Product:

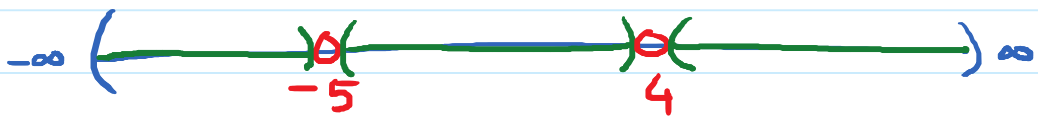
$$(f\cdot g)(x) = \frac{3}{x-4}\cdot\frac{1}{x+5} = \boxed{\frac{3}{(x-4)(x+5)}}$$

Domain of $f+g$, $f-g$, $f\cdot g$.

$$D = D_f \cap D_g .$$

$$f(x) = \frac{3}{x-4}. \quad D_f = (-\infty, 4)\cup(4,\infty)$$

$$g(x) = \frac{1}{x+5}. \quad D_g = (-\infty,-5)\cup(-5,\infty)$$

$D_f \cap D_g =$ 

So, $D_f \cap D_g = \boxed{(-\infty,-5)\cup(-5,4)\cup(4,\infty)}$

* Quotient:

$$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)} = \frac{\frac{3}{x-4}}{\frac{1}{x+5}} = \frac{3}{x-4} \cdot \frac{x+5}{1}$$

$$= \frac{3(x+5)}{1(x-4)} = \frac{3x+15}{x-4}.$$

Domain of quotient: (1) $D_f \cap D_g = (-\infty,-5) \cup (-5,4) \cup (4,\infty)$

(2) $g(x)=0$: $\frac{1}{x+5}=0 \rightarrow$ No solution.

(b/c numerator $= 1 \neq 0$)

$\rightarrow$ Don't need to exclude anything from $D_f \cap D_g$.

So, Domain of $\frac{f}{g}$ is $\boxed{(-\infty,-5) \cup (-5,4) \cup (4,\infty)}$

(2) Composition of Functions

$f(x)$; $g(x)$: given function

(a) $(f \circ g)(x) = f(g(x)) \rightarrow$ this means that we go into the formula for f and we replace all the x in the formula by formula of g.

read as f "circle" g

or f of g of x

E.g. $f(x) = \boxed{x} - 7$; $g(x) = x^2 + 2$.

$(f \circ g)(x) = f(g(x)) = (x^2+2) - 7$

$= \boxed{x^2 - 5}$

(b) $(g \circ f)(x) = g(f(x))$ → we go into formula for g and we replace all the x by formula for f.

E.g. $f(x) = x - 7$; $g(x) = \boxed{x}^2 + 2$

$(g \circ f)(x) = g(f(x)) = (x-7)^2 + 2$

$= (x-7)(x-7) + 2$

$= x^2 - 14x + 49 + 2$

$= \boxed{x^2 - 14x + 51}$

Ex. Given $f(x) = x^2 + 2$; $g(x) = \sqrt{x-4}$

Find $(f \circ g)(x)$ and $(g \circ f)(x)$

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$$(f \circ g)(x) = f(g(x)) = \left(\sqrt{x-4}\right)^2 + 2$$

$$= x - 4 + 2 = \boxed{x-2}$$

$$(g \circ f)(x) = g(f(x)) = \sqrt{(x^2+2) - 4}$$

$$= \sqrt{x^2 + 2 - 4}$$

$$= \sqrt{x^2 - 2}$$