

Day 1: Function Notation

Date _____

Period _____

Function Notation Review

1) Use the following functions for the problems below.

$$f(x) = 7x - 3$$

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

$$h(x) = \frac{2x+1}{x-2}$$

$$k(x) = \sqrt{x+3}$$

$$y = 10x + 50$$

$$f(x) = 10x + 50$$

$$f(20) = 10(20) + 50$$

$$f(12) = 10(12) + 50$$

$$\begin{aligned} 2) f(2) &= 7(2) - 3 \\ &= 14 - 3 \\ &= 11 \end{aligned}$$

$$\begin{aligned} 3) g(4) &= (4)^2 + 2 \\ &= 16 + 2 \\ &= 18 \end{aligned}$$

$$\begin{aligned} 4) h(6) &= \frac{2(6)+1}{6-2} \\ &= \frac{13}{4} \\ &= 3.25 \end{aligned}$$

$$5) h(5) = \frac{2(5)+1}{5-2} = \frac{11}{3}$$

$$\begin{aligned} 6) f(0) &= 7(0) - 3 \\ &= -3 \end{aligned}$$

$$\begin{aligned} 7) g(-6) &= (-6)^2 + 2 \\ &= 36 + 2 \\ &= 38 \end{aligned}$$

$$\begin{aligned} 8) k(-28) &= \sqrt{-28+3} \\ &= \sqrt{-25} \\ &= \sqrt{-1} \cdot \sqrt{25} \\ &= \pm 5i \end{aligned}$$

$$9) h(0) = \frac{2(0)+1}{0-2} = \frac{1}{-2} = -\frac{1}{2}$$

$$\begin{aligned} 10) f(-3) &= 7(-3) - 3 \\ &= -21 - 3 \\ &= -24 \end{aligned}$$

$$11) h(7) = \frac{2(7)+1}{7-2} = \frac{15}{5} = 3$$

$$\begin{aligned} 12) g(-2) &= (-2)^2 + 4 \\ &= 4 + 4 \\ &= 8 \end{aligned}$$

$$\begin{aligned} 13) k(25) &= \sqrt{25+3} \\ &= \sqrt{28} \\ &= 2\sqrt{7} \end{aligned}$$

$$\begin{array}{r} 28 \\ \sqrt{28} \\ 2 \quad 14 \\ \underline{2} \quad 7 \end{array}$$

Other Function Operations

14) Another use for function notation is that we can easily show what operations we want to perform on functions.

Addition: $f(x) + g(x)$ which could also look like $(f + g)(x)$

Subtraction: $f(x) - g(x)$ which could also look like $(f - g)(x)$

Multiplication: $f(x) \cdot g(x)$ which could also look like $(f \cdot g)(x)$

Let $f(x) = x - 3$ and $g(x) = 3x - 5$. Perform the following operations.

15) $(f + g)(x) = f(x) + g(x)$

$$\begin{array}{r} x-3 + 3x-5 \\ \hline 4x-8 \end{array}$$

16) $(f - g)(x)$

$$\begin{array}{r} x-3 - (3x-5) \\ \hline x-3 - 3x+5 \\ -2x+2 \end{array}$$

17) $(g - f)(x)$

$$\begin{array}{r} 3x-5 - (x-3) \\ \hline 3x-5 - x+3 \\ 2x-2 \end{array}$$

18) $(g \cdot f)(x)$

$$\begin{array}{r} (x-3)(3x-5) \\ \hline 3x^2 - 5x - 9x + 15 \\ 3x^2 - 14x + 15 \end{array}$$

Let $f(x) = 2x + 4$ and $g(x) = x - 1$. Perform the indicated operation.

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

$$\begin{aligned} &= 2x + 4 - x + 1 \\ &= x + 5 \end{aligned}$$

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

$$\begin{aligned} &= x - 1 - 2x - 4 \\ &= -x - 5 \end{aligned}$$

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

$$= 3x + 3$$

22) $(f \cdot g)(x) = (2x + 4)(x - 1)$

$$\begin{array}{r} 2x^2 - 2x + 4x - 4 \\ \hline 2x^2 + 2x - 4 \end{array}$$

23) $(f - g)(2)$

$$\begin{array}{r|l} 2x+4 - (x-1) & 2(2)+4 - (2-1) \\ 2x+4 - x+1 & 4+4-1 \\ x+5 & 8-1 \\ 2+5 = \textcircled{7} & \textcircled{7} \end{array}$$

24) $(g + f)(3) = x - 1 + 2x + 4$

$$\begin{array}{r} 3-1 + 2(3)+4 \\ 3-1 + 6+4 \\ 2+6+4 \\ 8+4 \\ 12 \end{array}$$

25) $(f \cdot g)(2)$

$$\begin{aligned} &= 2(2)^2 + 2(2) - 4 \\ &= 8 + 4 - 4 \\ &= 8 \end{aligned}$$

26) $(f \cdot g)(-4)$

$$\begin{array}{r} 2(-4)^2 + 2(-4) - 4 \\ 2(16) + (-8) - 4 \\ 32 - 12 \\ \textcircled{20} \end{array}$$

Compositions of Functions

- 27) We can compose two functions into one function. We do this by replacing the variable of one function with the second function.

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

And inside.

This means that we plug $g(x)$ in for every x in the $f(x)$ equation.

The process is the same if the order is reversed. For example:

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

This means that we plug $f(x)$ in for every x in the $g(x)$ equation.

Let $f(x) = 3x - 7$ and $g(x) = 2x + 4$. Find the following:

28) $f(g(x)) = f(2x+4)$

$$\begin{aligned} & 3(2x+4) - 7 \\ & 6x + 12 - 7 \\ & 6x + 5 \end{aligned}$$

29) $(g \circ f)(x) = g(f(x))$

$$\begin{aligned} & 2(3x-7) + 4 \\ & 6x - 14 + 4 \\ & 6x - 10 \end{aligned}$$

Let $g(x) = 2x + 7$ and $h(x) = -3x + 1$. Find the following:

30) $g(h(x)) = 2(-3x+1) + 7$

$$\begin{aligned} & 2(-3x+1) + 7 \\ & -6x + 2 + 7 \\ & -6x + 9 \end{aligned}$$

31) $(h \circ g)(x) = -3(2x+7) + 1$

$$\begin{aligned} & = -6x - 21 + 1 \\ & = -6x - 20 \end{aligned}$$

32) $g(h(4)) = 2(-3(4)+1) + 7$

$$\begin{aligned} & = -6x + 2 + 7 \\ & = -6x + 9 \\ & = -6(4) + 9 \\ & = -24 + 9 \\ & = -15 \end{aligned}$$

33) $(h \circ g)(2) = -6x - 20$

$$\begin{aligned} & = -6(2) - 20 \\ & = -12 - 20 \\ & = -32 \end{aligned}$$

Let $f(x) = x + 2$ and $g(x) = x^2 - 4$. Find the following:

$$\begin{aligned} 34) (f \circ f)(x) &= (x+2) + 2 \\ &= x + 4 \end{aligned}$$

$$\begin{aligned} 35) g(g(x)) &= (x^2 - 4)^2 - 4 \\ &= (x^2 - 4)(x^2 - 4) - 4 \\ &= x^4 - 4x^2 - 4x^2 + 16 - 4 \\ &= x^4 - 8x^2 + 12 \end{aligned}$$

$$\begin{aligned} 36) (f \circ g)(x) &= \left(\begin{matrix} x \\ x^2 - 4 \end{matrix} \right) + 2 \\ &= x^2 - 2 \end{aligned}$$

$$\begin{aligned} 37) g(f(x)) &= (x+2)^2 - 4 \\ &= (x+2)(x+2) - 4 \\ &= x^2 + 4x + 4 - 4 \\ &= x^2 + 4x \end{aligned}$$

$$\begin{aligned} 38) (f \circ g)(1) &= (1^2 - 4) + 2 \\ &= (1 - 4) + 2 \\ &= -3 + 2 \\ &= -1 \end{aligned}$$

$$\begin{aligned} 39) g(f(-2)) &= (-2+2)^2 - 4 \\ &= 0^2 - 4 \\ &= -4 \\ &= (x+2)^2 - 4 \\ &= (x+2)(x+2) - 4 \\ &= x^2 + 4x + 4 - 4 \\ &= x^2 + 4x \\ &= (-2)^2 + 4(-2) \\ &= 4 - 8 \\ &= -4 \end{aligned}$$