

# Solomon Practice Paper

## Core Mathematics 3B

Time allowed: 90 minutes

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

Name:

Teacher:

Question	Points	Score
1	7	
2	9	
3	9	
4	10	
5	13	
6	13	
7	14	
Total:	75	

How I can achieve better:

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Last updated: *May 5, 2023*



1. (a) Simplify

$$\frac{x^2 + 7x + 12}{2x^2 + 9x + 4}$$

[3]

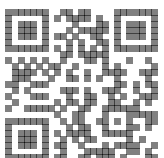
(b) Solve the equation

$$\ln(x^2 + 7x + 12) - 1 = \ln(2x^2 + 9x + 4),$$

[4]

giving your answer in terms of e.

Total: 7



2. A curve has the equation  $y = \sqrt{3x + 11}$ .

The point  $P$  on the curve has  $x$ -coordinate 3.

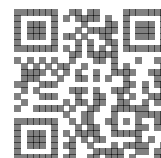
(a) Show that the tangent to the curve at  $P$  has the equation [6]

$$3x - 4\sqrt{5}y + 31 = 0.$$

The normal to the curve at  $P$  crosses the  $y$ -axis at  $Q$ .

(b) Find the  $y$ -coordinate of  $Q$  in the form  $k\sqrt{5}$ . [3]

Total: 9



3. (a) Use the identities for  $\sin(A + B)$  and  $\sin(A - B)$  to prove that [4]

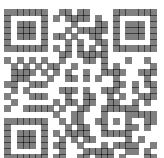
$$\sin(P) + \sin(Q) \equiv 2 \sin\left(\frac{P + Q}{2}\right) \cos\left(\frac{P - Q}{2}\right).$$

- (b) Find, in terms of  $\pi$ , the solutions of the equation [5]

$$\sin(5x) + \sin(x) = 0,$$

for  $x$  in the interval  $0 \leq x < \pi$ .

Total: 9



4. The curve with equation

$$y = x^{\frac{5}{2}} \ln\left(\frac{x}{4}\right), x > 0$$

crosses the  $x$ -axis at the point  $P$ .

(a) Write down the coordinates of  $P$ .

[1]

The normal to the curve at  $P$  crosses the  $y$ -axis at the point  $Q$ .

(b) Find the area of triangle  $OPQ$  where  $O$  is the origin.

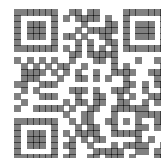
[6]

The curve has a stationary point at  $R$ .

(c) Find the  $x$ -coordinate of  $R$  in exact form.

[3]

Total: 10

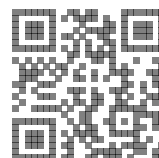


5.

$$f(x) \equiv 2x^2 + 4x + 2, \quad x \in \mathbb{R}, x \geq -1.$$

- (a) Express  $f(x)$  in the form  $a(x + b)^2 + c$ . [2]
- (b) Describe fully two transformations that would map the graph of  $y = x^2, x \geq 0$  onto the graph of  $y = f(x)$ . [3]
- (c) Find an expression for  $f^{-1}(x)$  and state its domain. [4]
- (d) Sketch the graphs of  $y = f(x)$  and  $y = f^{-1}(x)$  on the same diagram and state the relationship between them. [4]

Total: 13



6.

$$f(x) = e^{3x+1} - 2, \quad x \in \mathbb{R}.$$

- (a) State the range of  $f$ . [1]

The curve  $y = f(x)$  meets the  $y$ -axis at the point  $P$  and the  $x$ -axis at the point  $Q$ .

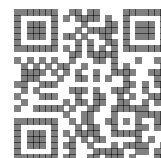
- (b) Find the exact coordinates of  $P$  and  $Q$ . [4]

- (c) Show that the tangent to the curve at  $P$  has the equation [4]

$$y = 3ex + e - 2.$$

- (d) Find to 3 significant figures the  $x$ -coordinate of the point where the tangent to the curve at  $P$  meets the tangent to the curve at  $Q$ . [4]

Total: 13



7. (a) Solve the equation

[2]

$$\pi - 3 \arccos(\theta) = 0.$$

(b) Sketch on the same diagram the curves

[5]

$$y = \arccos(x - 1), 0 \leq x \leq 2, \quad \text{and} \quad y = \sqrt{x + 2}, x \geq -2.$$

Given that  $\alpha$  is the root of the equation

$$\arccos(x - 1) = \sqrt{x + 2},$$

(c) show that  $0 < \alpha < 1$ ,

[3]

(d) use the iterative formula

[4]

$$x_{n+1} = 1 + \cos(\sqrt{x_n + 2})$$

with  $x_0 = 1$  to find  $\alpha$  correct to 3 decimal places.

Total: 14

