

IB Diploma

# MATHEMATICS AA

SL P1

2012 — 2023

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1 - (MAT/12\_SL\_Summer\_2012\_Q2) - Functions - Roots

Let  $f(x) = 2x - 1$  and  $g(x) = 3x^2 + 2$ .

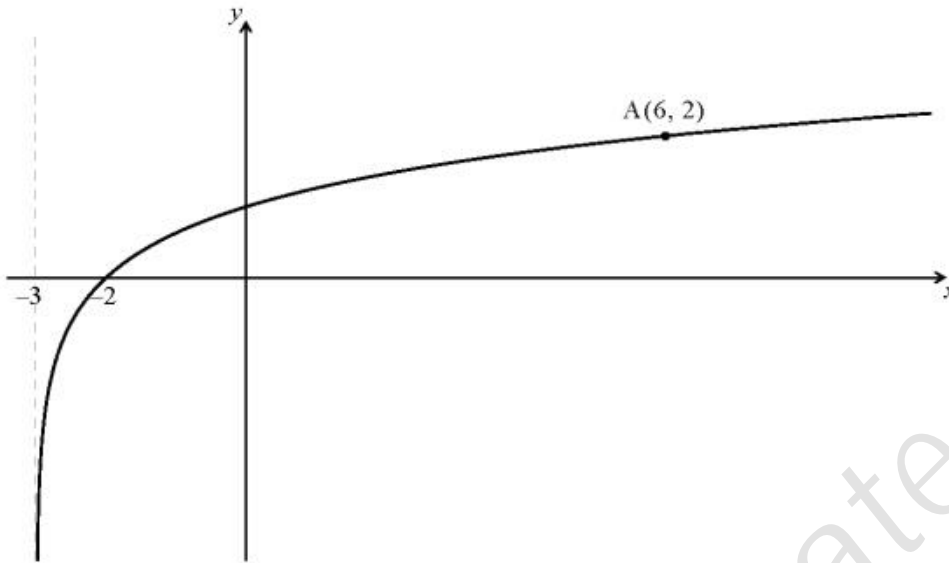
(a) Find  $f^{-1}(x)$ . [3 marks]

(b) Find  $(f \circ g)(1)$ . [3 marks]

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2 - (MAT/11\_SL\_Summer\_2012\_Q9) - Functions - Roots, Graphs

Let  $f(x) = \log_p(x+3)$  for  $x > -3$ . Part of the graph of  $f$  is shown below.



The graph passes through  $A(6, 2)$ , has an  $x$ -intercept at  $(-2, 0)$  and has an asymptote at  $x = -3$ .

(a) Find  $p$ . [4 marks]

The graph of  $f$  is reflected in the line  $y = x$  to give the graph of  $g$ .

(b) (i) Write down the  $y$ -intercept of the graph of  $g$ .  
 (ii) Sketch the graph of  $g$ , noting clearly any asymptotes and the image of  $A$ . [5 marks]

(c) Find  $g(x)$ . [4 marks]

3 - (MAT/12\_SL\_Summer\_2013\_Q1) - Functions - Roots

Let  $f(x) = 4x - 2$  and  $g(x) = -2x^2 + 8$ .

(a) Find  $f^{-1}(x)$ . [3 marks]

(b) Find  $(f \circ g)(1)$ . [3 marks]

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4 - (MAT/11\_SL\_Summer\_2013\_Q5) - Functions - Roots

Let  $f(x) = \sqrt{x-5}$ , for  $x \geq 5$ .

(a) Find  $f^{-1}(2)$ . [3 marks]

(b) Let  $g$  be a function such that  $g^{-1}$  exists for all real numbers. Given that  $g(30) = 3$ , find  $(f \circ g^{-1})(3)$ . [3 marks]

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# ANSWERS

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1 - (MAT/12\_SL\_Summer\_2012\_Q2) - Functions - Roots

(a) interchanging  $x$  and  $y$  (seen anywhere)

e.g.  $x = 2y - 1$

correct manipulation

e.g.  $x + 1 = 2y$

$$f^{-1}(x) = \frac{x+1}{2}$$

(b) **METHOD 1**

attempt to find  $g(1)$  or  $f(1)$

$$g(1) = 5$$

$$f(5) = 9$$

**METHOD 2**

attempt to form composite (in any order)

e.g.  $2(3x^2 + 2) - 1, 3(2x - 1)^2 + 2$

$$(f \circ g)(1) = 2(3 \times 1^2 + 2) - 1 \quad (= 6 \times 1^2 + 3)$$

$$(f \circ g)(1) = 9$$

2 - (MAT/11\_SL\_Summer\_2012\_Q9) - Functions - Roots, Graphs

- (a) evidence of substituting the point A  
e.g.  $2 = \log_p(6+3)$

(M1)

manipulating logs  
e.g.  $p^2 = 9$

A1

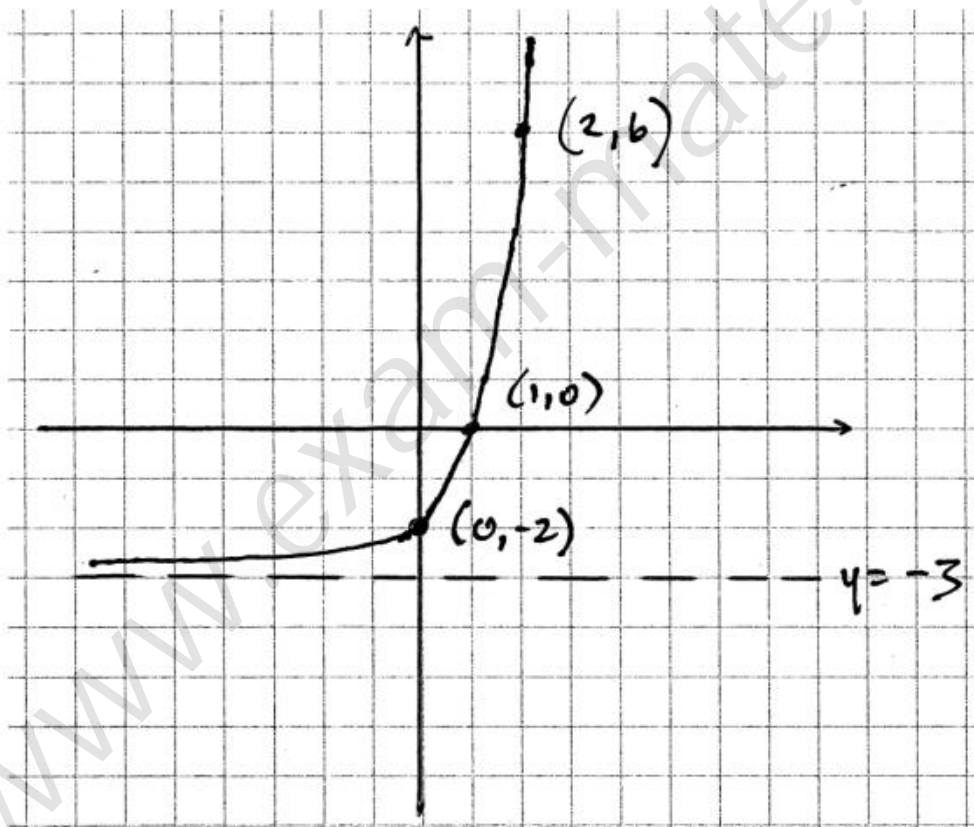
$$p = 3$$

A2

- (b) (i)  $y = -2$  (accept  $(0, -2)$ )

A1

(ii)





**(c) METHOD 1**

recognizing that  $g = f^{-1}$

evidence of valid approach

e.g. switching  $x$  and  $y$  (seen anywhere), solving for  $x$

correct manipulation

e.g.  $3^x = y + 3$

$$g(x) = 3^x - 3$$

**METHOD 2**

recognizing that  $g(x) = a^x + b$

identifying vertical translation

e.g. graph shifted down 3 units,  $f(x) - 3$

evidence of valid approach

e.g. substituting point to identify the base

$$g(x) = 3^x - 3$$

3 - (MAT/12\_SL\_Summer\_2013\_Q1) - Functions - Roots

(a) interchanging  $x$  and  $y$  (seen anywhere)

eg  $x = 4y - 2$

evidence of correct manipulation

eg  $x + 2 = 4y$

$$f^{-1}(x) = \frac{x+2}{4} \left( \text{accept } y = \frac{x+2}{4}, \frac{x+2}{4}, f^{-1}(x) = \frac{1}{4}x + \frac{1}{2} \right)$$

(b) METHOD 1

attempt to substitute 1 into  $g(x)$

eg  $g(1) = -2 \times 1^2 + 8$

$$g(1) = 6$$

$$f(6) = 22$$

METHOD 2

attempt to form composite function (in any order)

eg  $(f \circ g)(x) = 4(-2x^2 + 8) - 2 = (-8x^2 + 30)$

correct substitution

eg  $(f \circ g)(1) = 4(-2 \times 1^2 + 8) - 2 = -8 + 30$

$$f(6) = 22$$

4 - (MAT/11\_SL\_Summer\_2013\_Q5) - Functions - Roots

(a) **METHOD 1**

attempt to set up equation

$$\text{eg } 2 = \sqrt{y-5}, 2 = \sqrt{x-5}$$

correct working

$$\text{eg } 4 = y-5, x = 2^2 + 5$$

$$f^{-1}(2) = 9$$

**METHOD 2**

interchanging  $x$  and  $y$  (seen anywhere)

$$\text{eg } x = \sqrt{y-5}$$

correct working

$$\text{eg } x^2 = y-5, y = x^2 + 5$$

$$f^{-1}(2) = 9$$

(b) recognizing  $g^{-1}(3) = 30$

$$\text{eg } f(30)$$

correct working

$$\text{eg } (f \circ g^{-1})(3) = \sqrt{30-5}, \sqrt{25}$$

$$(f \circ g^{-1})(3) = 5$$