

Relations and Functions: practice solutions, Grade 9

– download the PDF

Written solutions to the chapter problems. Check each step, then correct yourself.

1 Domain and range of a relation



The first coordinates give the domain: $\{-3, 0, 4, 7\}$.

The second coordinates are $2, 5, 5, -1$. Listing each value once in increasing order, the range is $\{-1, 2, 5\}$.

2 Function or not?



- Each input $1, 2, 3$ appears once: **A** is a function.
- The input 0 is paired with 4 and with 6 : **B** is **not** a function.
- The inputs are all different. The output 1 repeats, which is allowed: **C** is a function.

3 Evaluate a linear function



$$f(2) = 4(2) + 3 = 11.$$

$$f(0) = 4(0) + 3 = 3.$$

$$f(-3) = 4(-3) + 3 = -12 + 3 = -9.$$

4 Complete a table



$$h(-2) = -2 - 7 = -9, h(0) = -7, h(5) = -2, h(10) = 3.$$

x	-2	0	5	10
$h(x)$	-9	-7	-2	3

5 Read a mapping diagram



- $\{(1, 4), (2, 5), (2, 7), (3, 6)\}$.
- Domain $\{1, 2, 3\}$; range $\{4, 5, 6, 7\}$.
- No. The input **2** has two arrows, to **5** and to **7**, so it is not a function.

6 Taxi fare



The fare is the flat fee plus **2** dollars for each mile: $f(m) = 2m + 3$.

$f(6) = 2(6) + 3 = 15$. A 6-mile trip costs **15 dollars**. Since a trip cannot have negative length, the domain is $m \geq 0$.

7 Next terms of a sequence



$d = 12 - 7 = 5$. The next terms are **22, 27, 32**.

$a_n = 7 + 5(n - 1) = 5n + 2$. Check: $a_3 = 17$.

8 Vertical line test on a graph



The dashed line $x = 3$ meets the curve at two points, **(3, 2)** and **(3, -2)**. The test fails, so the graph is **not** a function. The input **3** has the two outputs **2** and **-2**.

9 Evaluating a quadratic



$$g(0) = 1.$$

$$g(3) = 9 - 12 + 1 = -2.$$

$$g(-1) = 1 + 4 + 1 = 6.$$

$$g(5) = 25 - 20 + 1 = 6.$$

Notice that $g(-1) = g(5)$: two different inputs, same output, still a function.

10 Solve $f(x) = k$



a. $3x - 5 = 19$, $3x = 24$, $x = 8$.

b. $3x - 5 = -8$, $3x = -3$, $x = -1$.

c. $3x - 5 = 0$, $3x = 5$, $x = \frac{5}{3}$.

11 Domain and range from a table



Each x appears once, so it is a function. The domain is $\{0, 1, 2, 3, 4\}$ and the range is $\{0, 3, 6\}$ (the repeated outputs are listed once).

12 Reading a graph



The curve is $f(x) = x^2 - 2x - 3$.

a. $f(0) = -3$.

b. $f(1) = -4$, the lowest point.

c. The curve crosses the x -axis at $x = -1$ and $x = 3$.

d. $f(x) = 5$ at $x = -2$ and $x = 4$, since $f(-2) = 4 + 4 - 3 = 5$ and $f(4) = 16 - 8 - 3 = 5$.

13 Find the rule from a table



Each time x goes up by 1, $f(x)$ goes up by 3, so $f(x) = 3x + b$. With $f(1) = 7$: $3 + b = 7$, $b = 4$. So $f(x) = 3x + 4$ (check: $f(4) = 16$).

$$f(20) = 60 + 4 = 64.$$

14 Saving money



$$a_n = 15 + 6(n - 1) = 6n + 9.$$

$$a_{12} = 72 + 9 = 81, \text{ so } 81 \text{ dollars in week 12.}$$

Solve $6n + 9 > 100$: $n > 15.17$, so $n = 16$. Check: $a_{15} = 99$ and $a_{16} = 105$. The first week above 100 dollars is **week 16**.

15 Temperature function



$$F(0) = 32; F(100) = 180 + 32 = 212; F(-40) = -72 + 32 = -40.$$

$$\text{Solve } 1.8c + 32 = 50: 1.8c = 18, c = 10. \text{ So } 50^\circ\text{F is } 10^\circ\text{C.}$$

16 True or false?



- a. **True.** A function is a relation with the extra rule of one output per input.
- b. **False.** $\{(1, 2), (1, 3)\}$ is a relation but not a function.
- c. **False.** For $f(x) = x^2$, $f(-2) = f(2) = 4$.
- d. **False.** It is a vertical line, which crosses itself at every point: the input **4** has infinitely many outputs.
- e. **True.** It is a horizontal line; every vertical line meets it exactly once.

17 Evaluating with expressions



(a) $f(a + 1) = 2(a + 1) - 3 = 2a - 1$.

(b) $f(2x) = 2(2x) - 3 = 4x - 3$.

(c) $f(1) = -1$, so $f(x) + f(1) = 2x - 3 - 1 = 2x - 4$.

Since $f(x + 1) = 2x - 1 \neq 2x - 4$, they are **not** equal: a function does not “distribute” over addition.

18 Fencing a garden



a. $A(w) = w(20 - w)$.

b. $A(5) = 5 \cdot 15 = 75$, $A(10) = 100$, $A(15) = 15 \cdot 5 = 75$ (square feet).

c. Both sides must be positive: $w > 0$ and $20 - w > 0$, so the domain is $0 < w < 20$.

Writing $A(w) = 100 - (w - 10)^2$, the largest area is 100 ft^2 at $w = 10$, and the area gets close to but never reaches 0.

19 Two sequences race



a. $a_n = 3 + 7(n - 1) = 7n - 4$; $b_n = 40 - 5(n - 1) = 45 - 5n$.

b. $a_4 = 24 < b_4 = 25$, but $a_5 = 31 > b_5 = 20$. Sequence a passes b at $n = 5$.

c. $7n - 4 = 45 - 5n$ gives $12n = 49$, $n = \frac{49}{12} \approx 4.08$, not a whole number. So the sequences are **never equal**.

20 Find the missing constant



$f(3) = 3a + 5 = 14$, so $3a = 9$ and $a = 3$.

Then $f(x) = 3x + 5$ and $f(-4) = -12 + 5 = -7$.

21 Far terms of a sequence



$d = \frac{42 - 17}{9 - 4} = 5$. Then $a_1 = 17 - 3 \cdot 5 = 2$ and $a_n = 2 + 5(n - 1) = 5n - 3$.

$$a_{50} = 250 - 3 = 247.$$

$5n - 3 = 500$ gives $n = 100.6$: not a whole number, so 500 is not a term. $5n - 3 = 502$ gives $n = 101$: 502 is the 101st term.

22 Rule from a graph



Slope = $\frac{6 - (-2)}{4 - 0} = 2$; the y -intercept is -2 . So $f(x) = 2x - 2$.

$$f(10) = 20 - 2 = 18.$$

$$2x - 2 = -10 \text{ gives } 2x = -8, x = -4.$$



Test yourself: quick challenge for Grade 9

Change level

Level : Grade 9

6 random questions, instant feedback.



Start the challenge



Keep exploring with Zyro

 Math practice

Relations and Functions: math practice,
Grade 9

 Math quizzes

Relations and Functions: math quiz,
Grade 9

 Math tests

Relations and Functions: math test,
Grade 9

 Math practice

Slope and Graphing Linear Functions:
math practice, Grade 9

 Math practice

Writing Linear Equations and Scatter
Plots: math practice, Grade 9

 Math quizzes

Slope and Graphing Linear Functions:
math quiz, Grade 9

Zyro vous emmène sur nos sites partenaires

Embarquez pour d'autres planètes du savoir et leurs applis.

Décollage