

# Solomon Practice Paper

## Pure Mathematics 2F

Time allowed: 90 minutes

Centre: [www.CasperYC.club](http://www.CasperYC.club)

Name:

Teacher:

Question	Points	Score
1	5	
2	7	
3	8	
4	9	
5	11	
6	11	
7	12	
8	12	
Total:	75	

How I can achieve better:

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1. (a) Find [2]

$$\int 2x - 3e^x \, dx.$$

Given that  $f'(x) = 2x - 3e^x$  and that the curve  $y = f(x)$  meets the  $y$ -axis at the point  $(0, 6)$ ,

- (b) find  $f(x)$ . [3]

Total: 5

2. (a) Sketch on the same set of coordinate axes the graphs of  $y = x^2 + 1$  and  $y = |2x - 4|$ . [3]

- (b) Hence, or otherwise, solve the equation  $x^2 + 1 = |2x - 4|$ . [4]

Total: 7

3. (a) Find the first three terms in the expansion of  $(2 + kx)^5$  in ascending powers of  $x$ , simplifying each coefficient. [3]

Given that the coefficient of  $x^2$  in the expansion of  $(1 - x)(2 + kx)^5$  is 60,

- (b) find the two possible values of  $k$ . [5]

Total: 8

4. (a) Given that [5]

$$p = \log_2(x) \quad \text{and} \quad q = \log_2(y),$$

find expressions in terms of  $p$  and  $q$  for

i.  $\log_2(x^2y)$ ,

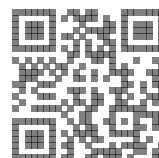
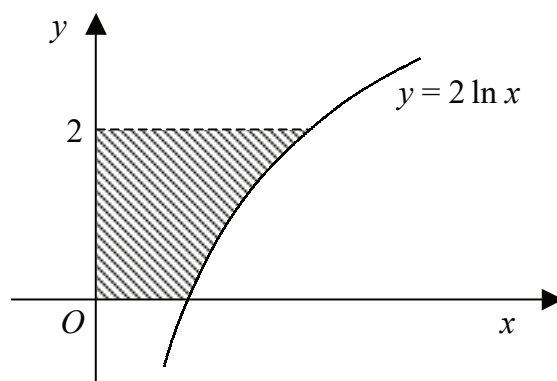
ii.  $\log_2\left(\frac{\sqrt{y}}{x^3}\right)$ .

- (b) Hence, or otherwise, solve the simultaneous equations [4]

$$\log_2(x^2y) = 2 \quad \text{and} \quad \log_2\left(\frac{\sqrt{y}}{x^3}\right) = -11$$

Total: 9

5. Figure shows part of the curve  $y = 2 \ln(x)$ .



- (a) Write the equation of the curve in the form  $x = f(y)$ . [2]

The shaded region is enclosed by the curve, the positive coordinate axes and the line  $y = 2$ .

- (b) Use the trapezium rule with 4 intervals of equal width to estimate the area of the shaded region correct to 3 significant figures. [4]
- (c) Find the volume of the solid generated when the shaded region is rotated through  $360^\circ$  about the  $y$ -axis. Give your answer in terms of  $e$  and  $\pi$ . [5]

Total: 11

6.

$$f(x) \equiv \sqrt{3} \sin(x) + \cos(x).$$

- (a) Express  $f(x)$  in the form  $R \sin(x + \alpha)$  where  $x$  is measured in degrees and  $0 < \alpha < 90^\circ$ . [5]
- (b) State the maximum value of  $(\sqrt{3} \sin(x) + \cos(x))$  and the smallest positive value of  $x$  for which  $f(x)$  takes this value. [2]
- (c) Solve the equation  $f(x) = \sqrt{2}$ , for  $x$  in the interval  $0 \leq x \leq 360^\circ$ . [4]

Total: 11

7. The functions  $f$  and  $g$  are defined as follows

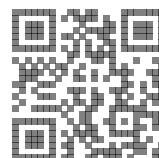
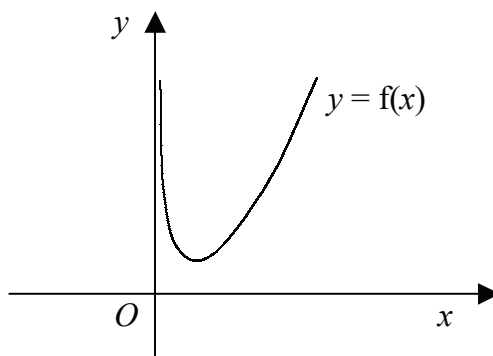
$$\begin{aligned} f: x &\mapsto x^2 - 6x, & x \in \mathbb{R}, \\ g: x &\mapsto e^x + 3, & x \in \mathbb{R}. \end{aligned}$$

- (a) Evaluate  $g(2 \ln(3))$ . [3]
- (b) Find and simplify an expression for  $fg(x)$ . [3]
- (c) Prove that for all values of  $x$ ,  $fg(x) \equiv g(2x) - 12$ . [2]
- (d) Solve the equation  $gf(x) = 4$ . [4]

Total: 12

8. Figure shows part of the curve with equation  $y = f(x)$  where

$$f(x) \equiv kx^{\frac{3}{2}} - \frac{7}{8} \ln(4x).$$



Given that the curve passes through the point  $A\left(\frac{1}{4}, \frac{1}{2}\right)$ ,

(a) show that  $k = 4$ , [3]

(b) find  $f'(x)$ , [3]

(c) prove that the normal to the curve at the point  $A$  passes through the origin. [6]

Total: 12

