

Cambridge International AS & A Level

Mathematics

9709

Paper 1 Pure Mathematics 1

Topic 2-Functions

Question No (24)

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Functions f and g are defined by

$$f: x \rightarrow 10 - 3x, \quad x \in \mathbb{R},$$

$$g: x \rightarrow \frac{10}{3-2x} \quad x \in \mathbb{R}, x \neq \frac{3}{2}.$$

Solve the equation $ff(x) = gf(2)$

Solution

$$\begin{aligned}
 f: x &\rightarrow 10 - 3x \\
 f(x) &= 10 - 3x \\
 \text{and } g: x &\rightarrow \frac{10}{3-2x} \\
 \Rightarrow g(x) &= \frac{10}{3-2x} \\
 \text{Equation to solve} \\
 ff(x) &= gf(2) \rightarrow \textcircled{1} \\
 f(f(x)) &= 10 - 3(f(x)) \\
 &= 10 - 3(10 - 3x) \\
 &= 10 - 30 + 9x \\
 f(f(x)) &= -20 + 9x \\
 \text{now } f(x) &= 10 - 3x \\
 f(2) &= 10 - 3(2) \\
 &= 10 - 6 = 4 \\
 g(f(2)) &= \frac{10}{3-2(f(2))} \\
 &= \frac{10}{3-2(4)} = \frac{10}{3-8} = \frac{10}{-5} = -2
 \end{aligned}$$

putting the value of $f(f(x))$
and $g(f(2))$ in ①

$$-20 + 9x = -2$$

$$9x = -2 + 20$$

$$9x = 18$$

$$x = 18/9$$

$$x = 2$$