

Composition of Functions

The COMPOSITION of f with g is

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

Ex. Given: $f(x) = 2x$, $g(x) = 8x - 6$

$$\begin{aligned} f(g(x)) &= 2(8x-6) \\ &= 16x-12 \end{aligned}$$

Now, evaluate $f(g(5))$ two ways ...

$$g(5) = 8(5) - 6$$

$$g(5) = 34$$

$$f(34) = 2(34)$$

$$f(g(5)) = 68$$

Ex. Given: $f(x) = 2x$, $g(x) = 8x - 6$

$$\begin{aligned} g(f(x)) &= 8(2x) - 6 \\ &= 16x - 6 \end{aligned}$$

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

Ex. Given: $f(x) = x^2 - 2x - 15$, $g(x) = x + 3$

$$\begin{aligned} f(g(x)) &= (x+3)^2 - 2(x+3) - 15 \\ &= x^2 + 6x + 9 - 2x - 6 - 15 \\ &= \boxed{x^2 + 4x - 12} \end{aligned}$$

$$\begin{aligned} g(f(x)) &= (x^2 - 2x - 15) + 3 \\ &= \boxed{x^2 - 2x - 12} \end{aligned}$$

$$\begin{aligned} g(g(x)) &= (x+3) + 3 \\ &= \boxed{x+6} \end{aligned}$$

Name: _____

Date: _____

Period: Key**COMPOSITE FUNCTION WORKSHEET****Directions:** Show all work for credit. Work must be neat and answer must be circled.For 1-9: Let $f(x) = 2x - 1$, $g(x) = 3x$, and $h(x) = x^2 + 1$. Compute the following:

1. $f(g(-3)) = -19$

$g(-3) = -9$

$f(-9) = 2(-9) - 1$

2. $f(h(7))$

$h(7) = 50$

$f(50) = 100 - 1 = 99$

3. $(g \circ h)(24) = 1731$

$h(24) = 577$

$g(577) = 3(577)$

4. $f(g(h(2)))$

$h(2) = 5$

$g(5) = 15$

$f(15) = 29$

5. $h(g(f(5))) = 730$

$f(5) = 9$

$g(9) = 27$

$h(27) = 27^2 + 1 = 730$

6. $g(f(h(-6)))$

$h(-6) = 37$

$f(37) = 73$

$g(73) = 219$

7. $f(x+1) = 2(x+1) - 1$

$= 2x + 2 - 1$

$= 2x + 1$

8. $g(3a) = 3(3a)$

$g(3a) = 9a$

9. $h(x-2) = (x-2)^2 + 1$

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

$= x^2 - 4x + 5$

For 10-11: Let $f(x) = -3x + 7$ and $g(x) = 2x^2 - 8$. Compute the following:

10. $f(g(x)) = -3(2x^2 - 8) + 7$

$= -6x^2 + 24 + 7$

$= -6x^2 + 31$

11. $(g \circ f)(x) = 2(-3x + 7)^2 - 8$

$= 2(9x^2 - 42x + 49) - 8$

$= 18x^2 - 84x + 98 - 8$

$= 18x^2 - 84x + 90$

$(-3x+7)(-3x+7) = 9x^2 - 21x - 21x + 49$

12. If $f(x) = 3x - 5$ and $g(x) = x^2$,

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

$g(3) = 9$

$f(9) = 3(9) - 5$

$= 22$

13. If $f(x) = -9x - 9$ and $g(x) = \sqrt{x-9}$,

find $(f \circ g)(10)$

$g(10) = \sqrt{10-9}$

$= 1$

$f(1) = -9(1) - 9$

$= -18$

14. If $f(x) = -4x + 2$ and $g(x) = \sqrt{x-8}$,

find $(f \circ g)(12)$

$$g(12) = \sqrt{12-8}$$

$$= 2$$

$$f(2) = -6$$

15. If $f(x) = -3x + 4$ and $g(x) = x^2$,

find $(g \circ f)(-2)$

$$f(-2) = -3(-2) + 4$$

$$= 10$$

$$g(10) = 100$$

16. If $f(x) = -2x + 1$ and $g(x) = \sqrt{x^2 - 5}$,

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

$$f(2) = -3$$

$$g(-3) = \sqrt{(-3)^2 - 5}$$

$$= \sqrt{4}$$

$$= 2$$

17. Given $f(x) = -9x + 3$ and $g(x) = x^4$,

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



$$= -9(x^4) + 3$$

$$= -9x^4 + 3$$

18. Given $f(x) = 2x - 5$ and $g(x) = x + 2$,

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

?

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

$$= 2x + 4 - 5$$

$$= 2x - 1$$

19. Given $f(x) = x^2 + 7$ and $g(x) = x - 3$,

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

$$= (x-3)^2 + 7$$

$$= x^2 - 6x + 9 + 7$$

$$= x^2 - 6x + 16$$

20. Given $f(x) = 4x + 3$ and $g(x) = x^2$,

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

$$= (4x+3)^2$$

$$= 16x^2 + 24x + 9$$

21. Given $f(x) = x - 1$ and $g(x) = x^2 + 2x - 8$,

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

$$= (x-1)^2 + 2(x-1) - 8$$

$$= (x^2 - 2x + 1) + 2x - 2 - 8$$

$$= x^2 - 9$$