The inverse rule for composite functions work as follows: $(fg)^{-1} = g^{-1}f^{-1}$

When is this actually useful?

To find $(fg)^{-1}$, at times after obtaining the expression for fg it might be rather difficult (or seemingly impossible) to obtain its inverse. However, you can simply find the expressions for f^{-1} and g^{-1} separately, then subsequently embed g^{-1} within f^{-1} to give $g^{-1}f^{-1}$. This is exactly equivalent to $(fg)^{-1}$.

While such an application is less common in examination questions, nonetheless it would be good to have this knowledge. I have worked out the proof for the interested student below:

Let $h = (fg)^{-1}$

Then $h^{-1} = fg$

$f^{-1}h^{-1} = f^{-1}(fg) = g$ (append f^{-1} to the **front** of both sides of the equation)

$g^{-1}f^{-1}h^{-1} = g^{-1}g = x$ (append g^{-1} to the **front** of both sides of the equation)

$\therefore \quad (g^{-1}f^{-1}h^{-1})h = h(x) \Rightarrow h(x) = g^{-1}f^{-1}$ (shown)

(append h to the **back** of both sides of the equation)