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Given $f(x) = \underline{x^2 - 3x + 1}$ and $g(x) = \underline{4x + 5}$, find each function.

$$\begin{aligned}(f+g)(x) &= f(x) + g(x) = (x^2 - 3x + 1) + (4x + 5) \\ &= x^2 - \underline{3x} + \underline{1} + \underline{4x} + \underline{5} \\ &\quad \text{(f+g)(x)} = x^2 + x + 6\end{aligned}$$

$$\begin{aligned}(f-g)(x) &= f(x) - g(x) = (x^2 - 3x + 1) - (4x + 5) \\ &= x^2 - \underline{3x} + \underline{1} - \underline{4x} - \underline{5} \\ &\quad \text{(f-g)(x)} = x^2 - 7x - 4\end{aligned}$$

$$\begin{aligned}(f \cdot g)(x) &= f(x) \cdot g(x) = (x^2 - 3x + 1)(4x + 5) \\ &= 4x^3 + 5x^2 - \underline{12x^2} - \underline{15x} + \underline{4x} + \underline{5} \\ &\quad \text{(f \cdot g)(x)} = 4x^3 - 7x^2 - 11x + 5\end{aligned}$$

$$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}, g(x) \neq 0 \quad \text{if } \frac{x^2 - 3x + 1}{4x + 5}, x \neq -\frac{5}{4}$$

$$\begin{aligned}4x + 5 &= 0 \\ 4x &= -5 \\ x &= -\frac{5}{4}\end{aligned}$$

Composition of functions

$$[f \circ g](x) = f[g(x)] = f(g(x))$$

f of g of x .

$$f(x) = x + 3$$

$$f(2) = 2 + 3 = 5$$

$$f(y) = y + 3$$

$$f(m-7) = (m-7) + 3 = m - 4$$

$$f(x) = x + 4$$

$$[f \circ g](x) = f[g(x)]$$

$$= f(2x-1) = (2x-1) + 4$$

$$\boxed{[f \circ g](x) = 2x + 3}$$

$$g(x) = 2x - 1$$

$$[g \circ f](x) = g[f(x)]$$

$$= g(x+4) = 2(x+4) - 1$$

$$= 2x + 8 - 1$$

$$\boxed{[g \circ f](x) = 2x + 7}$$

$$f(x) = 3x - 5$$

$$[f \circ g](x) = f[g(x)]$$

$$= f(x+2) = 3(x+2) - 5$$

$$= 3x + 6 - 5$$

$$\boxed{[f \circ g](x) = 3x + 1}$$

$$g(x) = x + 2$$

$$[g \circ f](x) = g[f(x)]$$

$$= g(3x-5) = (3x-5) + 2$$

$$\boxed{[g \circ f](x) = 3x - 3}$$

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