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Acc Alg 2 - 2

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AMDG

**NOT MULT!**

$$f(x) \Rightarrow y \qquad P(t)$$

Population dependent on time

If $f(x) = x^2 - 1$, $g(x) = 2x - 3$, and $h(x) = 1 - 4x$, find the following new functions, as well as any values indicated.

1.  a. $(f - g)(x) =$

    $x^2 - 1 - (2x - 3)$

    $x^2 - 1 - 2x + 3$

    $x^2 - 2x + 2$  $\rightarrow (3)^2 - 2(3) + 2$

    $9 - 6 + 2$

    $5$

    b. $(f - g)(3) =$ $\quad f(3) = 9 - 1 = 8$

    $\qquad\qquad\qquad -g(3) = 6 - 3 = 3$

    vs.  $\overline{\phantom{---}}$

    $\qquad\qquad\qquad\qquad 5$

2.  a. $(g + f)(x) =$

    $x^2 + 2x - 4 \longrightarrow 4 - 4 - 4$

    b. $(g + f)(-2) = -4$ vs $g(-2) = -7$

    $\qquad\qquad\qquad\qquad\qquad + f(-2) = +3$

    $\qquad\qquad\qquad\qquad\qquad\qquad -4$

3.  a. $(f + h)(x) =$

    b. $(f + h)(0) =$

4.  a. $(g \cdot h)(x) =$

    $(2x - 3)(1 - 4x)$

    $2x - 8x^2 - 3 + 12x$

    $\boxed{-8x^2 + 14x - 3} \Rightarrow -128 + 56 - 3 \Rightarrow \boxed{-75}$

    b. $(g \cdot h)(4) =$  $g(4) = 5$

    $\qquad\qquad\qquad h(4) = -15$

    $\qquad\qquad\qquad \overline{\phantom{---}}$

    $\qquad\qquad\qquad -75$

5.  a. $(f \cdot g)(x) =$

    b. $(f \cdot g)(-1) =$

6.  a. $\left(\dfrac{f}{g}\right)(x) = \dfrac{x^2 - 1}{2x - 3}$

    b. $\left(\dfrac{f}{g}\right)(2) = \dfrac{4 - 1}{4 - 3} = \dfrac{3}{1} = 3$

7.  a. $\left(\dfrac{g}{h}\right)(x) =$

    b. $\left(\dfrac{g}{h}\right)(0) =$

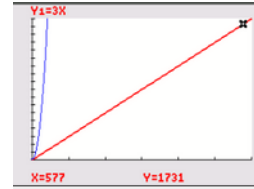Let $f(x) = 2x - 1$, $g(x) = 3x$, and $h(x) = x^2 + 1$. Compute the following:

$2^{4^2} + 1$

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

$=$ $\overbrace{3(-3)}$

$f(-9) = 2(-9) - 1$
$\phantom{f(-9)} = -18 - 1$
$\phantom{f(-9)} = -19$

2. $f(h(7))$

3. $g(h(24))$

$g(24^2 + 1) = 1731$



4. $h(f(9))$

5. $g(f(0))$

$g(-1) = -3$

6. $h(g(-4))$

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

8. $h(g(f(5)))$

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

$g[f(37)]$

$g(73) = 219$

$g(x) = 3x$

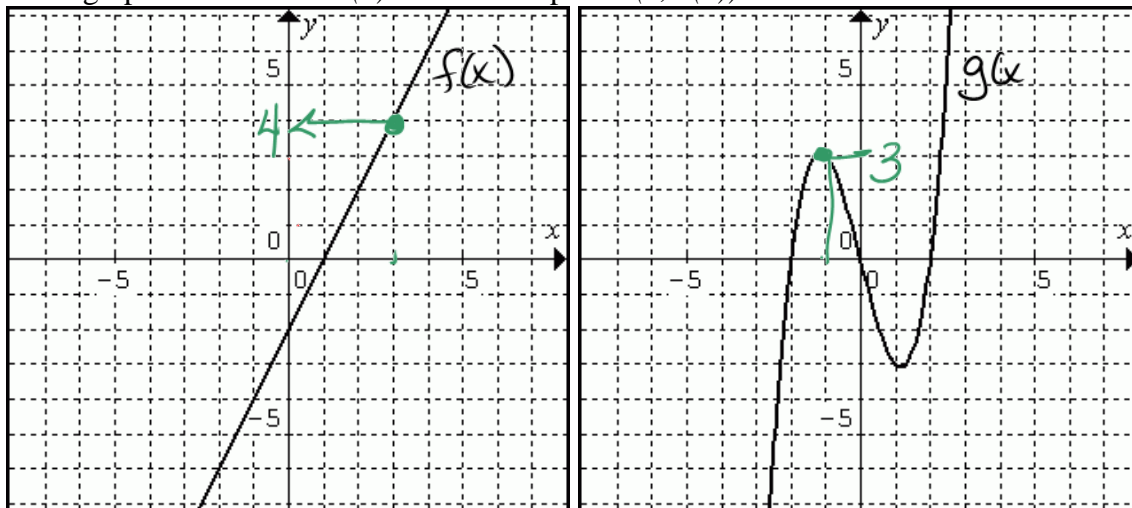10. $f(f(x))$

11. $g(g(x))$

$g(3x)$

$3(3x) = 9x$

12. $h(h(x))$

# Composition of Functions

Please work with a partner on this exercise. The purpose of this worksheet is to read and use graphs of functions in the context of composition of functions.

$$f\left(\underset{g(-1)}{}\right) \Rightarrow f(3) = 4$$

**Definition:** The graph of a function *h(x)* is the set of points *(x, h(x))*.



Shown above are sketches of the graphs of two functions, *f(x)* (left) and *g(x)* (right). Use the graphs to answer the questions below. The first question has been done for you.

1. Find *f(g(-1))*. = 4
    To find *f(g(-1))*, we first find *g(-1)* then use the graph of *f(x)* to find *f(g(-1))*.
    - First find find the point in the right hand graph that is on the *x*-axis at *x = -1*.
      The graph of *g(x)* lies above the *x*-axis at this point, so trace up from the *x*-axis to the point *(-1,3)* on the graph.
      The definition of the graph of a function tells us that this point on the graph has coordinates *(-1, g(-1))*, so it must be true that *g(-1) = 3*.
    - Now find *f(g(-1)) = f(3)*.
      In the left side graph of *f(x)*, locate the point on the *x*-axis where *x = 3*.
      Trace up from this point to the point *(3,4)* on the graph of *f(x)*.
      Use the definition of the graph of *f(x)* to conclude that *f(3) = 4*.
    - *f(g(-1)) = f(3) = 4*.
2. Find *f(g(0))*.
    - *g(0) =*

    - *f(g(0)) =*
3. Find *g(f(0))*.



4. Find *f(g(-1))*.



5. **Bonus:** Use the graphs to find the zeros of the function *g(f(x))*.

Name_____

# Compositions of Functions

Date_____ Period_____

**Perform the indicated operation.**

1)  $g(x) = 3x + 3$
    Find $(g \circ g)(6)$

$$g\left(g(6)\right)$$

2)  $g(x) = x^2 - 2 + x$
    $h(x) = 4x + 1$
    Find $(g \circ h)(-3)$

$$g\left(h(-3)\right)$$

3)  $g(n) = n - 2$
    $h(n) = n^2 + 3$
    Find $(g \circ h)(-8)$

4)  $g(x) = 3x + 2$
    Find $(g \circ g)(7)$

5)  $g(n) = 2n - 5$
    Find $(g \circ g)(6)$

6)  $f(a) = 4a - 2$
    Find $(f \circ f)(4)$

7)  $h(x) = 4x + 4$
    Find $(h \circ h)(-4)$

8)  $g(x) = 2x - 2$
    $f(x) = x^2 + 5x$
    Find $(g \circ f)(1)$

9)  $f(n) = 2n - 2$
    $g(n) = 2n - 4$
    Find $(f \circ g)(-9)$

10) $g(x) = x - 4$
    $f(x) = -3x^2 + 2$
    Find $(g \circ f)(1)$

11) $h(n) = 4n - 1$
    $g(n) = 4n - 4$
    Find $(h \circ g)(2n)$

12) $h(x) = 2x + 5$
    Find $(h \circ h)(3 - y)$

13) $g(n) = n - 3$
    $h(n) = n - 1$
    Find $(g \circ h)(4n)$

14) $f(a) = 4a - 2$
    $g(a) = 3a - 2$
    Find $(f \circ g)(1 + a)$

15) $g(n) = 3n + 4$
    $h(n) = 2n + 2$
    Find $(g \circ h)(-n)$

16) $f(t) = 2t - 1$
    $g(t) = -3t^2 - 4$
    Find $(f \circ g)(-2 + t)$

17) $g(a) = -4a + 3$
    $h(a) = 2a + 3$
    Find $(g \circ h)(a + 4)$

18) $g(n) = -2n + 2$
    $f(n) = n^3 - n$
    Find $(g \circ f)(n - 2)$

19) $g(x) = 4x - 4$
    $f(x) = -x - 2$
    Find $(g \circ f)(-2x)$

20) $h(x) = 4x - 5$
    $g(x) = x^2 - 2x$
    Find $(h \circ g)(4z)$

# Odd Answers to Compositions of Functions

1) 66

3) 65

5) 9

7) −44

9) −46

11) $32n - 17$

13) $4n - 4$

15) $-6n + 10$

17) $-8a - 41$

19) $8x - 12$

Name:_____ Date:_____ Period:_____

# 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))　　　　　　　　　　**2.** f(h(7))　　　　　　　　　　**3.** (g∘h)(24)

**4.** f(g(h(2)))　　　　　　　　　　**5.** h(g(f(5)))　　　　　　　　　　**6.** g(f(h(-6)))

**7.** f( x + 1)　　　　　　　　　　**8.** g(3a)　　　　　　　　　　**9.** h( x – 2)

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

**10.** f(g(x))　　　　　　　　　　　　**11.** (g∘f)(x)

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

**13.** If $f(x) = -9x - 9$ and $g(x) = \sqrt{x-9}$, find $(f \circ g)(10)$

**14.** If $f(x) = -4x + 2$ and $g(x) = \sqrt{x-8}$, find $(f \circ g)(12)$

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

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

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

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

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

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

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

$$g(f(x)) = x$$

Hf inverses $\Rightarrow$ $f(g(x)) = x$

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## Function Inverses

Date_____ Period____

**State if the given functions are inverses.**

$$g(f(x)) = 4 - \frac{3}{2}\left(\frac{1}{2}x + \frac{3}{2}\right)$$

1) $g(x) = 4 - \frac{3}{2}x$

$$4 - \frac{3}{4}x - \frac{9}{4} \neq x$$

$f(x) = \left(\frac{1}{2}x + \frac{3}{2}\right)$   ∴ NOT INVERSES

2) $g(n) = \frac{-12 - 2n}{3}$

$f(n) = \frac{-5 + 6n}{5}$

3) $f(n) = \left(\frac{-16 + n}{4}\right)$

$g(n) = 4n + 16$

$$\frac{-16 + (4n + 16)}{4} = n$$

$$4\left(\frac{-16 + n}{4}\right) + 16 = n$$

Yes

4) $f(x) = -\frac{4}{7}x - \frac{16}{7}$

$g(x) = \frac{3}{2}x - \frac{3}{2}$

5) $f(n) = -(n + 1)^3$

$g(n) = 3 + n^3$

6) $f(n) = 2(n - 2)^3$

$g(n) = \frac{4 + \sqrt[3]{4n}}{2}$

7) $f(x) = \frac{4}{-x - 2} + 2$

$h(x) = -\frac{1}{x + 3}$

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

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

**Find the inverse of each function.** Switch x & y. then solve for y.

9) $h(x) = \sqrt[3]{x} - 3$

$$x = y^{1/3} - 3$$

$$x + 3 = y^{1/3}$$

$$(x+3)^3 = h^{-1}(x)$$

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

11) $h(x) = 2x^3 + 3$

12) $g(x) = -4x + 1$

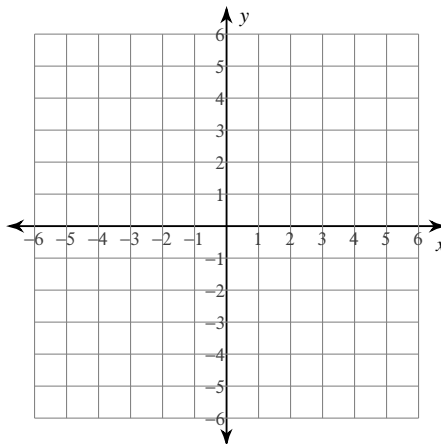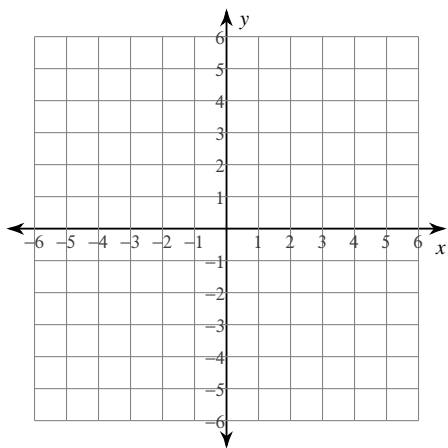13) $g(x) = \dfrac{7x + 18}{2}$

14) $f(x) = x + 3$

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

16) $f(x) = 4x$

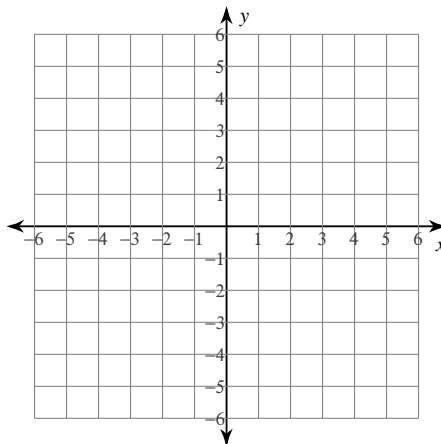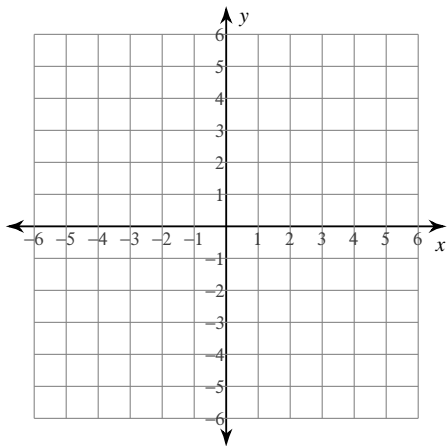**Find the inverse of each function.  Then graph the function and its inverse.**

17) $f(x) = -1 - \dfrac{1}{5}x$

18) $g(x) = \dfrac{1}{x - 1}$





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

20) $g(x) = \dfrac{-x - 5}{3}$

# Function Inverses Key to the Odds

**State if the given functions are inverses.**

1) $g(x) = 4 - \dfrac{3}{2}x$

$f(x) = \dfrac{1}{2}x + \dfrac{3}{2}$

No

2) $g(n) = \dfrac{-12 - 2n}{3}$

$f(n) = \dfrac{-5 + 6n}{5}$

3) $f(n) = \dfrac{-16 + n}{4}$

$g(n) = 4n + 16$

Yes

4) $f(x) = -\dfrac{4}{7}x - \dfrac{16}{7}$

$g(x) = \dfrac{3}{2}x - \dfrac{3}{2}$

5) $f(n) = -(n+1)^3$

$g(n) = 3 + n^3$

No

6) $f(n) = 2(n-2)^3$

$g(n) = \dfrac{4 + \sqrt[3]{4n}}{2}$

7) $f(x) = \dfrac{4}{-x-2} + 2$

$h(x) = -\dfrac{1}{x+3}$

No

8) $g(x) = -\dfrac{2}{x} - 1$

$f(x) = -\dfrac{2}{x+1}$

**Find the inverse of each function.**

9) $h(x) = \sqrt[3]{x} - 3$

$h^{-1}(x) = (x+3)^3$

10) $g(x) = \dfrac{1}{x} - 2$

11) $h(x) = 2x^3 + 3$

$h^{-1}(x) = \sqrt[3]{\dfrac{x-3}{2}}$

12) $g(x) = -4x + 1$

13) $g(x) = \dfrac{7x + 18}{2}$

14) $f(x) = x + 3$

$g^{-1}(x) = \dfrac{2x - 18}{7}$

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

16) $f(x) = 4x$
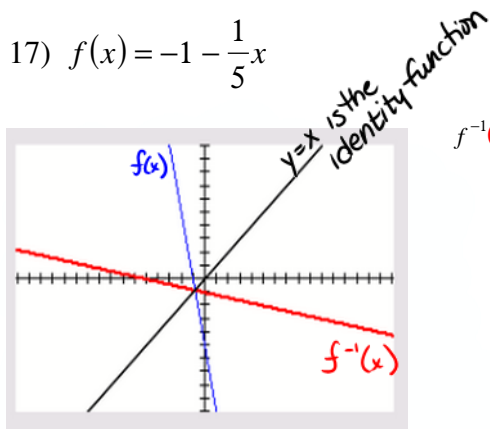
$f^{-1}(x) = -x + 3$

**Find the inverse of each function.  Then graph the function and its inverse.**
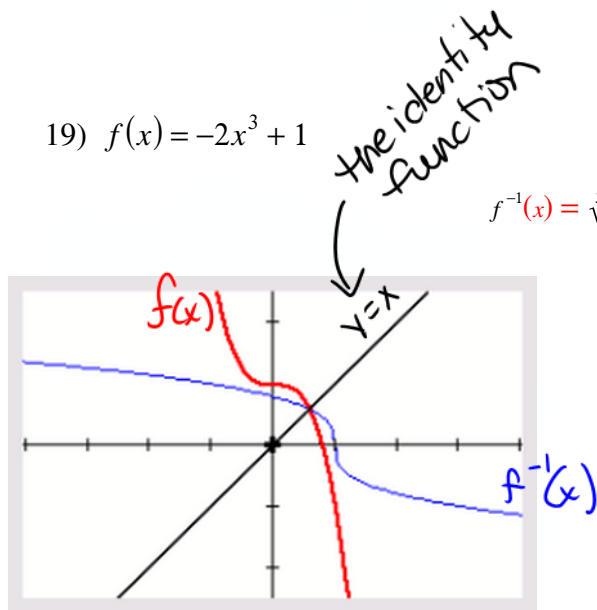
17) $f(x) = -1 - \dfrac{1}{5}x$

18) $g(x) = \dfrac{1}{x - 1}$

$y = x$ is the identity function

$f^{-1}(x) = -5x - 5$



f(x)

f⁻¹(x)

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

the identity function

20) $g(x) = \dfrac{-x - 5}{3}$

$f^{-1}(x) = \sqrt[3]{\dfrac{-x + 1}{2}}$



f(x)

y=x

f⁻¹(x)

the graph of f⁻¹(x) is
a reflection of f(x)
over the identity (that's y=x).