## Solomon Practice Paper

Pure Mathematics 3D

Time allowed: 90 minutes

Centre: www.CasperYC.club

Name:

Teacher:

Question	Points	Score
1	5	
2	7	
3	8	
4	8	
5	10	
6	10	
7	13	
8	16	
Total:	77	

## How I can achieve better:

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1.	Α	curve	$\mathrm{is}$	given	by	the	parametric	equations
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$$x = 1 + t^2$$
, and  $y = 2t^6$ .

(a) Find an equation of the curve in Cartesian form.	[2]
(b) Sketch the curve, labelling the coordinates of any points where the curve meets the coordinate axes.	[3]
	Total: 5

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2. The lines  $l_1$  and  $l_2$  are given by

$$l_1$$
:  $\mathbf{r} = -38 + 8 + \mathbf{k} + \lambda(5\mathbf{i} - 7\mathbf{j} + 4\mathbf{k})$   
 $l_2$ :  $\frac{x-5}{2} = \frac{y+9}{3} + \frac{z-3}{6}$ .

(a) Find an equation for  $l_2$  in vector form. [3]

(b)	Find the size of the acute angle	between lines $l_1$	$_1$ and $l_2$ in degrees	correct to 1 deci	mal place.	[4]
					Total:	: 7




3.	(a) Use integration by parts to find $\int 2x \ln(x) dx.$	[4]
	(b) Given that $y = 2e$ when $x = e$ , solve the differential equation	[4]
	$\frac{\mathrm{d}y}{\mathrm{d}x} = \frac{2x\ln(x)}{y}.$	
		Total: 8



4.	Α	curve	has	the	equation
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$$4\cos(x) + \tan(y) = 0.$$

(a) Show that $\frac{dy}{dx} = 4\sin(x)\cos^2(y)$ .	[3]
$\mathrm{d} x$	LJ

(b)	Find the equation of the normal to the curve at the point with coordinates $(\frac{\pi}{2}, \frac{\pi}{6})$ in the	[5]
	form $ax + by + c = 0$ .	

Total: 8



5.	(a)	Given that $ x  < 1$ , express $(1+x)^{-1}$ as a series in ascending powers of $x$ , as far as the term in $x^3$ .	[3]	
	(b)	$f(x) \equiv \frac{4x+1}{(1-2x)(1+x)}.$	[7]	
		By expressing $f(x)$ in partial fractions, find the series expansion of $f(x)$ in ascending powers of $x$ as far as the term in $x^3$ and state the set of values of $x$ for which your series is valid.	1 10	
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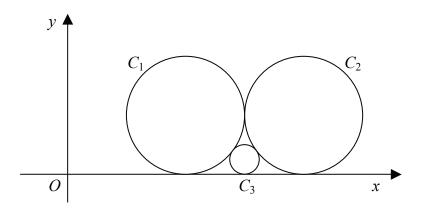
[3]

[7]

10

6.	(a) Find $\int \tan^2(3x) dx$ .
	(b) Using the substitution $u = x^2 + 4$ , or otherwise, evaluate
	$\int_0^2 \frac{5x}{(x^2+4)^2}  \mathrm{d}x.$
	Total:
	Total.

7. Figure shows three circles,  $C_1, C_2$  and  $C_3$  which all touch the x-axis.



Circle  $C_1$  has the equation  $x^2 + y^2 - 12x - 8y + 36 = 0$ .

(a) Find the coordinates of the centre of  $C_1$  and write down its radius.

[5]

Circle  $C_2$  has the same radius as  $C_1$  and is touching circle  $C_1$ .

(b) Find an equation of circle  $C_2$ .

[3]

[5]

Circle  $C_3$  is touching both circles  $C_1$  and  $C_2$ .

(c) Find an equation of circle  $C_3$ .

Total: 13

8.			[5]
	$y = \frac{x}{\sqrt{x-2}},  x > 2.$		
	Show that $\frac{\mathrm{d}y}{\mathrm{d}x} = \frac{x-4}{2(x-2)^{\frac{3}{2}}}$		
	(b) Find the coordinates of the stationary point on the curve.		[3]
	(c) Find and simplify an expression for $\frac{d^2y}{dx^2}$ .		[5]
	(d) Hence, determine the nature of the stationary point on the curve.		[3]
		Total:	
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