

# Solomon Practice Paper

## Core Mathematics 3L

Time allowed: 90 minutes

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

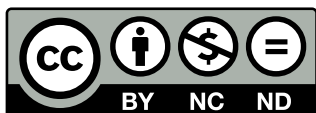
Name:

Teacher:

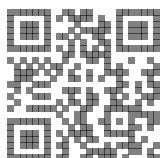
Question	Points	Score
1	6	
2	7	
3	8	
4	9	
5	9	
6	10	
7	12	
8	14	
Total:	75	

How I can achieve better:

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Last updated: May 5, 2023



1.

$$f(x) \equiv \frac{2x-3}{x-2}, \quad x \in \mathbb{R}, x > 2.$$

(a) Find the range of  $f$ . [2](b) Show that  $ff(x) = x$  for all  $x > 2$ . [3](c) Hence, write down an expression for  $f^{-1}(x)$ . [1]

Total: 6

2. Solve each equation, giving your answers in exact form.

(a)  $e^{4x-3} = 2$  [3](b)  $\ln(2y-1) = 1 + \ln(3-y)$  [4]

Total: 7

3. The curve  $C$  has the equation  $y = 2e^x - 6\ln(x)$  and passes through the point  $P$  with  $x$ -coordinate 1.(a) Find an equation for the tangent to  $C$  at  $P$ . [4]The tangent to  $C$  at  $P$  meets the coordinate axes at the points  $Q$  and  $R$ .(b) Show that the area of triangle  $OQR$ , where  $O$  is the origin, is  $\frac{9}{3-e}$ . [4]

Total: 8

4. (a) Express [5]

$$\frac{x-10}{(x-3)(x+4)} - \frac{x-8}{(x-3)(2x-1)}$$

as a single fraction in its simplest form.

(b) Hence, show that the equation [4]

$$\frac{x-10}{(x-3)(x+4)} - \frac{x-8}{(x-3)(2x-1)} = 1$$

has no real roots.

Total: 9

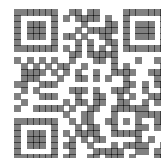
5. Find the values of  $x$  in the interval  $-180^\circ < x < 180^\circ$  for which [9]

$$\tan(x+45)^\circ - \tan(x)^\circ = 4,$$

giving your answers to 1 decimal place.

6. (a) Sketch on the same diagram the graphs of [6]

$$y = |x| - a \quad \text{and} \quad y = |3x + 5a|,$$



where  $a$  is a positive constant.

Show on your diagram the coordinates of any points where each graph meets the coordinate axes.

- (b) Solve the equation [4]

$$|x| - a = |3x + 5a|.$$

Total: 10

7. (a) Use the identity [3]

$$\cos(A + B) \equiv \cos(A)\cos(B) - \sin(A)\sin(B)$$

to prove that

$$\cos(x) \equiv 1 - 2\sin^2\left(\frac{x}{2}\right).$$

- (b) Prove that, for  $\sin(x) \neq 0$ , [3]

$$\frac{1 - \cos(x)}{\sin(x)} \equiv \tan\left(\frac{x}{2}\right).$$

- (c) Find the values of  $x$  in the interval  $0 \leq x \leq 360^\circ$  for which [6]

$$\frac{1 - \cos(x)}{\sin(x)} = 2\sec^2\left(\frac{x}{2}\right) - 5.$$

giving your answers to 1 decimal place where appropriate.

Total: 12

8. A curve has the equation  $y = (2x + 3)e^{-x}$ .

- (a) Find the exact coordinates of the stationary point of the curve. [4]

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

- (b) Find an equation for the normal to the curve at  $P$ . [2]

The normal to the curve at  $P$  meets the curve again at  $Q$ .

- (c) Show that the  $x$ -coordinate of  $Q$  lies in the interval  $[-2, -1]$ . [3]

- (d) Use the iterative formula [3]

$$x_{n+1} = \frac{3 - 3e^{x_n}}{e^{x_n} - 2},$$

with  $x_0 = -1$ , to find  $x_1, x_2, x_3$  and  $x_4$ . Give the value of  $x_4$  to 2 decimal places.

- (e) Show that your value for  $x_4$  is the  $x$ -coordinate of  $Q$  correct to 2 decimal places. [2]

Total: 14

