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JC MATHEMATICS (H2) STUDY TIPS

**TWO POWERFUL TACTICS FOR
FINDING THE RANGE OF A
COMPOSITE FUNCTION**

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JC_H2Maths_036



Quick Practice

It is given that

$$f : x \mapsto 2x - 1, \quad x \in \mathbb{R},$$

$$g : x \mapsto (x-1)(x-3), \quad x \in \mathbb{R},$$

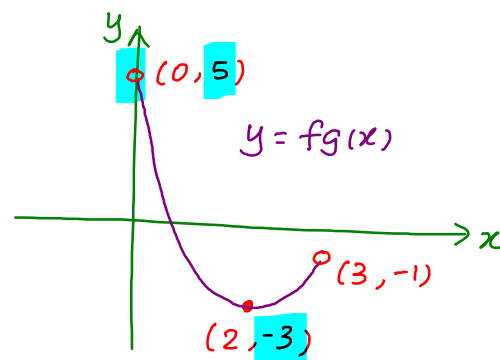
$$x \in \mathbb{R},$$

$$0 < x < 3.$$

Find the range of the composite function $fg(x)$.

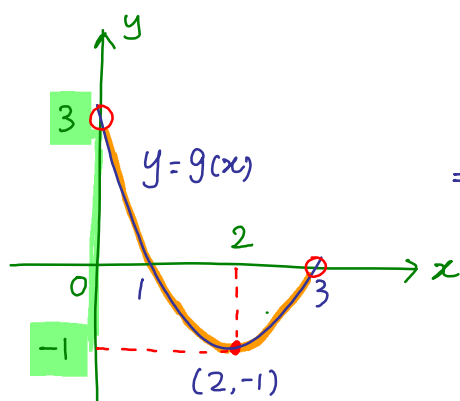
Method 1 (with known $fg(x)$)

$$\begin{aligned} fg(x) &= f((x-1)(x-3)) \\ &= 2(x-1)(x-3) - 1 \\ &= 2(x^2 - 4x + 3) - 1 \\ &= 2x^2 - 8x + 5, \quad 0 < x < 3. \end{aligned}$$

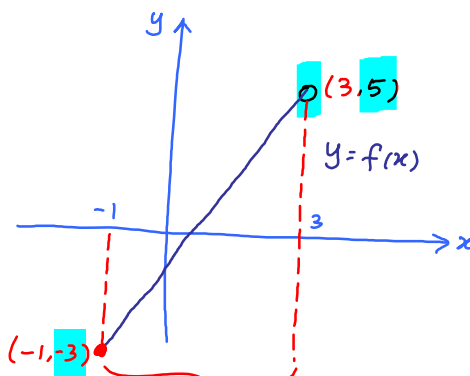


$$\therefore R_{fg} = [-3, 5)$$

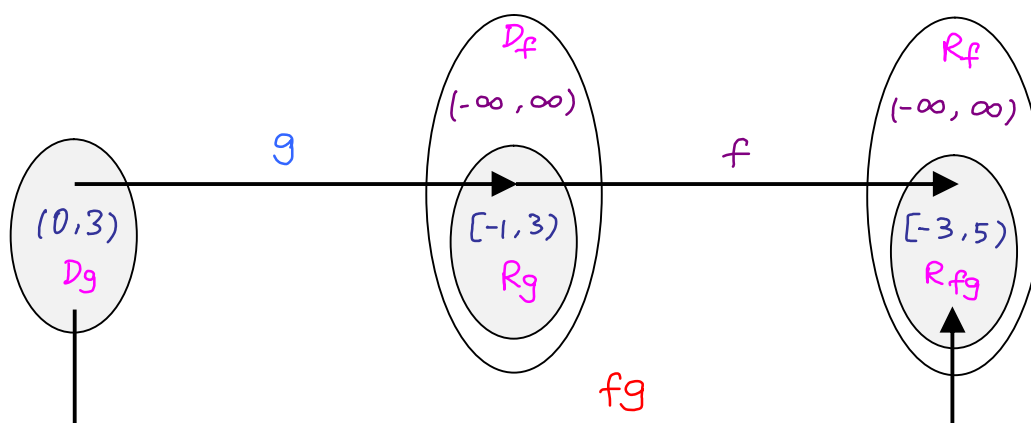
Method 2 (without knowing $fg(x)$)



$$\Rightarrow R_g = [-1, 3)$$



$$\therefore R_{fg} = [-3, 5)$$





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Explanation

Here is a handy tip to master the two distinct ways of finding the range of a combined function. The first method is the direct approach: you merge the inner and outer operations together from the very beginning to create one single, unified function.

Once you have this brand new function, you simply graph or analyze it across your original starting boundaries to see the absolute highest and lowest levels it reaches. The second method is the step-by-step relay: instead of building a new formula, you focus entirely on the inner function first.

Figure out the full span of outputs that the inner function spits out, and then treat that exact span as the brand new set of inputs for the outer function.

By tracking how the outer function behaves over these new inputs, you will successfully uncover the final overall range without ever needing to algebraically combine the two functions.

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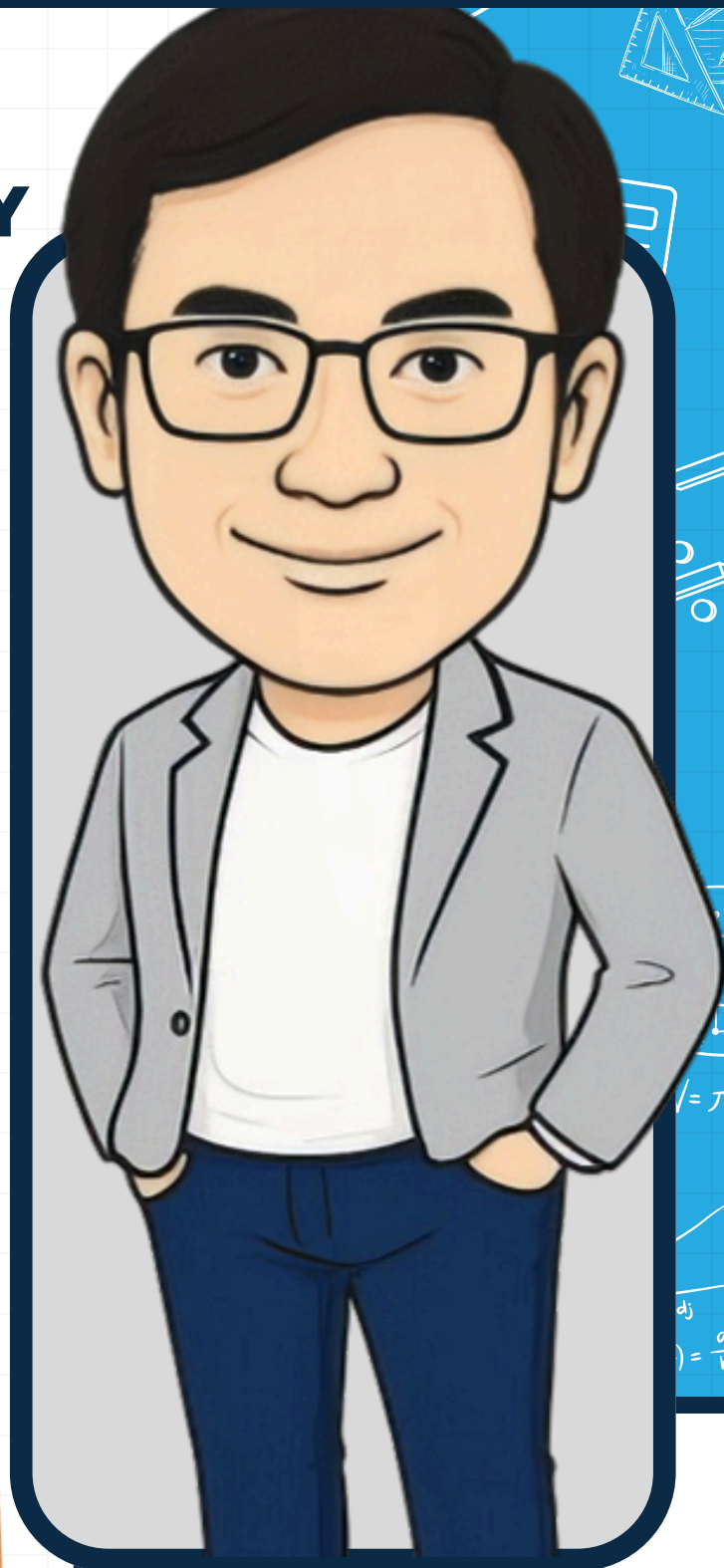
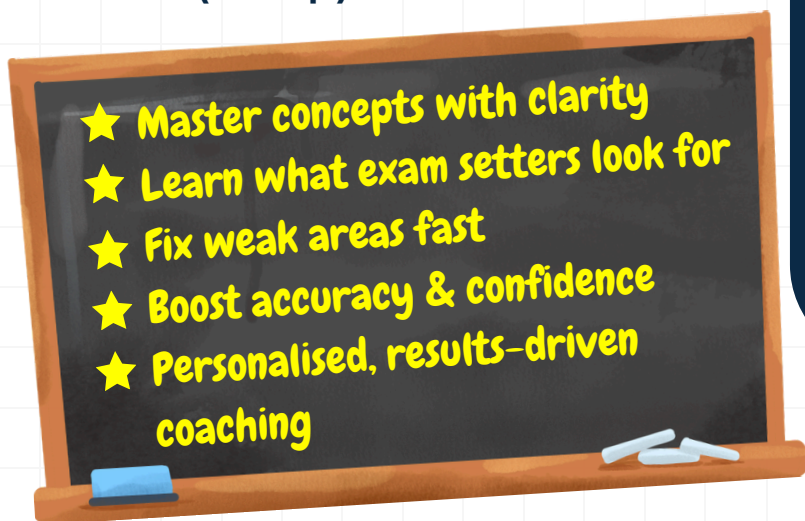
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