## Solomon Practice Paper

Pure Mathematics 2G

Time allowed: 90 minutes

Centre: www.CasperYC.club

Name:

Teacher:

Question	Points	Score
1	5	
2	7	
3	8	
4	8	
5	8	
6	10	
7	13	
8	16	
Total:	75	

## How I can achieve better:

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 $1. \ \,$  The terms of a sequence satisfy the following recurrence relation:

$$u_{n+1} = \frac{u_n - 1}{2}, \quad n \ge 1.$$

Given that  $u_4 = \frac{1}{4}$ , find the value of

(a)  $u_5$ ,

[2]

[3]

(b)  $u_1$ .

Total:	b



2. (	(a)	Show	that	the	equation
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$$1 + \cos(x) = 2x^2 - 1$$

can be rearranged into the form

$$x = \pm \sqrt{a + b\cos(x)},$$

and state the values of a and b.

 $x_{n+1} = \pm \sqrt{a + b\cos(x_n)},$ 

with your values of a and b and with  $x_0 = 1$  to find a root of the equation correct to 2 decimal places.

(c) Without further calculation write down another root of the equation and explain your answer.

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[2]

[3]

[2]



3.	(a) Find the coordinates of the points where the curve $y = 4 - x^2$ crosses the x-axis.	[2]
	(b) The region bounded by the curve $y = 4 - x^2$ and the x-axis is rotated through 360° about the x-axis. Show that the volume of the solid generated is $\frac{512}{15}\pi$ .	[6]
		Total: 8



4. A bicycle tyre develops a slow puncture.

The pressure, P pounds per square inch, in the tyre t minutes after the puncture occurs is given by

$$P = 14 + 50e^{-kt}$$
.

(a) Find the pressure in the tyre when the puncture occurs.

[2]

Given that the pressure in the tyre is halved during the first 5 minutes after the puncture occurs, find correct to 3 significant figures

(b) the value of the constant k,

[4]

[2]

(c) the pressure in the tyre 12 minutes after the puncture occurs.

Total: 8

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5. The functions f and g are defined by

$$\begin{aligned} \mathbf{f} \colon x &\mapsto & 3x^2 - 1, & x \in \mathbb{R}, \\ \mathbf{g} \colon x &\mapsto & \mathbf{e}^{3x}, & x \in \mathbb{R}. \end{aligned}$$

(a) Solve the equation f(x) = 26.

[3]

(b) Evaluate gf(0.8) correct to 3 significant figures.

[2]

[3]

(c) Define fg(x) as simply as possible.

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[5]

[5]

Total: 10

6. (a) Simplify

i. 
$$\frac{x^2 + 3x}{x^2 + 5x + 6},$$
  
ii. 
$$\frac{2x^2 - x - 1}{x^2 + 8x - 9}.$$

ii. 
$$\frac{2x^2-x-1}{x^2+8x-9}$$
.

(b) Hence solve the equation

$$\frac{x^2 + 3x}{x^2 + 5x + 6} = \frac{2x^2 - x - 1}{x^2 + 8x - 9},$$

giving your answers in the form  $a + b\sqrt{2}$ .



7. (a) Prove that there are no real values of  $\theta$  for which

[4]

$$\cos(2\theta) + \cos(\theta) + 2 = 0.$$

(b) Find the values of x in the interval  $0 \le x \le 360^{\circ}$ , for which [5]

$$3\sin(x) - 2\cos^2(x) = 0.$$

(c) Hence, find the values of y in the interval  $0 \le y \le 180^{\circ}$ , for which

[4]

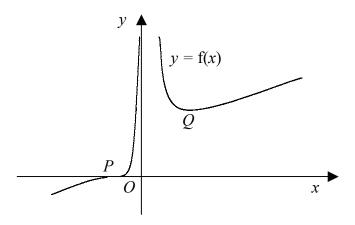
$$3\sec(2y) - 2\cot(2y) = 0.$$

Total: 13





8. Figure shows the curve y = f(x) where  $f(x) \equiv \frac{(2+x)^3}{x^2}$ .



- (a) Express  $(2+x)^3$  as a series in ascending powers of x.
- (b) Hence, express f(x) in the form  $Ax^{-2} + Bx^{-1} + C + Dx$ . [2]

The curve intersects the x-axis at the point P.

- (c) Find the coordinates of P.
- (d) Show that f(x) is stationary at P.
- (e) Hence, find the coordinates of the other stationary point on the curve, Q.

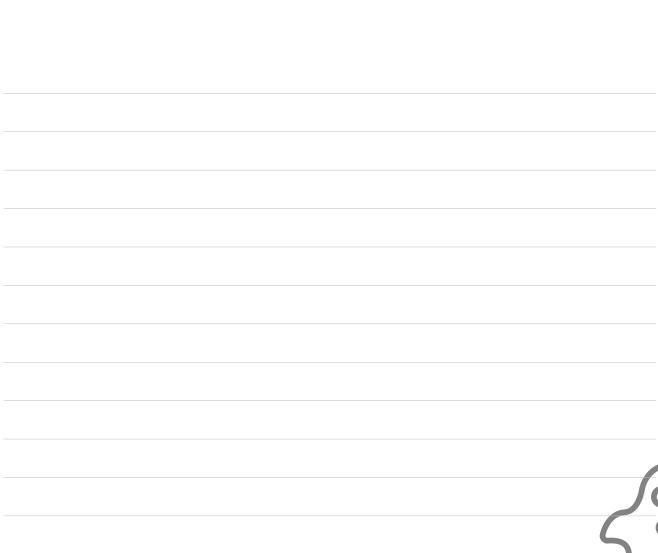
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[2]

[2]

[6]





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