

# Algebra 2 · Function Operations, Composition and Inverses · Worksheet

Common Core F-BF.A.1b, F-BF.A.1c, F-BF.B.4a · mathovore.fr

Name: \_\_\_\_\_ Date: \_\_\_\_/\_\_\_\_/\_\_\_\_ Score: \_\_\_\_\_

These twenty-four problems practice Common Core standards F-BF.A.1b, F-BF.A.1c and F-BF.B.4a. Add, subtract, multiply, and divide functions, compose them, and find inverse functions algebraically and from graphs, including domain restrictions.

The last six problems are word problems and multi-step tasks about temperature, car rentals, discounts, and growing areas. Work from easiest to hardest and show every step.

## Algebra 2 Common Core: F-BF.A.1b · F-BF.A.1c · F-BF.B.4a

### Problem 1: Add and subtract functions

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Let  $f(x) = 3x - 4$  and  $g(x) = x^2 + 2x$ . Find each function.

- a.  $(f + g)(x)$
- b.  $(f - g)(x)$

### Problem 2: Multiply functions

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Let  $f(x) = x + 3$  and  $g(x) = 2x - 5$ .

- a. Find  $(fg)(x)$ .
- b. Evaluate  $(fg)(4)$ .

### Problem 3: Divide functions and state the domain

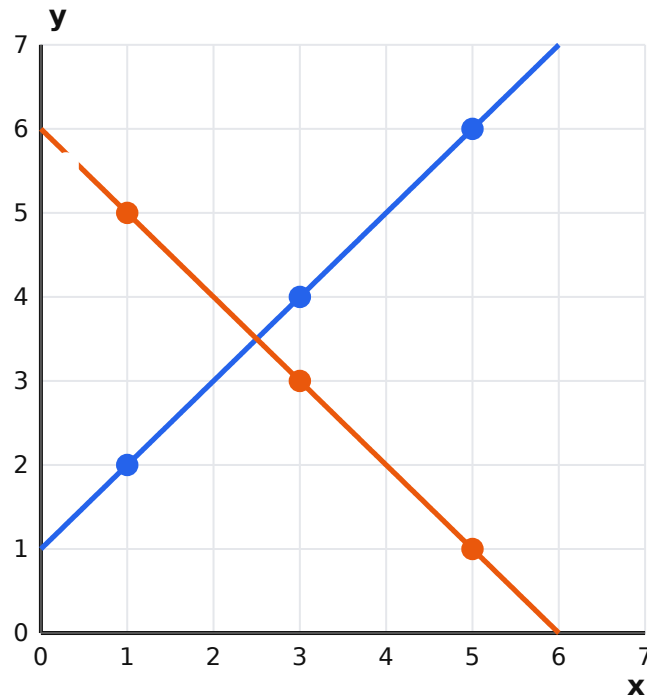
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Let  $f(x) = x^2 - 9$  and  $g(x) = x - 3$ . Write  $\left(\frac{f}{g}\right)(x)$  in simplest form and state its domain.

### Problem 4: Operations from graphs

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The graphs of  $f$  and  $g$  are shown. Read values from the graph to find each result.



Graphs of  $f$  (blue) and  $g$  (orange).

- $(f+g)(1)$
- $(f-g)(5)$
- $(fg)(3)$

### Problem 5: Evaluate a composition

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

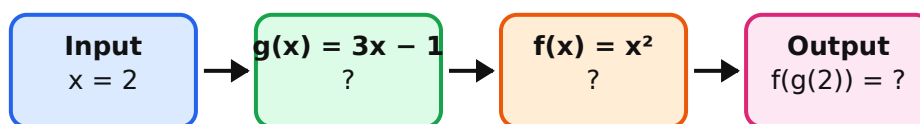
- $f(g(3))$
- $g(f(3))$

### Problem 6: Write composite functions

Let  $f(x) = x + 4$  and  $g(x) = 3x^2$ . Write each composite function in simplest form.

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

### Problem 7: Trace a value through a machine



Follow the input 2 through  $g$  and then  $f$ .

Let  $g(x) = 3x - 1$  and  $f(x) = x^2$ .

- Find  $g(2)$  and then  $f(g(2))$ .
- Write  $f(g(x))$  as a polynomial and check it at  $x = 2$ .

### Problem 8: Domain of a composition

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Let  $f(x) = \sqrt{x}$  and  $g(x) = x - 5$ .

- Write  $f(g(x))$  and state its domain.
- Write  $g(f(x))$  and state its domain.

### Problem 9: Decompose a function

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Write each function as  $h(x) = f(g(x))$  by naming an inner function  $g$  and an outer function  $f$ , neither equal to  $x$ .

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

### Problem 10: Inverse of a linear function

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Find the inverse of  $f(x) = 4x - 9$  and check it with the point  $(5, 11)$ .

### Problem 11: Inverse with fractions

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Find the inverse of  $f(x) = -\frac{2}{3}x + 4$ .

### Problem 12: Verify inverses by composition

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Show that  $f(x) = 5x + 3$  and  $g(x) = \frac{x-3}{5}$  are inverse functions.

### Problem 13: Are they inverses?

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Decide whether  $f(x) = 2x + 6$  and  $g(x) = \frac{x}{2} - 6$  are inverse functions. If not, write the correct inverse of  $f$ .

### Problem 14: Inverse with a restricted domain

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Let  $f(x) = x^2 + 3$  for  $x \geq 0$ . Find  $f^{-1}(x)$ , state its domain, and evaluate  $f^{-1}(12)$ .

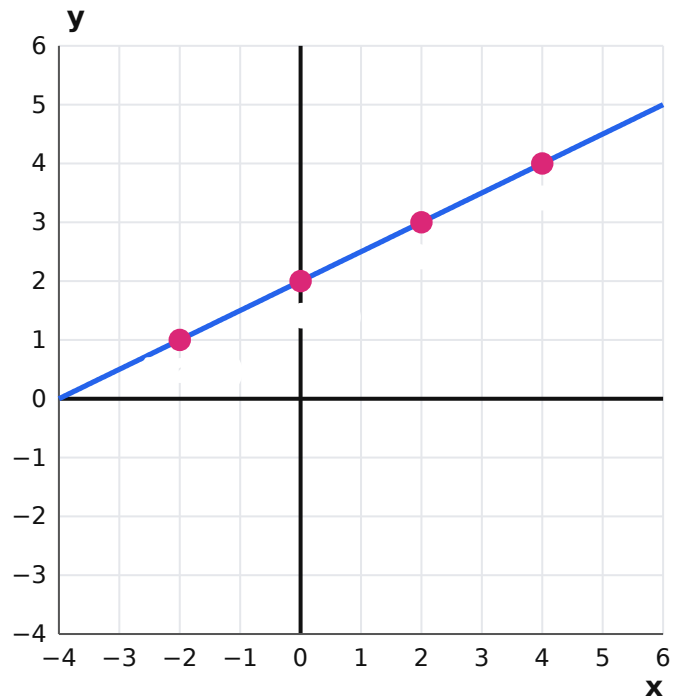
### Problem 15: Inverse of a square root function

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Find the inverse of  $f(x) = \sqrt{x+2}$  and state the domain of  $f^{-1}$ .

### Problem 16: Reflect points over $y = x$

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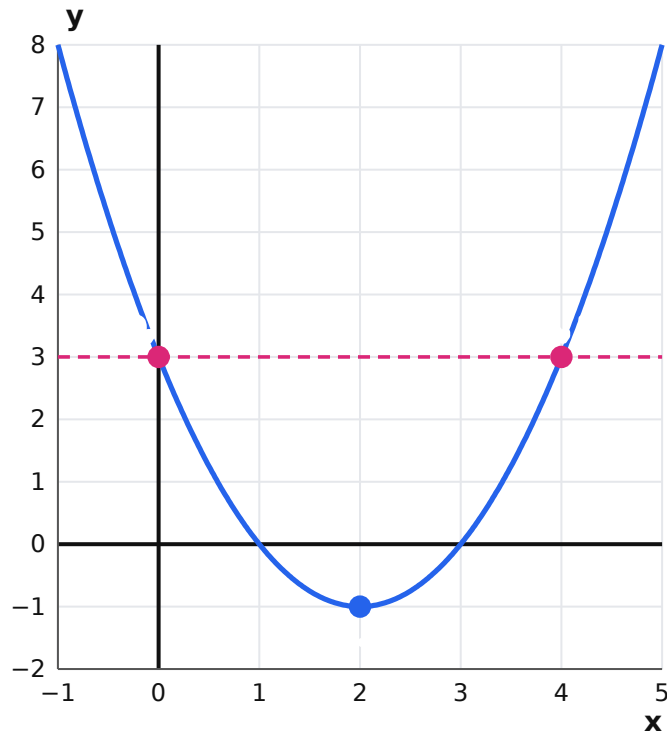
The graph of  $f$  with four marked points.

The graph shows a linear function  $f$ .

- Give the coordinates of the points on the graph of  $f^{-1}$  that correspond to the four marked points.
- Write a formula for  $f^{-1}(x)$ .

### Problem 17: Horizontal line test

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The graph of  $f$  with the horizontal line  $y = 3$ .

Use the graph of  $f(x) = (x-2)^2 - 1$  to answer.

- Does the horizontal line  $y = 3$  meet the graph more than once? Name the points.
- Does  $f$  have an inverse function on all real numbers? Explain.
- Name a restriction of the domain that makes  $f$  one-to-one.

### Problem 18: Inverse after restricting the domain

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Let  $f(x) = (x-2)^2 - 1$  for  $x \geq 2$ . Find  $f^{-1}(x)$  and its domain, and check with  $f(5)$ .

### Problem 19: Inverse of a rational function

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Find the inverse of  $f(x) = \frac{2x}{x+3}$  for  $x \neq -3$ .

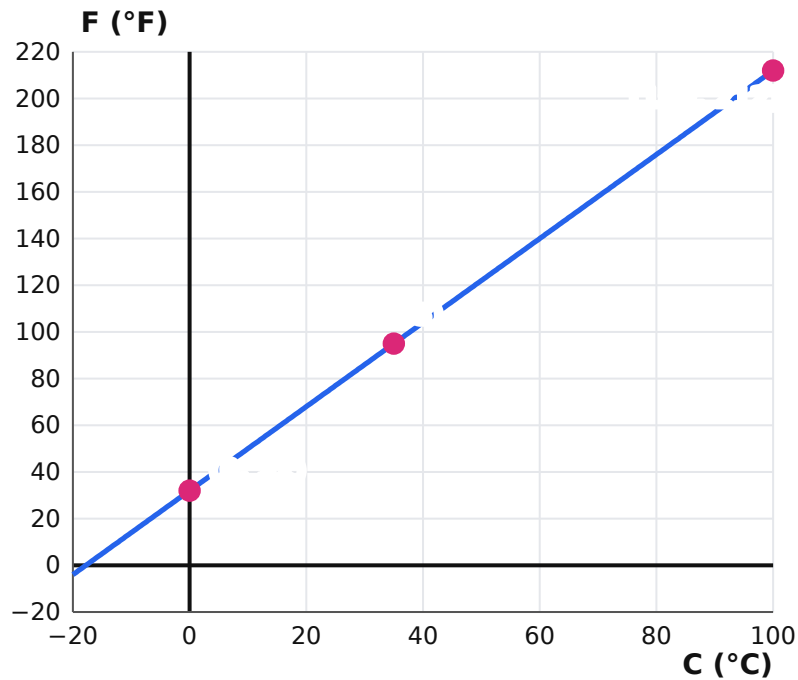
### Problem 20: Compositions that are equal

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Let  $f(x) = 2x - 1$  and  $g(x) = x^2$ . Find all values of  $x$  for which  $f(g(x)) = g(f(x))$ .

### Problem 21: Temperature conversion

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Fahrenheit temperature  $F$  as a function of Celsius temperature  $C$ .

Fahrenheit temperature is  $F(C) = \frac{9}{5}C + 32$  for Celsius temperature  $C$ .

- Find the inverse function  $C(F)$ .
- Use it to convert  $95^\circ\text{F}$  and  $-4^\circ\text{F}$  to Celsius.

### Problem 22: Car rental inverse

Maya rents a car for a base fee of \$25 plus \$0.45 per mile, so the cost is  $C(m) = 0.45m + 25$  dollars for  $m$  miles.

- Find the inverse function  $m(C)$ .
- Explain what the inverse tells you, then find the miles driven when the bill is \$70.

### Problem 23: Discount and coupon order

A store takes 20% off every price, and Jamal has a \$5-off coupon. Let  $d(x) = 0.8x$  be the discount and  $c(x) = x - 5$  the coupon.

- Write  $c(d(x))$  and  $d(c(x))$ .
- Find the cost of a \$60 jacket for each order.
- Which order is cheaper, and by how much for any price?

### Problem 24: Composition in context

A circular oil spill spreads so that its radius after  $t$  seconds is  $r(t) = 3t$  inches. The area is

$A(r) = \pi r^2$  square inches.

- Write  $A(r(t))$  in simplest form.
- Find the area after 2 seconds, in terms of  $\pi$  and rounded to the nearest tenth.