**A2 Assignment beta Cover Sheet**          **Name:**

| Question | | Done | Backpack | | Topic | Comment |
|---|---|---|---|---|---|---|
| **Drill** | 1i | | | | C3 Differentiation trig | $4\sec^2 2x\tan 2x$ |
| | 1ii | | | | C3 Differentiation trig | $-6\cot 3x\,\text{cosec}^2 3x$ |
| | 1iii | | | | C3 Differentiation trig | $-2\text{cosec}^2 x\cot x$ |
| | 2i | | | | C4 Integration Reverse chain | $\dfrac{1}{16}(4x-3)^4 + c$ |
| | 2ii | | | | C4 Integration Reverse chain | $\dfrac{1}{5}\sin(5x+4)+c$ |
| | 2iii | | | | C4 Integration Reverse chain | $\dfrac{1}{4}\cos(3-4x)+c$ |
| | 3i | | | | C2 Log evaluation | -2 |
| | 3ii | | | | C2 Log evaluation | 3 |
| | 3iii | | | | C2 Log evaluation | 1/3 |
| | 4i | | | | C4 Integration Reverse chain | $\dfrac{1}{3}\sec 3x + c$ |
| | 4ii | | | | C4 Integration Reverse chain | $(b)-\cos ecx + c$ |
| | 4iii | | | | C4 Integration Reverse chain | $\dfrac{1}{2}\tan 2x + c$ |
| **Consolidation** | 1a | | | | C3 Differentiation all & factorising to simplify | $2\sec 7x(7\cos x\tan 7x - \sin x)$ |
| | 1b | | | | C3 Differentiation all & factorising to simplify | 0 |
| | 1c | | | | C3 Differentiation all & factorising to simplify | $\dfrac{2x^2+1}{\sqrt{x^2+1}}$ |
| | 2 | | | | C3 Find normal | $x = \dfrac{\pi}{2}$ |
| | 3a | | | | C4 Finding dy/dx from dx/dy | $\cos^2 y$ |
| | 3b | | | | C4 Finding dy/dx from dx/dy | $1\Big/ y^2(3\sin y + y\cos y)$ |
| | 3c | | | | C4 Finding dy/dx from dx/dy | $\dfrac{\cos y}{3(1+y\tan y)}$ |
| | 4a | | | | C2 Solving trig equations | $\dfrac{\pi}{12}, \dfrac{7\pi}{12}, \dfrac{13\pi}{12}, \dfrac{19\pi}{12}$ |
| | 4b | | | | C2 Solving trig equations | $0.322^c, 3.46^c, 2.82^c, 5.96^c$ |
| | 5a | | | | C3 Proving trig identities | PROOF |
| | 5b | | | | C3 Proving trig identities | PROOF |
| | 6 | | | | C3 Find normal | PROOF |
| | 7 | | | | C3 Differentiation & factorising to simplify | PROOF |
| | 8 | | | | C3 Algebraic division | $A = 2, B = -4, C = 6, D = -11$ |

| | | | | | |
|---|---|---|---|---|---|
| M1 Practice | 9 | | | M1 Impulse | 0.4Ns   ,    6.33 ms$^{-1}$ |
| Challenge | 10 | | | C2 TOOLS | 5.04 |

*"It is a mathematical fact that the casting of this pebble from my hand alters the centre of gravity of the universe."*  T Carlyle

# A2 Maths with Mechanics Assignment $\beta$ (beta)
## due w/b 26/9

Come along to the Maths Association Talk – 29th September at 4:30pm in room 3
"Geometry Ancient And Modern" (It's free! Come along!)

Maths Trip:  Maths In Action University Lectures in London. £20 a ticket (10 tickets available) 15th November
Maths Trip:  Maths In Action University Lectures in London. £20 a ticket (10 tickets available) 14th December

## Drill

**Part A** Differentiate the following functions with respect to $x$:

(a)      $f(x) = \sec^2 2x$ (b)      $f(x) = \cot^2 3x$      (c) $f(x) = \operatorname{cosec}^2 x$

**Part B** Find the following integrals by considering what has been differentiated

(a)      $\int (4x-3)^3 dx$          (b)      $\int \cos(5x+4)dx$          (c) $\int \sin(3-4x)dx$

**Part C** Find the exact values of the following

(a)      $\log_3 \dfrac{1}{9}$          (b)      $-\log_2 \dfrac{1}{8}$      (c)      $\log_8 2$

Part D   Find the following integrals by considering what has been differentiated

$(a) \int \sec 3x \tan 3x dx$          (b) $\int \cos ecx \cot x dx$          (c) $\int \sec^2 2x dx$

## Current work

1.      Differentiate the following using the correct notation:
   (a)      f(x) $= 2\cos x \sec 7x$      (b)      f(x) $= \tan 2x \cot 2x$      (c) $y = x\sqrt{x^2+1}$

2.      Find the equation of the normal to $y = \operatorname{cosec} x$ at the point where $(\dfrac{\pi}{2}, 1)$

3.      Find $\dfrac{dy}{dx}$ , in terms of y, given that
   (a)      $x = \tan y$          (b)      $x = y^3 \sin y$          (c)      $x = 3y \sec y$

## Consolidation

4.     Solve the following equations in the interval $0 \le \theta \le 2\pi$. Give exact answers where you can, but otherwise give your answers to 3sf:

    (a)     $\sqrt{3}\sin 2\theta + 2\sin^2 \theta = 1$         (b)     $4\tan 2\theta \tan \theta = 1$

5.     Prove the following identities:

    (a)     $\sec x + \tan x \equiv \dfrac{1}{\sec x - \tan x}$         (b)     $\cos(90° - x) \equiv \sin x$

6.     The maximum point on the curve with equation $y = x\sqrt{\sin x}$ where $0 < x < \pi$ is $A$. Show that the $x$ coordinate of $A$ satisfies the equation $2\tan x + x = 0$.

7.     Show that $\dfrac{d}{dx}\left[\dfrac{1 + \cot x}{1 - \cot x}\right] = -2\left(\dfrac{\mathrm{cosec}\, x}{1 - \cot x}\right)^2$

8.     Show that $\dfrac{4x^3 - 6x^2 + 8x - 5}{2x + 1}$ can be written in the form $Ax^2 + Bx + C + \dfrac{D}{2x + 1}$ where $A$, $B$, $C$ and $D$ are constants to be found.

## M1 Practice (Preparation for M2)

9.     Two uniform smooth spheres, A of mass 0.03kg and B of mass 0.1kg, have equal radii and are moving directly towards each other with speeds of $7 \text{ ms}^{-1}$ and $4\text{ms}^{-1}$ respectively. The spheres collide directly and B is reduced to rest by the impact. State the magnitude of the impulse experienced by B, and find the speed of A after impact.

**10.Challenge Question**

The area of each large semicircle is 2. What is the difference between the black and grey shaded areas?
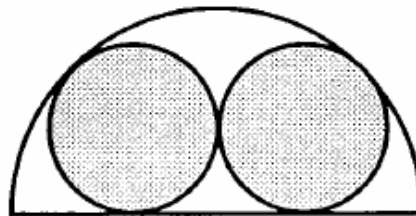


**Preparation: Read*** about the inverse of functions, the one to one condition for a function to have an inverse. Also transforming graphs including the modulus functions $|f(x)|$ and $f(|x|)$ and the difference between them

C3 new textbook pages 23-30 and 63-82 C3 old textbook pages 21-28 and 54-72

\* you are not expected to work through questions in this preparation section but read the textbook to understand the topic.