## Solomon Practice Paper

Further Pure Mathematics 2B

Time allowed: 90 minutes

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Name:

Teacher:

Question	Points	Score
1	7	
2	8	
3	9	
4	11	
5	12	
6	13	
7	15	
Total:	75	

How I can achieve better:

- •



July 14, 2025



1. Given that

$$y \arccos(x) - \frac{x}{\pi} e^{2x} - 1 = 0,$$

find the value of  $\frac{\mathrm{d}y}{\mathrm{d}x}$  at the point where x = 0, giving your answer in terms of  $\pi$ .



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2.

$$f(x) = 5\cosh(x) + 3\sinh(x).$$

The minimum value of f(x) occurs at the point  $(p \ln q, r)$  where p, q and r are integers. Find the values of p, q and r.



## Further Mathematics – Practice Paper 2B

- 3. The line y = mx + c is a tangent to the rectangular hyperbola with equation xy = -9.
  - (a) Show that  $c = \pm 6\sqrt{m}$ .
  - (b) Hence, or otherwise, find the equations of the tangents from the point (4, -2) to the rectangular hyperbola xy = -9.

Total: 9

[4]



4. The curve C is defined by

 $y^2 = x, \qquad x \ge 0, \qquad y \ge 0.$ 

The region between C, the x-axis and the line x = 1 is rotated through  $2\pi$  about the x-axis. Show that the area of the surface generated is

$$\frac{\pi}{6} \left( 5\sqrt{5} - 1 \right).$$

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[11]

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- 5. (a) Using the definition of  $\cosh x$  in terms of exponential functions, express  $\operatorname{sech}(x)$  in terms of [1]  $e^x$  and  $e^{-x}$ .
  - (b) Sketch the graph of  $y = \operatorname{sech}(x)$ .
  - (c) Show that

$$\int \operatorname{sech}(x) \, \mathrm{d}x = 2 \arctan e^x + c.$$

The curve C has equation  $y = \operatorname{sech}(x)$ . The region between C, the x-axis and the lines x = -a and x = a, where a is a positive constant, is rotated through  $2\pi$  about the x-axis.

- (d) Find the volume of revolution of the solid generated.
- (e) Find the limit of the volume of revolution as  $a \to \infty$ .

Total: 12

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[2]

[4]

[4]

[1]

$$I_n = \int_0^{\sqrt{2}} (2 - x^2)^n \, \mathrm{d}x, \qquad n \ge 0.$$

(a) Show that

$$I_n = \frac{4n}{2n+1}I_{n-1}, \qquad n \ge 1.$$

(b) Hence evaluate  $I_3$ , leaving your answer in surd form.

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[9]

[4]

7. The curve C has intrinsic equation

$$s = \ln\left(\tan\frac{1}{2}\psi\right), \qquad 0 < \psi \le \frac{\pi}{2}.$$

(a) Show that radius of curvature of C is given by $\rho = \operatorname{cosec} \psi$ .	[4]
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Given that 
$$y = \psi = \frac{\pi}{2}$$
 when  $x = 0$ ,  
(b) show that  $y = \psi$ , [4]

- (b) show that  $y = \psi$ ,
- (c) use integration to show that a Cartesian equation of C is  $x = \ln(\sin y)$ .

Total: 15

[7]

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