

Understanding Functions and Function Notation

Grade 9 – Algebra 1 math · Worksheet Answer Key · Standards: F-IF.A.1, F-IF.A.2, F-IF.B.5

Each answer key shows the substitution step by step and states domain and range with inequalities or sets. When a statement is interpreted, the answer names the input and output quantities and their units.

Standards: F-IF.A.1, F-IF.A.2, F-IF.B.5 · **Level:** Grade 9 Algebra 1

Problem 1 Repeated outputs

Each input 1, 2, 3, 4 appears once, so each has exactly one output. Two inputs share the output 5, which is allowed.

Yes, it is a function.

Problem 2 Repeated input

The input 2 is paired with both 3 and 7.

No, it is not a function.

Problem 3 Evaluate a linear function

$$f(5) = 4(5) - 3 = 20 - 3 = 17.$$

$$f(5) = 17$$

Problem 4 Evaluate a quadratic

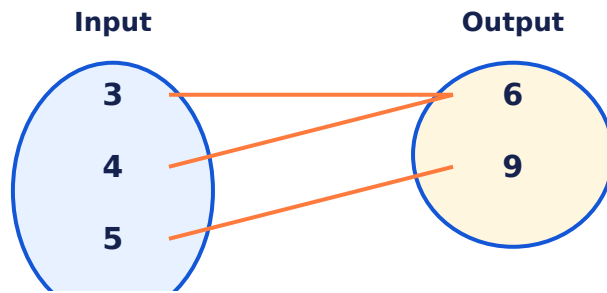
$$g(-3) = (-3)^2 + 2 = 9 + 2 = 11.$$

$$g(-3) = 11$$

Problem 5 Mapping diagram

Each input has one arrow: $3 \rightarrow 6$, $4 \rightarrow 6$, $5 \rightarrow 9$.

Domain: the inputs $\{3, 4, 5\}$. Range: the outputs used $\{6, 9\}$.

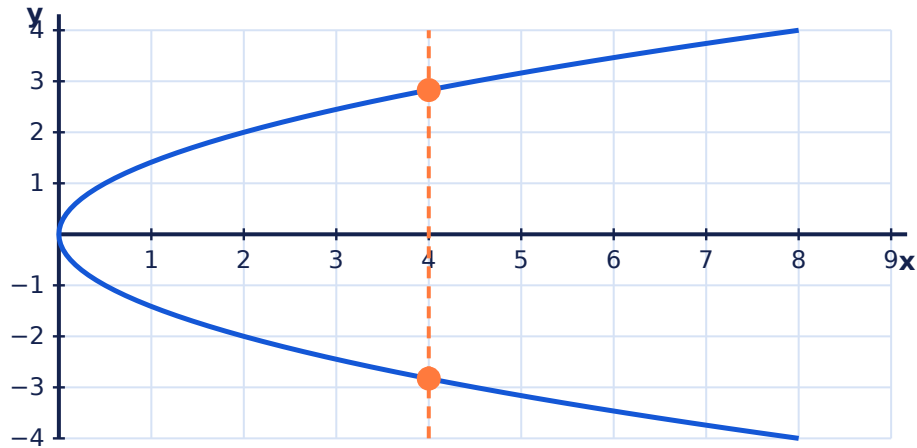


A mapping diagram.

Yes; domain {3, 4, 5}, range {6, 9}

Problem 6 Vertical line test

The vertical line $x = 4$ meets the curve at two points, about $(4, 2.8)$ and $(4, -2.8)$.



The line $x = 4$ crosses twice.

No, it is not a function.

Problem 7 Evaluate with a square

$$f(-4) = 5(-4)^2 - 2(-4) + 9 = 5(16) + 8 + 9 = 80 + 17 = 97.$$

$$f(-4) = 97$$

Problem 8 Find the input

$$5 - 3x = -10, \text{ so } -3x = -15 \text{ and } x = 5.$$

$$\text{Check: } f(5) = 5 - 15 = -10.$$

$$x = 5$$

Problem 9 Substitute an expression

$$f(a + 1) = 2(a + 1) + 5 = 2a + 2 + 5 = 2a + 7.$$

$$\mathbf{f(a + 1) = 2a + 7}$$

Problem 10 Table to rule

The outputs increase by 3 each time and $f(0) = 4$, so $f(x) = 3x + 4$.

$$f(10) = 3(10) + 4 = 34.$$

$$\mathbf{f(x) = 3x + 4; f(10) = 34}$$

Problem 11 Interpret $f(a) = b$

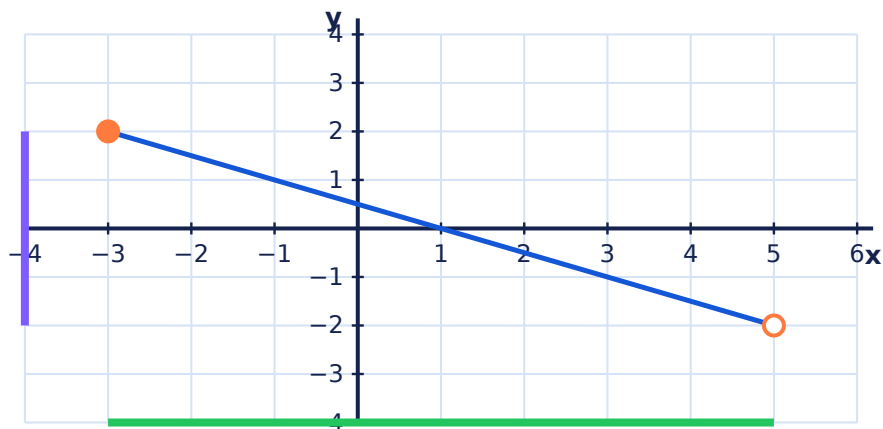
$f(8) = 120$: eight seconds after takeoff, the drone is 120 feet high.

$f(15) = 0$: after 15 seconds the drone is at ground level, so it has landed.

120 ft at 8 s; landed at 15 s

Problem 12 Domain and range from a graph

The graph runs from $x = -3$ (included) to $x = 5$ (not included). Heights run from -2 (not included) to 2 (included).



Domain in green, range in violet.

Domain: $-3 \leq x < 5$. Range: $-2 < y \leq 2$.

Problem 13 Discrete domain

Burritos are counted in whole numbers, so the domain is $\{0, 1, 2, \dots, 40\}$. The outputs are the multiples of 7 from 0 to 280.

Domain: whole numbers 0 to 40 (discrete); range: $\{0, 7, 14, \dots, 280\}$

Problem 14 Continuous domain

Time can be any value from 0 to 25 minutes. At 25 minutes, $V = 12(25) = 300$.

Domain: $0 \leq t \leq 25$ (continuous); range: $0 \leq V \leq 300$ gallons

Problem 15 Ticket pricing

$$A(6) = 8.5(6) + 3 = 51 + 3 = 54.$$

$$8.5n + 3 = 88 \text{ gives } 8.5n = 85, \text{ so } n = 10.$$

6 tickets cost \$54; \$88 buys 10 tickets

Problem 16 Town population

$$P(10) = 12,000 + 3,500 = 15,500.$$

$$12,000 + 350t = 17,600 \text{ gives } 350t = 5,600, \text{ so } t = 16 \text{ (the year 2036).}$$

The 350 is the yearly increase in people.

$P(10) = 15,500$; $t = 16$ years; 350 people per year

Problem 17 Points to a rule

The points are $(0, 3)$, $(1, 5)$, $(2, 7)$, $(3, 9)$: outputs go up by 2, and $f(0) = 3$, so $f(x) = 2x + 3$.

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

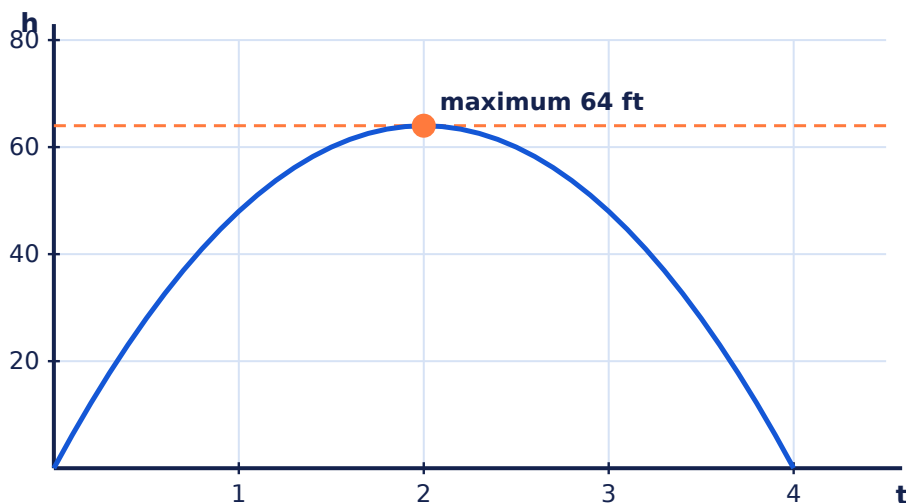
Domain $\{0, 1, 2, 3\}$; range $\{3, 5, 7, 9\}$.

$f(x) = 2x + 3$; $f(4) = 11$

Problem 18 Thrown ball

$$h(1) = -16 + 64 = 48. \quad h(2) = -64 + 128 = 64. \quad h(4) = -256 + 256 = 0.$$

$h(4) = 0$ means the ball is back on the ground after 4 seconds, so the domain is $0 \leq t \leq 4$. The highest point is 64 feet.



The range runs from 0 to 64 feet.

48 ft, 64 ft, 0 ft; domain $0 \leq t \leq 4$; range $0 \leq h \leq 64$

Problem 19 Students and buses

(a) Each student has exactly one bus, so yes.

(b) Bus 2 is paired with both Ana and Cai, so one input has two outputs. No.

Domain of (a): {Ana, Ben, Cai, Dee}; range {1, 2, 3}.

(a) yes (b) no

Problem 20 Compare two functions

$$f(10) = 30 - 5 = 25.$$

g increases by 3 each step and $g(1) = 2$, so $g(x) = 3x - 1$ and $g(10) = 29$.

$$29 - 25 = 4.$$

$g(10)$ is larger, by 4