

# IB Maths AA HL Unit 2 Functions Practice Exam: Mark Scheme

IB Mathematics: Analysis and Approaches HL · 11 questions · 60 marks

- M marks are for a correct method; A marks for an accurate answer that follows a correct method; R marks are for clear reasoning.
- Accept any correct method that reaches a correct answer, unless the question says which method to use.
- Practise these topics online with instant feedback: [ibmathrevision.com/HLAAUnit2](https://ibmathrevision.com/HLAAUnit2)

## Section A: no calculator

### Question 1

3 marks

$$(x - 5)(x + 3) < 0 \text{ (M1)}$$

critical values  $x = -3, 5$  **A1**

$$-3 < x < 5 \text{ A1}$$

### Question 2

4 marks

a.  $f(x) > 1$  **A1**

b.  $x > 2$  **A1**

$$x = 2 \text{ A1}$$

c.  $\ln(x - 2) = 0 \implies x = 3$  **A1**

### Question 3

5 marks

a.  $g(0) = -3$ :  $(0, -3)$  **A1**

$$2^x = 4 \implies x = 2$$
:  $(2, 0)$  **A1**

b.  $y = -4$  **A1**

c. increasing exponential shape, approaching  $y = -4$  as  $x \rightarrow -\infty$  **A1**  
intercepts  $(0, -3)$ ,  $(2, 0)$  shown **A1**

### Question 4

4 marks

a.  $x = e^{2y} - 3$  **(M1)**

$$f^{-1}(x) = \frac{1}{2} \ln(x + 3) \text{ A1}$$

b.  $x > -3$  **A1**

c. reflections of each other in the line  $y = x$  **A1**



**Question 5****10 marks**

- a.  $x = 3$  **A1**
- b. division:  $x^2 + x - 2 = (x - 3)(x + 4) + 10$  **M1A1**  
 $y = x + 4$  **A1**
- c.  $f'(x) = 1 - \frac{10}{(x - 3)^2} = 0$  **M1**  
 $x = 3 \pm \sqrt{10}$  **A1**  
 $(3 + \sqrt{10}, 7 + 2\sqrt{10}), (3 - \sqrt{10}, 7 - 2\sqrt{10})$  **A1A1**
- d.  $f(x) \leq 7 - 2\sqrt{10}$  or  $f(x) \geq 7 + 2\sqrt{10}$  **A1A1**

**Question 6****9 marks**

- a.  $g(g(x)) = \frac{2\frac{2x+1}{x-2} + 1}{\frac{2x+1}{x-2} - 2}$  **M1**  
 $= \frac{5x}{5} = x$  **A1AG**
- b. vertex at  $x = 2$  (**M1**)  
 $c = 2$  **A1**
- c.  $x = (y - 2)^2 - 4$  **M1**  
 $h^{-1}(x) = 2 + \sqrt{x + 4}$  **A1**  
 $x \geq -4$  **A1**
- d.  $h(-1) = 5 \neq h(1) = -3$ , and  $h(-1) \neq -h(1)$  **R1**  
neither **A1**

**Section B: calculator allowed****Question 7****4 marks**

- a. max  $(1, 5)$  **A1**  
min  $(3, 1)$  **A1**
- b.  $1 \leq f(x) \leq 5$  **A1A1**

**Question 8****4 marks**

- a.  $x > -2$  **A1**
- b.  $x = -1.22$  **A1**  
 $x = 2.21$  **A1**
- c.  $-1.22 < x < 2.21$  **A1**

**Question 9****6 marks**

- a.  $x = 0$  **A1**
- b. using technology,  $x = 2.52$  **A1**  
 $y = 4.76$  **A1**
- c.  $x^3 = -32 \implies x = -3.17$  **A1**
- d. two branches either side of  $x = 0$ ; right branch has a minimum, left branch crosses the  $x$ -axis **A1**  
asymptotic behaviour near  $x = 0$  and parabolic growth for large  $|x|$  **A1**



**Question 10****5 marks**

a.  $x = -2, x = 2$  **A1**

b.  $x = 1$  **A1**

c.  $x^2 - 4 = 3x - 3 \implies x^2 - 3x - 1 = 0$  **(M1)**

$x = -0.303$  or  $x = 3.30$  **A1A1**

**Question 11****6 marks**

a.  $90^\circ\text{C}$  **A1**

b.  $T(10) = 20 + 70e^{-0.8} = 51.5^\circ\text{C}$  **A1**

c.  $70e^{-0.08t} = 30$  **(M1)**

$t = \frac{\ln(7/3)}{0.08} = 10.6$  minutes **A1**

d.  $T = 20$  **A1**

the coffee cools towards room temperature,  $20^\circ\text{C}$  **R1**

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