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**A Level Mathematics Year 2 Exam Questions by Topic**  
**Chapter 4: Functions - Compositions, Inverses, Domain and Range**

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These questions are taken from the Specimen Exam materials and the real 2018 papers for the new syllabus AS and A-level mathematics courses and arranged by chapter of the textbooks by Goldie et al (available here: <https://amzn.to/39umfr5> and <https://amzn.to/3hE8kBL> ). There are a mixture of questions from OCR A, OCR B (MEI), Edexcel and AQA. Although the style of questions varies a little across the exam boards the content of the syllabus is almost identical so these are suitable for students preparing for any exam board.

Free problem sets for all other chapters, as well as video solutions, full past papers and other content for GCSE and A-level maths can be found at:

<https://mathsaurus.com/>

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OCR A Sample Paper 1 Question 11:

- 11** For all real values of  $x$ , the functions  $f$  and  $g$  are defined by  $f(x) = x^2 + 8ax + 4a^2$  and  $g(x) = 6x - 2a$ , where  $a$  is a positive constant.
- (i) Find  $fg(x)$ . Determine the range of  $fg(x)$  in terms of  $a$ . [4]
- (ii) If  $fg(2) = 144$ , find the value of  $a$ . [3]
- (iii) Determine whether the function  $fg$  has an inverse. [2]
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OCR B MEI 2018 Paper 3 Question 9:

- 9** The function  $f(x) = \frac{e^x}{1 - e^x}$  is defined on the domain  $x \in \mathbb{R}, x \neq 0$ .
- (i) Find  $f^{-1}(x)$ . [3]
- (ii) Write down the range of  $f^{-1}(x)$ . [1]
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OCR B MEI Sample Paper 2 Question 4:

4 The function  $f(x)$  is defined by  $f(x) = x^3 - 4$  for  $-1 \leq x \leq 2$ .

For  $f^{-1}(x)$ , determine

- The domain
- The range.

[5]

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AQA 2018 Paper 1 Question 4:

4 The function  $f$  is defined by  $f(x) = e^{x-4}$ ,  $x \in \mathbb{R}$

Find  $f^{-1}(x)$  and state its domain.

[3 marks]

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Edexcel 2018 Paper 2 Question 1:

1.

$$g(x) = \frac{2x + 5}{x - 3} \quad x \geq 5$$

(a) Find  $gg(5)$ .

(2)

(b) State the range of  $g$ .

(1)

(c) Find  $g^{-1}(x)$ , stating its domain.

(3)

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Edexcel Sample Paper 2 Question 4:

4. Given

$$f(x) = e^x, \quad x \in \mathbb{R}$$

$$g(x) = 3 \ln x, \quad x > 0, x \in \mathbb{R}$$

(a) find an expression for  $gf(x)$ , simplifying your answer.

(2)

(b) Show that there is only one real value of  $x$  for which  $gf(x) = fg(x)$

(3)

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AQA Sample Paper 1 Question 10:

10 The function  $f$  is defined by

$$f(x) = 4 + 3^{-x}, \quad x \in \mathbb{R}$$

10 (a) Using set notation, state the range of  $f$

[2 marks]

10 (b) The inverse of  $f$  is  $f^{-1}$

10 (b) (i) Using set notation, state the domain of  $f^{-1}$

[1 mark]

10 (b) (ii) Find an expression for  $f^{-1}(x)$

[3 marks]

10 (c) The function  $g$  is defined by

$$g(x) = 5 - \sqrt{x}, \quad (x \in \mathbb{R} : x > 0)$$

10 (c) (i) Find an expression for  $gf(x)$

[1 mark]

10 (c) (ii) Solve the equation  $gf(x) = 2$ , giving your answer in an exact form.

[3 marks]

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OCR A 2018 Paper 1 Question 9:

9 The function  $f$  is defined for all real values of  $x$  as  $f(x) = c + 8x - x^2$ , where  $c$  is a constant.

(i) Given that the range of  $f$  is  $f(x) \leq 19$ , find the value of  $c$ .

[3]

(ii) Given instead that  $ff(2) = 8$ , find the possible values of  $c$ .

[4]

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OCR A 2018 Paper 3 Question 4:

**4 In this question you must show detailed reasoning.**

The functions  $f$  and  $g$  are defined for all real values of  $x$  by

$$f(x) = x^3 \quad \text{and} \quad g(x) = x^2 + 2.$$

(i) Write down expressions for

(a)  $fg(x)$ , [1]

(b)  $gf(x)$ . [1]

(ii) Hence find the values of  $x$  for which  $fg(x) - gf(x) = 24$ . [6]

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