Solomon Practice Paper

Pure Mathematics 2F

Time allowed: 90 **minutes**

Centre: **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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BY NC ND

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1. (a) Find [2]

$$\int 2x - 3\mathrm{e}^x \, \mathrm{d}x.$$

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

(b) find $\mathrm{f}(x)$. [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. $\log_2(x^2y)$,

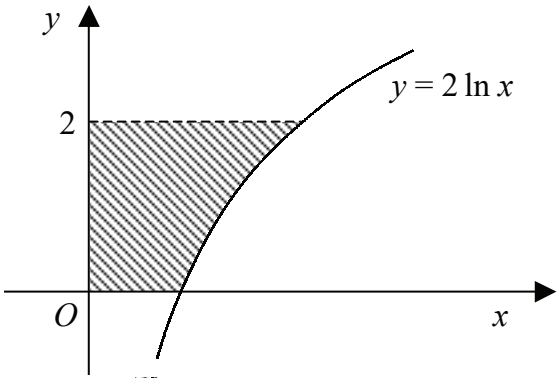
ii. $\log_2\left(\frac{\sqrt{y}}{x^3}\right)$.

(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 $x = \mathrm{f}(y)$. [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° about the y-axis. Give your answer in terms of e and π. [5]

Total: 11

6.

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

(a) Express $\mathrm{f}(x)$ in the form $R\sin(x+\alpha)$ where x is measured in degrees and $0 < \alpha < 90°$. [5]

(b) State the maximum value of $(\sqrt{3}\sin(x) + \cos(x))$ and the smallest positive value of x for which $\mathrm{f}(x)$ takes this value. [2]

(c) Solve the equation $\mathrm{f}(x) = \sqrt{2}$, for x in the interval $0 \leq x \leq 360°$. [4]

Total: 11

7. The functions f and g are defined as follows

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

(a) Evaluate $\mathrm{g}(2\ln(3))$. [3]

(b) Find and simplify an expression for $\mathrm{fg}(x)$. [3]

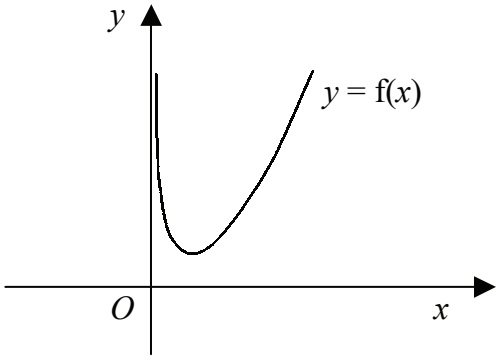
(c) Prove that for all values of x, $\mathrm{fg}(x) \equiv \mathrm{g}(2x) - 12$. [2]

(d) Solve the equation $\mathrm{gf}(x) = 4$. [4]

Total: 12

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

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



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 $\mathrm{f}'(x)$, [3]

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

Total: 12