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# Operations on Functions

Name: _____ Date: _____

## Concepts

- Operations on Functions (theory)
- The Composition of Functions (theory)
- The Difference of Functions (theory)
- The Product of Functions (theory)
- The Quotient of Functions (theory)
- The Sum of Functions (theory)

### Operations on Functions

**1.** Let $f(x) = \sqrt{x-4}$ and $g(x) = x - 9$.

**a)** Evaluate $(f+g)(8)$ and $(f \cdot g)(13)$.

**b)** Give the domain of $\dfrac{f}{g}$ in Québec interval notation, and name the *two* different restrictions that produce it.

### The Composition of Functions

**2.** Let $f(x) = 2x - 5$ and $g(x) = x^2 + 1$.

**a)** Find the rules of $(f \circ g)(x)$ and $(g \circ f)(x)$, and use them to show that composition is not commutative.

**b)** Evaluate $(f \circ g)(3)$ and solve $(g \circ f)(x) = 1$.

### The Difference of Functions

**3.** Let $f(x) = \sqrt{x-2}$ and $g(x) = 3x - 1$.

**a)** Write the rule of $(f-g)(x)$ and the rule of $(g-f)(x)$, and give the domain of each.

**b)** Evaluate $(f-g)(6)$.

**c)** A student claims that $f-g$ and $g-f$ are "the same function written the other way round". Explain why this is false, then determine whether there is any value of $x$ at which the two rules give the same number.

### The Product of Functions

**4.** Let $f(x) = \sqrt{x+4}$ and $g(x) = \dfrac{1}{x-2}$. Give the rule of $(f \cdot g)(x)$, determine its domain, and evaluate $(f \cdot g)(0)$.

### The Quotient of Functions

**5.** Let $f(x) = x^2 - 9$ and $g(x) = x - 3$, both defined on $\mathbb{R}$.

**a)** Give the simplified rule of $\left(\frac{f}{g}\right)(x)$ and its domain.

**b)** Evaluate $\left(\frac{f}{g}\right)(5)$.

**c)** The simplified rule is a first-degree polynomial, which is defined for every real number. Explain why $x = 3$ must nevertheless be excluded.

### The Sum of Functions

**6.** Let $f(x) = 2x - 5$, defined on $\mathbb{R}$, and $g(x) = \sqrt{x - 1}$.

**a)** Give the rule and the domain of $(f + g)$.

**b)** Evaluate $(f + g)(10)$.

**c)** Explain why the domain of a sum of two functions is the intersection of their domains, using $x = 0$ as an illustration.