Review Exercise Set 5

Exercise 1: Find $(f + g)(x)$ for the given functions.

$f(x) = 2x + 1$ and $g(x) = -x^2 - 2$

Exercise 2: Find $(fg)(x)$ for the given functions.

$f(x) = 2x + 6$ and $g(x) = \frac{4x-3}{x^2-9}$

Exercise 3: Find the composite function $(f \circ g)(x)$ and its domain for the given functions.

$f(x) = \sqrt{x}$ and $g(x) = 3x + 2$

Exercise 4: Find the composite function $(g \circ f)(x)$ and its domain for the given functions.

f(x) = $\frac{5}{2x+7}$ and g(x) = $\frac{2x}{x+4}$

Exercise 5: Find $(f \circ g)(x)$ for the given functions and then evaluate it at x = 3.

f(x) = $3x^2$ - 1 and g(x) = x + 2

Review Exercise Set 5 Answer Key

Exercise 1: Find (f + g)(x) for the given functions.

$f(x) = 2x + 1$ and $g(x) = -x^2 - 2$

$(f + g)(x) = f(x) + g(x)$
$(f + g)(x) = (2x + 1) + (-x^2 - 2)$
$(f + g)(x) = -x^2 + 2x - 1$

Exercise 2: Find (fg)(x) for the given functions.

$f(x) = 2x + 6$ and $g(x) = \frac{4x-3}{x^2-9}$

$$\begin{aligned}(fg)(x) &= f(x) \times g(x) \\ &= (2x+6)\left(\frac{4x-3}{x^2-9}\right) \\ &= 2(x+3)\left(\frac{4x-3}{(x+3)(x-3)}\right) \\ &= 2\left(\frac{4x-3}{x-3}\right) \\ &= \frac{8x-6}{x-3}\end{aligned}$$

Exercise 3: Find the composite function $(f \circ g)(x)$ and its domain for the given functions.

$f(x) = \sqrt{x}$ and $g(x) = 3x + 2$

$$\begin{aligned}(f \circ g)(x) &= f\left[g(x)\right] \\ &= f\left[3x+2\right] \\ &= \sqrt{3x+2}\end{aligned}$$

The radicand must be greater than or equal to zero so

$$\begin{aligned}3x+2 &\geq 0 \\ 3x &\geq -2 \\ x &\geq -\frac{2}{3}\end{aligned}$$

The domain and range of g(x) is all real numbers since it is a linear function. Therefore, the domain of the composite function is restricted only by the radicand making the domain $\left[-\frac{2}{3}, \infty\right)$.

Exercise 4: Find the composite function $(g \circ f)(x)$ and its domain for the given functions.

f(x) = $\frac{5}{2x+7}$ and g(x) = $\frac{2x}{x+4}$

$$
\begin{aligned}
(g \circ f)(x) &= g\left[f(x)\right] \\
&= g\left[\frac{5}{2x+7}\right] \\
&= \frac{2\left(\frac{5}{2x+7}\right)}{\frac{5}{2x+7}+4} \\
&= \frac{2\left(\frac{5}{2x+7}\right)}{\frac{5}{2x+7}+4} \times \frac{2x+7}{2x+7} \\
&= \frac{2(5)}{5+4(2x+7)} \\
&= \frac{10}{8x+33}
\end{aligned}
$$

The denominator of the composite function cannot be zero

$$
\begin{aligned}
8x+33 &\neq 0 \\
8x &\neq -33 \\
x &\neq -\frac{33}{8}
\end{aligned}
$$

$-\frac{33}{8}$ must be excluded from the domain of the composite function

Domain of g(x) is all real numbers except -4 since this would make the denominator equal to zero, so -4 must also be excluded from the domain of the composite function.

Domain of $(g \circ f)(x)$ is $\left(-\infty, -\frac{33}{8}\right) \cup \left(-\frac{33}{8}, -4\right) \cup (-4, \infty)$

Exercise 5: Find $(f \circ g)(x)$ for the given functions and then evaluate it at x = 3.

f(x) = $3x^2$ - 1 and g(x) = x + 2

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

$$\begin{aligned}(f \circ g)(x) &= f\left[g(x)\right] \\ &= f\left[x+2\right] \\ &= 3(x+2)^2 - 1 \\ &= 3\left(x^2 + 4x + 4\right) - 1 \\ &= 3x^2 + 12x + 12 - 1 \\ &= 3x^2 + 12x + 11\end{aligned}$$

Find $(f \circ g)(3)$

$$\begin{aligned}(f \circ g)(x) &= 3x^2 + 12x + 11 \\ (f \circ g)(3) &= 3(3)^2 + 12(3) + 11 \\ &= 3(9) + 36 + 11 \\ &= 27 + 47 \\ &= 74\end{aligned}$$