

Question	Done	BP	Topic	Comment
Drill	Aa		C4 Integral – $2/\cos^2$	$4 \tan \frac{x}{2} + c$
	Ab		C4 Integral – $\sec 3x \tan 3x$	$\frac{1}{3} \sec 3x + c$
	Ac		C4 Integral – $\operatorname{cosec} 2x \cot 2x$	$-\frac{1}{2} \operatorname{cosec} 2x + c$
	Ba		C3 MOD – $ f(x) $ solve	$2 \pm 2\sqrt{2}$ and 2
	Bb		C3 MOD – $f( x )$ solve	$\pm 1, \pm 3$
	Ca		C2 Logs – solve with base change	2 or 16
	Cb		C2 logs – solve with base change	$-\frac{1}{3}, -2$
	Da		C4 Integral – Improper Partial Fractions	$x^2 + 2x + \frac{19}{5} \ln x+2  + \frac{56}{5} \ln x-3  + c$
Db		C4 Integral – Improper Partial Fractions	$x - \ln x+1  + \ln x-1  + c$	
Current Work	1a		C3 Differentiation – Give answer in x only	$\frac{dy}{dx} = \frac{1}{x}$
	1b		C3 Differentiation – Give answer in x only	$\frac{dy}{dx} = \frac{3}{9+x^2}$
	1c		C3 Differentiation – Give answer in x only	$\frac{dy}{dx} = \frac{1}{\sqrt{1-x^2}}$
	1d		C3 Differentiation – Give answer in x only	$\frac{1}{2\sqrt{4-x^2}}$
	2a		C4 Implicit Diff – find $dy/dx$	$-\frac{x^2}{y^2}$
	2b		C4 Implicit Diff – find $dy/dx$	$\frac{dy}{dx} = \frac{2x - 2\operatorname{cosec}^2(2x+y)}{e^y + \operatorname{cosec}^2(2x+y)}$
	2c		C4 Implicit Diff – find $dy/dx$	$\frac{dy}{dx} = \frac{3 \sec(3x+1) \tan(3x+1)}{2y+1}$
	2d		C4 Implicit Diff – find $dy/dx$	$\frac{2y^3 - 3xy^2}{3x^2y - 6xy^2}$
	2e		C4 Implicit Diff – find $dy/dx$	$\frac{dy}{dx} = \frac{4x^3(x^2+1) + 2x - y(x^2+1)}{(x^2+1)(x+2y)}$
	2f		C4 Implicit Diff – find $dy/dx$	$\frac{dy}{dx} = \frac{3 \cos(3x-y) + 2 \sec^2 2x}{3^y \ln 3 + \cos(3x-y)}$
3		C4 Implicit Diff – find tangent at point	$y = -x + 2$	
Consolidation	4		C4 Integration – Improper partial frac w/ limits	$\frac{7}{2} + \ln\left(\frac{192}{5}\right)$
	5		C3 Diff – given $y=e^x/(x+1)$ find 1 <sup>st</sup> & 2 <sup>nd</sup> deriv	$e/4$ and $e/4$ ☺
	6a		M2 Kinematics vectors – given v find a	$6\mathbf{i} + 5\mathbf{j} \text{ ms}^{-2}$
	6b		M2 Kinematics vectors – find when // to j	2
	6c		M2 Kinematics vectors – find displacement	6.10m
7a		M2 Projectiles – find height of cliff	150m	

	7b		M2 Projectiles – find speed hits ground	$73 \text{ ms}^{-1}$
	7c		M2 Projectiles – find horizontal distance	360m (2sf)
	8a		C3 facts about e – which statements correct?	B
	8b		C3 curve intersections – which statement corr?	E
Mock exam	A i)		R, $\alpha$ transformations	
	A ii)		R, $\alpha$ transformations	$R = 10.82, \alpha = 33.69$
	A iii)		R, $\alpha$ transformations	$x = 56.1^\circ$ or $x = 11.3^\circ$
	B)		Implicit differentiation	$y = 2x - 2$

$\alpha$	$\beta$	$\gamma$	$\delta$	$\varepsilon$	$\zeta$	$\eta$	$\theta$	$\iota$	$\kappa$	$\lambda$	$\mu$	$\nu$	$\xi$	$\omicron$	$\pi$	$\rho$	$\sigma$	$\tau$	$\upsilon$	$\varphi$	$\chi$	$\psi$	$\omega$
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*"Numbers written on restaurant bills within the confines of restaurants do not follow the same mathematical laws as numbers written on any other pieces of paper in any other parts of the universe."*  
Douglas Adams

## A2 Maths with Statistics Assignment $\xi$ (xi) due w/b 15 Jan 2018

### Drill

**Part A** Integrate with respect to  $x$

(a)  $\frac{2}{\cos^2 \frac{x}{2}}$                       (b)  $\sec 3x \tan 3x$                       (c)  $\operatorname{cosec} 2x \cot 2x$

**Part B** Given that  $f(x) = x^2 - 4x$ ,  $x \in \mathbb{R}$ , solve the following equations:

(a)  $|f(x)| = 4$                       (b)  $f(|x|) = -3$

**Part C** Solve the equations

(a)  $\log_2 x + 4 \log_x 2 = 5$                       (b)  $\log_3(2 - 3x) = \log_9(6x^2 - 19x + 2)$

**Part D** Integrate the following CASE 3 improper fractions using partial fractions:

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

### Current work

1 Find  $\frac{dy}{dx}$  IN TERMS OF  $x$  ONLY if: (great questions ☺)

(a)  $x = e^y$                       (b)  $x = 3 \tan y$                       (c)  $x = -\cos y$   
(d)  $x = 2 \sin 2y$

2 Find  $\frac{dy}{dx}$  using implicit differentiation in the following

(a)  $x^3 + y^3 = 5$                       (b)  $x^2 + \cot(2x + y) = e^y$   
(c)  $y^2 + y = \sec(3x + 1)$   
(d)  $3x^2 y^2 - 4xy^3 = 7$                       (e)  $(x + y)y - \ln(x^2 + 1) = x^4$   
(f)  $\sin(3x - y) + \tan(2x) = 3^y$

3. Find the equation of the tangent to the curve  $x^2 + 3xy + y^2 = x + 3y + 2$  at the point (2, 0)

## Consolidation

4.  $\int_2^3 \frac{4x^3-1}{(x-1)^2(2x-1)} dx$  giving your answer in the form  $a + \ln b$  where  $a$  and  $b$  are rational

\* remember to check your partial fractions on your calculator using  $x = 0.01$  each side before you integrate ! otherwise, you are wasting your time !! \*

5. Given that  $y = \frac{e^x}{x+1}$  find in terms of  $e$  the values of  $\frac{dy}{dx}$  and  $\frac{d^2y}{dx^2}$  at  $x = 1$ .

## Mechanics

6. The velocity  $v$  m s<sup>-1</sup> of a particle  $P$  at time  $t$  seconds is given by

$$v = (3t^2 - 12)\mathbf{i} + 5t\mathbf{j}$$

(a) Find the acceleration of  $P$  at time  $t$  seconds.

(b) Find the value of  $t$  when  $P$  is moving parallel to the vector  $\mathbf{j}$ .

With respect to a fixed origin  $O$ , the position vector of  $P$  when  $t = 2$  is  $4\mathbf{j}$ .

(c) Find the distance  $OP$  when  $t = 1$ .

7. A particle of mass 2 kg is projected off the edge of a cliff with velocity 49 ms<sup>-1</sup> at an angle of 25° above the horizontal. It hits the sea after 8 seconds.

Find (a) the height of the cliff.

(b) the speed that the particle hits the sea.

(c) the horizontal distance that the particle has travelled when it hits the sea.

8.

*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)*

*1. The second derivative of  $e^{2x}$  is  $4e^{2x}$*

*2. The area under the curve of  $e^{2x}$  and bounded by the lines  $x = 0$  and  $x = \ln 2$  is  $3/2$*

*3. The curve  $y = e^{2x}$  has no asymptote(s)*

*b)*

*The solutions of the equation  $2x^3 + 6x^2 - 1 = 0$*

*can be found from the intersections of the two graphs*

1.  $y = 2x^3$  and  $y = 6x^2 - 1$
2.  $y = 6 - 1/x^2$  and  $y = 2x$
3.  $y = x^2(x+3)$  and  $y = 1/2$

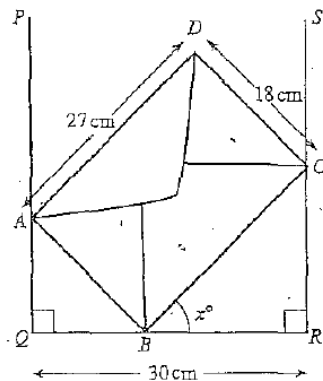
### Challenge

Which one of these is prime?

- a)  $1000^2 + 111^2$       b)  $555^2 + 666^2$       c)  $2000^2 - 999^2$   
d)  $1001^2 + 1002^2$       e)  $1001^2 + 1003^2$

### Optional extra questions for you if you are catching up on work from the C3 mock exam

(A)



The figure shows the rectangular cross-section  $PQRS$  of a letter rack. A rectangular envelope  $ABCD$  rests in the vertical plane  $PQRS$  inside the letter rack.  $QR$  is horizontal.  $QR = 30$  cm,  $AD = 27$  cm and  $CD = 18$  cm. the bottom edge,  $BC$ , of the envelope, makes an angle  $x^\circ$  with the base  $QR$  of the rack.

- i) Prove that  $9 \cos x^\circ + 6 \sin x^\circ = 10$
  - ii) Express  $9 \cos x^\circ + 6 \sin x^\circ$  in the form  $R \cos(x^\circ - \alpha^\circ)$ , where  $R > 0$  and  $0 < \alpha < 90$  giving the values of  $R$  and  $\alpha$  to 2 decimal places.
  - iii) Hence, or otherwise, find  $x$ , giving your answer to the nearest tenth of a degree.
- (B) Find the equation of the normal to the curve with implicit equation  $(x + y)^3 = x^2 + y$  at the point  $(1, 0)$ .