

1.) Given $f(x) = 2x - 5$ and $g(x) = 2 - x$, find

(a) $(f + g)(x)$

$$2x - 5 + 2 - x$$

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

(c) $(fg)(x)$

$$(2x - 5)(2 - x)$$
$$4x - 2x^2 - 10 + 5x$$

$$(fg)(x) = -2x^2 + 9x - 10$$

(b) $(f - g)(6)$

$$2x - 5 - (2 - x)$$
$$2(6) - 5 - (2 - (6))$$

$$12 - 5 - 2 + 6$$
$$(f - g)(x) = 11$$

(d) $(\frac{f}{g})(x)$

$$(\frac{f}{g})(x) = \frac{2x - 5}{2 - x}$$

2.) Given $f(x) = \frac{2}{x}$ and $g(x) = \frac{1}{x^2}$, find

(a) $(f + g)(x)$

$$x \cdot \frac{2}{x} + \frac{1}{x^2}$$

$$\frac{2x}{x^2} + \frac{1}{x^2} = \frac{2x + 1}{x^2} = (f + g)(x)$$

(c) $(fg)(x)$

$$\frac{2}{x} \cdot \frac{1}{x^2}$$

$$(fg)(x) = \frac{2}{x^3}$$

(b) $(f - g)(x)$

$$x \cdot \frac{2}{x} - \frac{1}{x^2}$$

$$(f - g)(x) = \frac{2x - 1}{x^2}$$

(d) $(\frac{f}{g})(3)$

$$\frac{2}{x} \div \frac{1}{x^2} = \frac{2}{x} \cdot \frac{x^2}{1} = 2x$$

$$(\frac{f}{g})(3) = 6$$

3.) Given $f(x) = x^2$ and $g(x) = 2x + 5$, find

(a) $(f + g)(x)$

$$(f + g)(x) = x^2 + 2x + 5$$

(b) $(f - g)(-4)$

$$x^2 - (2x + 5)$$
$$(-4)^2 - (2(-4) + 5)$$
$$16 - (-8 + 5) = 16 - (-3)$$

$$(f - g)(-4) = 19$$

(d) $(\frac{f}{g})(x)$

$$\frac{x^2}{2x + 5} = (\frac{f}{g})(x)$$

(c) $(fg)(-2)$

$$(x^2)(2x + 5)$$

$$(-2)^2 (2(-2) + 5)$$

$$(4)(-4 + 5) = (4)(1)$$

$$(fg)(-2) = 4$$

4.) Given $f(x) = 4x - 3$ and $g(x) = 2x - 5$, find

(a) $f(g(x))$

$$\begin{aligned} & 4(\quad) - 3 \\ & 4(2x - 5) - 3 \\ & 8x - 20 - 3 \end{aligned}$$

$$\boxed{f(g(x)) = 8x - 23}$$

(b) $g(f(x))$

$$\begin{aligned} & 2(\quad) - 5 \\ & 2(4x - 3) - 5 \\ & 8x - 6 - 5 \end{aligned}$$

$$\boxed{g(f(x)) = 8x - 11}$$

5.) Given $f(x) = x^2 - 3x$ and $g(x) = x - 3$, find

(a) $(f \circ g)(x)$

$$\begin{aligned} & (\quad)^2 - 3(\quad) \\ & (x - 3)^2 - 3(x - 3) \\ & (x - 3)(x - 3) - 3(x - 3) \\ & x^2 - 3x - 3x + 9 - 3x + 9 \end{aligned}$$

$$\boxed{(f \circ g)(x) = x^2 - 9x + 18}$$

(c) $f(g(1))$

$$\begin{aligned} f(g(x)) &= x^2 - 9x + 18 \\ f(g(1)) &= (1)^2 - 9(1) + 18 \\ f(g(1)) &= 1 - 9 + 18 \end{aligned}$$

$$\boxed{f(g(1)) = 10}$$

(b) $(g \circ f)(x)$

$$\begin{aligned} (g \circ f)(x) &= (\quad) - 3 \\ &= (x^2 - 3x) - 3 \\ &= \boxed{x^2 - 3x - 3} \end{aligned}$$

(d) $(g \circ f)(2)$

$$\begin{aligned} (g \circ f)(x) &= x^2 - 3x - 3 \\ (g \circ f)(2) &= (2)^2 - 3(2) - 3 \\ &= 4 - 6 - 3 \\ &= \boxed{-5} \end{aligned}$$

(e) $(f \circ f)(x)$

$$\begin{aligned} & (\quad)^2 - 3(\quad) \\ & (x^2 - 3x)^2 - 3(x^2 - 3x) \\ & (x^2 - 3x)(x^2 - 3x) - 3(x^2 - 3x) \\ & x^4 - 3x^3 - 3x^3 + 9x^2 - 3x^2 + 9x \end{aligned}$$

$$\boxed{(f \circ f)(x) = x^4 - 6x^3 + 6x^2 + 9x}$$

(f) $g(g(10))$

$$\begin{aligned} g(10) &= 10 - 3 = 7 \\ g(g(10)) &= (7) - 3 \\ &= \boxed{4} \end{aligned}$$