

Understanding Functions and Their Graphs

Grade 8 math · Worksheet Answer Key · Standards: 8.F.A.1, 8.F.A.2, 8.F.A.3

Each answer states the one-output test or the rate of change used, and gives final results in bold. Graph figures are repeated with the key features marked so the reasoning can be checked.

Standards: 8.F.A.1, 8.F.A.2, 8.F.A.3 · **Level:** Grade 8

Problem 1 Ordered pairs

(a) The inputs 1, 2, 3, 4 are all different, so each has one output. (b) The input 2 is paired with both 5 and 8.

(a) function (b) not a function

Problem 2 Mapping diagram

Every input has exactly one arrow. The outputs go up by 3 as the inputs go up by 1, and input 1 gives 5, so output = $3 \cdot \text{input} + 2$. Check: $3(4) + 2 = 14$.

Yes, a function; output = $3 \cdot \text{input} + 2$

Problem 3 Table rule

Each step of 1 in x adds 3 to y , and $y = 6$ when $x = 0$.

$y = 3x + 6$

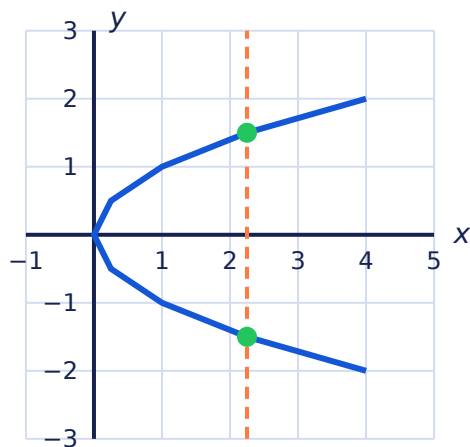
Problem 4 Function notation

$f(5) = 4(5) - 7 = 13$. $f(-2) = 4(-2) - 7 = -15$. $f(0) = -7$.

13, -15 and -7

Problem 5 Vertical line test

The dashed vertical line crosses the curve at two points, which means one input has two outputs.



Two crossings.

Not a function

Problem 6 Input and output

$2(3) + 9 = 15$, $2(6) + 9 = 21$ and $2(10) + 9 = 29$.

15, 21 and 29

Problem 7 Quadratic table

Compute: $4 - 3 = 1$, $1 - 3 = -2$, $0 - 3 = -3$, $4 - 3 = 1$, $16 - 3 = 13$. The output 1 appears for both -2 and 2 , which is allowed.

1, -2, -3, 1, 13; yes, 1 repeats

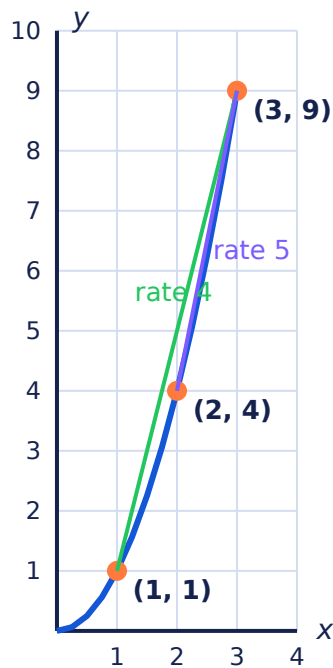
Problem 8 Linear or nonlinear tables

Table 1: the outputs rise 4, 4, 4, so the rate is constant. Table 2: the outputs rise 3, 5, 7, so the rate changes.

Table 1 is linear; Table 2 is nonlinear.

Problem 9 Side and area

From (1, 1) to (3, 9): $8 \div 2 = 4$. From (2, 4) to (3, 9): $5 \div 1 = 5$. Different pairs of points give different rates, so the graph is not a line.



Two different rates.

Rates 4 and 5; nonlinear

Problem 10 Compare two functions

B: the rate is $(9 - 3) \div 2 = 3$ and the initial value is 3. A: rate 2.5 and initial value 4. Since $3 > 2.5$ and $4 > 3$:

B has the greater rate; A has the greater initial value.

Problem 11 Graph versus equation

C: rate $(10 - 2) \div 4 = 2$ and y-intercept 2. D: rate 3 and y-intercept -1 .

D is steeper ($3 > 2$); C starts higher ($2 > -1$).

Problem 12 Spot the linear equations

(a) The form $mx + b$ with $m = 7$: linear. (b) x is squared, so the graph is a curve: nonlinear. (c) This equals $-0.5x + 4$: linear.

(a) and (c) are linear; (b) is nonlinear.

Problem 13 Find the rule

The outputs rise 6 when x rises 2, so the rate is 3. Then $7 = 3(2) + b$ gives $b = 1$. Check: $3(8) + 1 = 25$.

$$y = 3x + 1$$

Problem 14 Repeated outputs

Each name has one month, so the first is a function even though June repeats. In the reverse, the input June is paired with both Ava and Ben.

First: function. Reverse: not a function.

Problem 15 Pool water level

$d(t) = 4t + 12$. $d(6.5) = 26 + 12 = 38$. For 60: $4t + 12 = 60$, so $4t = 48$ and $t = 12$.

$d(t) = 4t + 12$; 38 inches; after 12 hours

Problem 16 Two phone plans

B rises \$10 per 100 minutes, which is \$0.10 per minute, so the rate matches A. B: $28 = 0.10(100) + b$, so $b = 18$. A has a \$15 fee and B has an \$18 fee, so B costs \$3 more at every number of minutes.

Same rate; Plan A costs \$3 less.

Problem 17 Perimeter and area

P: 4, 8, 12, 16, 20 (steps of 4: linear). A: 1, 4, 9, 16, 25 (steps of 3, 5, 7, 9: nonlinear). At $s = 4$ both are 16.

Perimeter is linear; they are equal when $s = 4$.

Problem 18 Constant versus vertical

The graph of $y = 5$ is a horizontal line: every input has the single output 5. The graph of $x = 5$ is a vertical line: the input 5 is paired with every y , so it fails the vertical line test.

$y = 5$ is a function; $x = 5$ is not.

Problem 19 Points on a line

$(14 - 6) \div (3 - 1) = 4$ and $(26 - 14) \div (6 - 3) = 4$. The rate is constant. From $6 = 4(1) + b$, $b = 2$. So $f(x) = 4x + 2$ and $f(10) = 42$.

$f(x) = 4x + 2$; $f(10) = 42$

Problem 20 Fence and seed

At $s = 6$: $C = 72$ and $S = 0.5(36) = 18$. They match when $12s = 0.5s^2$, so $s = 24$ (cost \$288 for each). At $s = 30$: $C = 360$ and $S = 450$.

\$72 and \$18; match at $s = 24$; seed costs more at $s = 30$