

**Subject – Math (Higher Level)**  
**Topic - Functions and Equations**  
**Year - Nov 2011 – Nov 2019**  
**Paper -2**

**Question 1**

*[Maximum mark: 3]*

Consider the graph of  $y = x + \sin(x - 3)$ ,  $-\pi \leq x \leq \pi$ .

- (a) Sketch the graph, clearly labelling the  $x$  and  $y$  intercepts with their values. *[3 marks]*

**Question 2**

*[Maximum mark: 7]*

Given that  $f(x) = \frac{1}{1 + e^{-x}}$ .

- (a) Find  $f^{-1}(x)$ , stating its domain. *[6 marks]*
- (b) Find the value of  $x$  such that  $f(x) = f^{-1}(x)$ . *[1 mark]*

**Question 3**

*[Maximum mark: 5]*

Let  $f(x) = \ln x$ . The graph of  $f$  is transformed into the graph of the function  $g$  by a translation of  $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$ , followed by a reflection in the  $x$ -axis. Find an expression for  $g(x)$ , giving your answer as a single logarithm.

**Question 4**

*[Maximum mark: 5]*

- (a) Sketch the curve  $y = \frac{\cos x}{\sqrt{x^2 + 1}}$ ,  $-4 \leq x \leq 4$  showing clearly the coordinates of the  $x$ -intercepts, any maximum points and any minimum points. *[4 marks]*

**Question 5**

*[Maximum mark: 4]*

Show that the quadratic equation  $x^2 - (5 - k)x - (k + 2) = 0$  has two distinct real roots for all real values of  $k$ .

# Ib Math HL Paper 22

**Sabine Zange**



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