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# Function composition worksheet key

## LASS EXERCISES - Composite Functions

1.  $(g \circ f)(x) = 6x - 5$ ,  $f(x) = 2x - 3$ ,  $g(x) = ?$

$$g(2x-3) = 6x-5$$

$$\begin{aligned} x &\mapsto \frac{2x-3}{x-3} \\ g(x) &= \cancel{g}\left(\frac{2x-3}{x-3}\right) = 3x+2 \end{aligned}$$

2.  $(f \circ g)(x) = \frac{2x+1}{x-1}$ ,  $f(x) = ?$ ,  $g(x) = ?$

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

$$\begin{aligned} g(x) + 4 &= \frac{2x+1}{x-1} \\ g(x) &= \frac{2x+1}{x-1} - 4 \end{aligned}$$

3.  $f'(x) = 2x + 9$ ,  $g'(x) = -3x - 1$ ,  $(f \circ g)'(x) = ?$

$$\begin{aligned} g'(f^{-1}(x)) &= g^{-1}(2x+9) \\ &= -3(2x+9) - 1 \\ &= -6x - 27 - 1 \\ &= -6x - 28 \end{aligned}$$

4.  $f(x) = \frac{-x+1}{3}$ ,  $g^{-1}(x) = x - 5$ ,  $(g \circ f^{-1})(x) = ?$

$$\begin{aligned} f(g^{-1}(x)) &= f(x-5) \\ &= \frac{-(x-5)+1}{3} \\ &= \frac{6-x}{3} \end{aligned}$$

5.  $g(x) = 2x - 1$ ,  $(g \circ f)^{-1}(x) = 3x + 4$ ,  $f(x) = ?$

$$\begin{aligned} f^{-1}(g^{-1}(x)) &= f^{-1}\left(\frac{x+4}{2}\right) = 3x+4 \\ f(3x+4) &= \frac{x+4}{2} \\ x &\mapsto \frac{x+4}{2} \\ f(x) &= \frac{2}{x+4} \\ &= \frac{x-4}{x+3} \end{aligned}$$

6.  $(f \circ g^{-1})^{-1}(x) = \frac{2x-1}{x-3}$ ,  $f(x) = ?$ ,  $g(x) = ?$

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

$$\begin{aligned} g\left(\frac{2x-1}{x-3}\right) &= \frac{2x-1}{x-3} \\ x &\mapsto 3x-1 \end{aligned}$$

7.  $f(x) = x + 2$ ,  $g(x) = \frac{x-4}{5}$ ,  $(f \circ g)^{-1}(4) = ?$

$$\begin{aligned} g(f^{-1}(4)) &=? \\ g^{-1}(-2) &=? \\ f^{-1}(x+2) &= x \\ x &\mapsto -2 \\ f^{-1}(4) &= -2 \\ g^{-1}(-2) &= 6 \end{aligned}$$

8.  $f'(3x+1) = 3x-4$ ,  $g(x+3) = 2-x$ ,  $(g \circ f)'(3) = ?$

$$\begin{aligned} f'(g^{-1}(3)) &=? \\ &= -3 \\ g'(2-x) &= x+3 \\ g^{-1}(3) &= -1+3=2 \\ f'^{-1}\left(\frac{3x+1}{2}\right) &= 3x-4 \\ x &\mapsto \frac{3}{2} \\ f'(2) &= \frac{3}{2}-4=-3 \end{aligned}$$

9.  $(f \circ g)'(x-3) = 4x+1$ ,  $f(x) = x+3$ ,  $g(x) = ?$

$$\begin{aligned} f(g(x+3)) &= x-3 \\ f(g(4x+1)) &= x-3 \\ g(4x+1)+3 &= x-3 \\ g(4x+1) &= x-6 \\ x &\mapsto \frac{x-6}{4} \\ g(x) &= \frac{x-6}{4}-6=\frac{x-26}{4} \end{aligned}$$

10.  $f(x) = 3x-1$ ,  $g(x) = \frac{1}{x-1}$ ,  $(f' \circ g)(x) = 2$ ,  $x = ?$

$$\begin{aligned} g(2) &= \frac{1}{2-1}=1 \\ 3x-1 &= 1 \\ 3x &= 2 \\ x &= \frac{2}{3} \end{aligned}$$

$$\begin{aligned} f'(g(2)) &= x \\ f'\left(\frac{1}{2-1}\right) &= x \\ f'(1) &= x \\ f'(x) &= 2 \end{aligned}$$

$$\begin{aligned} 20 &+ \frac{1}{2} + 4k = 2 \\ 2 &+ 4k = 2 \\ 4k &= 0 \\ k &= 0 \end{aligned}$$

If we multiply the last two equations, we get  $20k = 0$  or  $k = 0$ .

Since  $k = 0$ ,  $\ell = \frac{1}{2}$ ,  $b = 0$ , and  $a = 2$ .

In other words, let's find the equation of the parabola that goes through at least three points of  $\ell(x)$ .

c) Now that you know  $a$ ,  $b$ , and  $c$ , write the equation of the parabola.

$$T(x) = \frac{1}{2}x^2 + 3$$

d) Graph your parabola. If it's true, position (d) compares the original function  $f(x) = \sqrt{x^2 + 9}$  on a GDC and find a value of  $x$  for which  $T(x)$  and  $f(x)$  ...

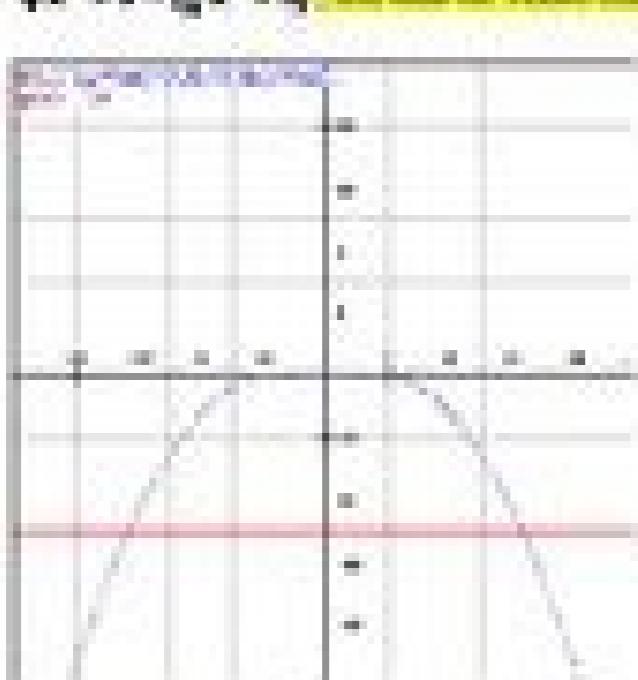
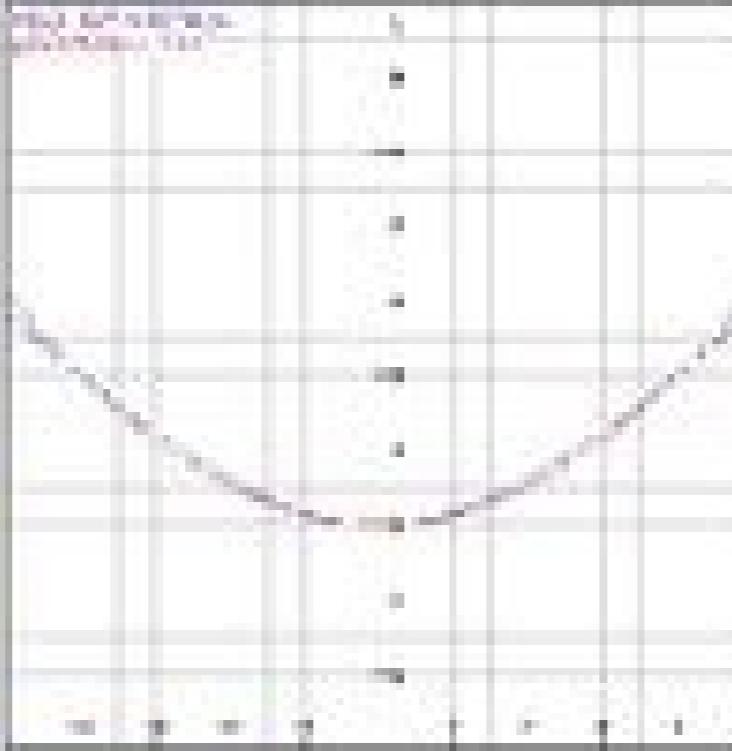
i) are equal.

We know that both functions are identical for  $x = -3$ ,  $x = 0$ , and  $x = 3$ .

ii) are different by more than 20.

Instead of graphing each of them separately, we can graph the difference between them,

$\sqrt{x^2 + 9} - T(x) = \sqrt{x^2 + 9} - \frac{1}{2}x^2 - 3$ , and look for values that differ by more than 20.



Name:	Score:
Composition of Functions	
Choose the correct choice that best describes f (x, y).	
1) $f(x) = x+2$ ; $g(x) = x+1$ ; $h(x)=x$ . a) $x-2$ b) $x-4$ c) $x+2$ d) $x+8$	
2) $f(x) = 2x+4$ ; $g(x) = x+7$ ; $h(x)=x+5$ . a) $x+5$ b) $2x+10$ c) $2x$ d) $x+2$	
3) $f(x) = 3x+7$ ; $g(x) = 1-4x$ ; $h(x)=4x+9$ . a) $12x+29$ b) $12x-29$ c) $72x+112$ d) $72x-112$	
4) $f(x) = 2x+4$ ; $g(x) = 7x+4$ ; $h(x)=9x$ . a) $28x+96$ b) $126x-33$ c) $126x+78$ d) $126x-96$	
5) $f(x) = 2x+1$ ; $g(x) = 5x+9$ ; $h(x)=x+8$ . a) $5x+46$ b) $3x+14$ c) $-3x+14$ d) $3x+49$	
6) $f(x) = x+6$ ; $g(x) = x+2$ ; $h(x)=x+9$ . a) $x+6$ b) $x+12$ c) $x+18$ d) $x+18$	
7) $f(x) = x+4$ ; $g(x) = x+3$ ; $h(x)=x+7$ . a) $x+6$ b) $x+12$ c) $x+18$ d) $x+18$	
8) $f(x) = x+4$ ; $g(x) = x+2$ ; $h(x)=x+8$ . a) $x+6$ b) $x+10$ c) $x+14$ d) $x+14$	
9) $f(x) = x+6$ ; $g(x) = x+3$ ; $h(x)=x+9$ . a) $x+6$ b) $x+12$ c) $x+18$ d) $x+18$	
10) $f(x) = x+4$ ; $g(x) = 3x+8$ ; $h(x)=x+2$ . a) $x+6$ b) $x+10$ c) $x+14$ d) $x+14$	

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## Algebra II -- Operations on Functions

SP-1000.3.1: Given two functions  $f$  and  $g$  defined on their domains, determine the domain of the sum, difference, product, and quotient of the two functions.

SP-1000.3.2: Given two functions  $f$  and  $g$  defined on their domains, determine the domain of the composition of the two functions, and find the value of the composed function for a given value of the independent variable.

SP-1000.3.3: Given two functions  $f$  and  $g$  defined on their domains, find the value of the composed function for a given value of the independent variable.

Find the sum of each of the following functions.

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

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

$$h(x) = 3x^2 + 2x - 1$$

Find the difference of each of the following functions.

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

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

$$h(x) = 3x^2 + 2x - 1$$

Find the product of each of the following functions.

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

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

$$h(x) = 3x^2 + 2x - 1$$

Find the quotient of each of the following functions.

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

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

$$h(x) = 3x^2 + 2x - 1$$

Find the composition of each of the following functions.

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

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

$$h(x) = 3x^2 + 2x - 1$$

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

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

$$h(x) = 3x^2 + 2x - 1$$

Find the composition of each of the following functions.</

Name: _____	Score: _____
Ordered Pairs	
Example: Find the Domain and Range.	
{(1, 2), (2, 5), (3, 1), (1, 6), (4, 8)}	
Domain = {1, 2, 3, 4}	Range = {1, 2, 5, 6, 8}
Find the Domain and Range for each set of ordered pairs.	
1) {(3, 2), (5, 7), (1, 4), (9, 2), (3, 7)}	2) {(6, 2), (3, 5), (9, 0), (5, 7), (8, 1)}
Domain : _____	Domain : _____
Range : _____	Range : _____
3) {(1, 9), (2, 7), (5, 4), (7, 12), (3, 9)}	4) {(0, 2), (3, 3), (8, 7), (2, 2), (5, 9)}
Domain : _____	Domain : _____
Range : _____	Range : _____
5) {(11, 3), (6, 5), (7, 1), (9, 7), (8, 3)}	6) {(6, 1), (9, 2), (6, 8), (9, 7), (8, 3)}
Domain : _____	Domain : _____
Range : _____	Range : _____
7) {(1, 9), (0, 8), (3, 0), (4, 9), (7, 7)}	8) {(9, 9), (7, 4), (1, 2), (2, 6), (5, 0)}
Domain : _____	Domain : _____
Range : _____	Range : _____
9) {(1, 1), (2, 3), (3, 4), (4, 2), (5, 1)}	10) {(8, 4), (6, 2), (1, 9), (3, 8), (0, 7)}
Domain : _____	Domain : _____
Range : _____	Range : _____

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