

Introduction to Functions: practice solutions, Grade 8 – download the PDF

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

1 Function or not?



- a. Each input 1, 2, 3, 4 appears once, so each has exactly one output. The inputs 1 and 3 share the output 4, which is allowed. **It is a function.**
- b. The input 2 is paired with both 1 and 5. **It is not a function.**

2 Running a machine



$$x = 0: 4(0) - 3 = -3.$$

$$x = 2: 8 - 3 = 5.$$

$$x = 5: 20 - 3 = 17.$$

$$x = -1: -4 - 3 = -7.$$

3 Completing a table



$x = -1: 2 + 6 = 8$. $x = 0: 6$. $x = 1: -2 + 6 = 4$. $x = 3: -6 + 6 = 0$.

x	-1	0	1	3
y	8	6	4	0

4 Rate and initial value



- a. Rate 5, initial value 12.
- b. Rate -3 , initial value 9.
- c. Rate 0.5, initial value 0 (no constant term).

5 True or false?



- a. **False.** A function gives exactly one output for each input.
- b. **True.** For example $y = x^2$ gives 4 for both $x = 2$ and $x = -2$.
- c. **False.** The points $(0, 0)$, $(1, 1)$, $(2, 4)$ are not aligned; the graph is a curve.

6 Is the change constant?



The changes in y are $10 - 7 = 3$, $13 - 10 = 3$, $16 - 13 = 3$. The change is constant, so the function is **linear** with rate of change 3. The initial value is 7, so $y = 3x + 7$.

7 A circle on the grid



A vertical line at $x = 3$ meets the circle at $(3, 4)$ and at $(3, -4)$. By the **vertical line test**, the circle is **not** the graph of a function: the input 3 has two outputs.

8 Taxi fare



- a. $C = 2m + 3$.
- b. $C = 2(6) + 3 = 15$. The ride costs **15 dollars**.
- c. $2m + 3 = 27 \Rightarrow 2m = 24 \Rightarrow m = 12$. The ride is **12 miles** long (about 19.3 km).

9 Equation from two points



Rate: $\frac{19 - 7}{6 - 2} = \frac{12}{4} = 3$.

Going from $x = 2$ back to $x = 0$ lowers y by $3 \times 2 = 6$: initial value $7 - 6 = 1$.

Equation: $y = 3x + 1$. Check with $(6, 19)$: $3(6) + 1 = 19$. Correct.

10 Linear or nonlinear?



- a. Linear (rate 3, initial value -5).
- b. Nonlinear: x is squared; the graph is a curve.
- c. Linear: a horizontal line with rate of change 0.
- d. Nonlinear: x is cubed.

11 Which function is greater?



- a. For f , the change is constant, $+3$, so the rate is 3 and the initial value is 2:

$f(x) = 3x + 2$. For g , the rate is 4 and the initial value is -1 .

- b. $f(5) = 3(5) + 2 = 17$ and $g(5) = 4(5) - 1 = 19$. The function g is greater at $x = 5$.
(They are equal at $x = 3$, where both equal 11.)

12 Draining a tank



- a. $V = 80 - 5t$, or $V = -5t + 80$.
- b. The rate -5 means the volume drops by 5 gallons each minute. The initial value 80 is the volume at $t = 0$.
- c. $80 - 5t = 0 \Rightarrow t = 16$. The tank is empty after **16 minutes**.

13 Phone battery



- a. Rate: $\frac{84 - 100}{2 - 0} = -8$ percentage points per hour. Initial value 100. Equation:
 $y = 100 - 8x$. Check at $x = 4$: $100 - 32 = 68$.
- b. $100 - 8x = 0 \Rightarrow x = 12.5$. The battery is empty after **12.5 hours**.

14 Temperature conversion

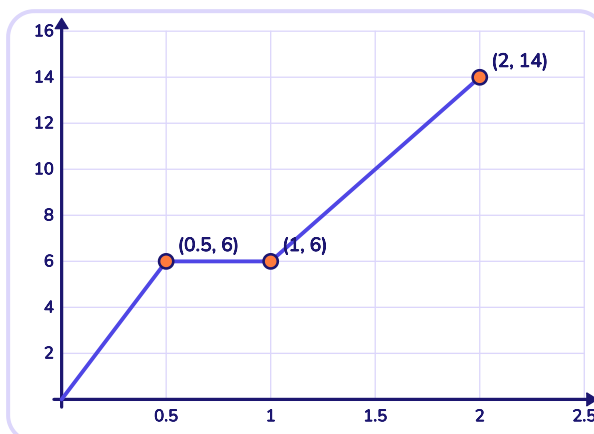


- a. $1.8(0) + 32 = 32$ °F. $1.8(25) + 32 = 45 + 32 = 77$ °F. $1.8(100) + 32 = 212$ °F.
- b. The rate is 1.8 °F per °C and the initial value is 32 °F. The equation has the form $y = mx + b$, so the function is **linear**.

15 Cyclist's trip

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First stage: $12 \times 0.5 = 6$ miles, so the graph goes from $(0, 0)$ to $(0.5, 6)$. Rest: the distance stays at 6, so the graph is flat from $(0.5, 6)$ to $(1, 6)$ (rate 0). Last stage: $8 \times 1 = 8$ more miles, so the graph reaches $(2, 14)$.



The cyclist covers 14 miles (about 22.5 km) in 2 hours.

16 A table that fails

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The input 2 appears twice, with outputs 5 and 6, so the student is **wrong**: the table does not show a function. Changing the second output 6 into 5 gives the pairs $(1, 3), (2, 5), (2, 5), (3, 8)$, where each input has exactly one output. A repeated identical pair is fine.

17 Two gym plans

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- Month 3: A costs $12 + 54 = 66$, B costs $40 + 30 = 70$, so A is cheaper. Month 4: A costs $12 + 72 = 84$, B costs $40 + 40 = 80$, so B is cheaper.
- $18x - 10x = 40 - 12 \Rightarrow 8x = 28 \Rightarrow x = 3.5$. After 3.5 months the plans cost the same (75 dollars). Before that A is cheaper; after that B is cheaper, because B has the smaller rate (10 versus 18).

18 Error analysis



The outputs are 1, 4, 9, 16. The changes are **3, 5, 7**. A constant rate of change would give equal changes. Increasing is not the same as increasing by a constant amount, so $y = x^2$ is nonlinear.

19 Equation from a graph



a. Initial value -2 . Rate $\frac{6 - (-2)}{4 - 0} = 2$. Equation: $y = 2x - 2$.

b. Set $y = 0$: $2x - 2 = 0 \Rightarrow x = 1$. The graph crosses the x -axis at $(1, 0)$.

20 A burning candle



a. $h = 12 - 1.5t$.

b. $h = 12 - 7.5 = 4.5$ inches (about 11.4 cm).

c. The candle cannot have a negative height. $12 - 1.5t = 0$ gives $t = 8$. The function makes sense for $0 \leq t \leq 8$.

21 Area of a square



a. Each side length gives exactly one area, so A is a function of s . It is nonlinear because s is squared.

b. Side 3 gives 9 square inches and side 6 gives 36 square inches. When the side doubles, the area is multiplied by 4 ($36 = 4 \times 9$).

22 Missing coefficients



$b = f(0) = 5$. Then $4a + 5 = 17 \Rightarrow a = 3$. So $f(x) = 3x + 5$. Then $f(10) = 35$. For $f(x) = 50$: $3x + 5 = 50 \Rightarrow x = 15$.



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