cos3x)\, dx$$

9. Integration by Substitution:

a) Using $t^2 = x + 1, find\ \int_0^3 \frac{x}{\sqrt{x+1}} dx$

b) Using $u = 1 + 2x, find\ \int \frac{4x}{(1+2x)^2} dx$

10. Two functions *f* and *g* are defined by $f : x \mapsto \frac{25}{3x-2},\ x \in \mathbb{R}, : 1 < x \leq 9$

and $g : x \mapsto x^2,\ x \in \mathbb{R}, : 1 < x \leq 3$. Find

(a) the range of f (using a sketch to illustrate your answer)

(b) the inverse function f^{-1}, stating its domain

(c) the composite function *fg*, stating its domain

(d) the solutions to the equation $fg(x) = \frac{2}{x-1}$

Preparation

Read about Vectors in particular the equation of a line and the intersection of two lines

new C4 pages 75-81 old C4 pages 70-76