

Grade 8 Target E

Domain, Target, Standards, DOK, Vertical Alignments, Achievement Levels, Evidence Required, Vocabulary, Response Types, Materials, Attributes, Question Types, and Question Banks (Examples)

[Content Domain:Functions](#)

[Target E \[m\]: 8.F.A Define, evaluate, and compare functions.](#)

[Standards included in Target E: 8.F.A, 8.F.A.1, 8.F.A.2, 8.F.A.3](#)

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Content Domain:Functions

Target E [m]: 8.F.A Define, evaluate, and compare functions.

Standards included in Target E: 8.F.A, 8.F.A.1, 8.F.A.2, 8.F.A.3

8.F.A.1 Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.

8.F.A.2 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.

8.F.A.3 Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1, 1), (2, 4) and (3, 9), which are not on a straight line.

Vertical Alignment

Related Grade 7 standards

7.RP.A Analyze proportional relationships and use them to solve real-world and mathematical problems.

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7.RP.A.2c Represent proportional relationships by equations. For example, if total cost t is proportional to the number n of items purchased at a constant price p , the relationship between the total cost and the number of items can be expressed as $t = pn$.

7.RP.A.2d Explain what a point (x,y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points $(0, 0)$ and $(1, r)$ where r is the unit rate.

7.EE.B Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

7.EE.B.4a Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q , and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?

Related Grade HS Standards

F-IF.A Understand the concept of a function and use function notation.

F-IF.A.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x . The graph of f is the graph of the equation $y = f(x)$.

F-IF.A.2 Use function notations, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. F-IF.B Interpret functions that arise in applications in terms of the context.

F-IF.B.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

F-IF.B.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

F-IF.C Analyze functions using different representations.

F-IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

F-IF.C.7a Graph linear and quadratic functions and show intercepts, maxima, and minima.

F-IF.C.7b Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

F-IF.C.7c Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

F-IF.C.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

F-IF.C.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

Achievement Level Descriptors

Level 1 Students should be able to identify whether or not a relationship that is represented graphically, in a table, or algebraically, is a function. They should be able to compare the properties of two linear functions represented in the same way (graphically or in a table).

Level 2 Students should be able to produce input and output pairs for a given function and identify whether an input/output pair satisfies a function. They should be able to compare properties of two functions represented in the same way (algebraic, graphic, tabular, or verbal). They should be able to classify functions as linear or nonlinear on the basis of their graph.

Level 3 Students should be able to classify functions as linear or nonlinear in different forms (e.g., graphical, algebraic, verbal description, and/or tabular) and should know linear equations of the form $y = mx + b$ are functions. They should also be able to define a function as a rule that assigns to each input exactly one output. They should be able to compare properties of two functions represented in different ways (algebraic, graphic, tabular, or verbal).

Level 4 Students should be able to give examples of functions that are not linear and be able to compare properties of two nonlinear functions represented in different ways (algebraic, graphic, tabular, or verbal).

Evidence Required

1. The student recognizes that a function is a rule that assigns to each input exactly one output.
2. The student identifies or produces input and output pairs for given functions.
3. The student recognizes the same function written in different functional forms (algebraic, graphic, tabular, or verbal).
4. The student compares properties of two functions, each represented in a different way (algebraic, graphic, tabular, or verbal).

5. [Retired this Evidence Required statement]

6. The student recognizes and gives examples of functions that are not linear.

Vocabulary

function, relation, linear, nonlinear, ordered pairs, coordinate grid, rate of change, y -intercept, x -intercept, slope

Response Types

Multiple Choice, multiple correct response; Multiple Choice, single correct response; Equation/Numeric; Matching Tables

Materials

equations that define functions, graphical representations of functions, functions represented by tables, written descriptions of functions, sets of ordered pairs

Attributes

None

Claim 1: Concepts and Procedures (DOK 2) Question Banks

Students can explain and apply mathematical concepts and carry out mathematical procedures with precision and fluency.

Claim 1 8.F.A.1 DOK Level 1

Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.

Evidence Required

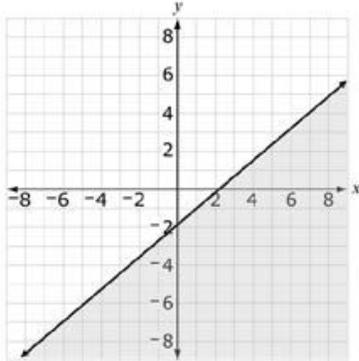
The student recognizes that a function is a rule that assigns to each input exactly one output.

Question Type 1: The student is presented with relations that may be functions and are represented as tables, graphs, and equations.

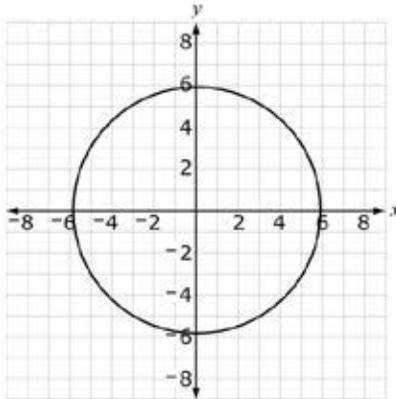
1. Which relation defines y as a function of x ?
 - A. The proportional relationship $y = 2.4x$.
 - B. The table showing the age in years, x , and weight in pounds, y , of five dogs.

x	y
3	30
4	38
4	21
5	9
6	42

C. The graph of an inequality as shown by the shaded region.



D. The graph of $x^2 + y^2 = 36$ as shown.



Question Type 2: The student is presented with equations in two variables.

1. Which equation defines p as a function of t ?

- A. $p = 3t + 2$
- B. $t = 3p + 2$
- C. $p = 0t + 2$
- D. $t = 0p + 2$

Rubric: Student selects correct values (e.g., A, B, C).

Response Type: Multiple Choice, multiple correct response

Claim 1 8.F.A.1 DOK Level 1

Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.

Evidence Required

The student identifies or produces input and output pairs for given functions.

Question Type 1: The student is presented with an equation or table that represents a function.

1. Select **all** ordered pairs that correspond to input-output pairs for the function $y = -6x + 7$.

- A. (1, 1)
- B. (-1, 1)
- C. (-6, 7)
- D. (3, -11)

2. A swimming pool had 30 gallons of water in it. Then water was added to the pool at a rate of 5 gallons per second.

The function $y = 5t + 30$ describes the relationship between the number of gallons, y , and the number of seconds water was added, t .

Select **all** of the ordered pairs that correspond to input-output pairs for the function.

A. (45, 3) B. (3, 45) C. (0, 30) D. (30, 0)

Answer Choices: The answer choices will include at least two correct input-output pairs.

Incorrect options will include input-output pairs resulting from switching the variables and integer signs, and using the slope and y -intercept to form an input-output pair.

Rubric: (1 point) The student selects all correct input-output pairs (e.g., A and D; B and C).

Response Type: Multiple Choice, multiple correct response

Claim 1 8.F.A.2 DOK Level 2

Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.

Evidence Required

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The student recognizes the same function written in different functional forms (algebraic, graphic, tabular, or verbal).

Question Type 1: The student is presented with a function represented in algebraic, graphic, or tabular form.

1. Consider the function represented by this table of values.

x	y
-4	-10
-3	-7
-2	-4
-1	-1
0	2

Which function could have produced the values in the table?

- A. $y = -x - 14$
- B. $y = -3x + 2$
- C. $y = 3x - 22$
- D. $y = 3x + 2$

Rubric: (1 point) The student selects the correct answer choice (e.g., D).

Response Type: Multiple Choice, single correct response

2. A swimming pool has 30 gallons of water in it. Water is added to the pool at a rate of 5 gallons per second.

Which equation models the relationship between W , the number of gallons of water, and t , the number of seconds water is being added to the swimming pool?

- A. $W=30t+5$
- B. $W=5t+30$
- C. $W=t+35$
- D. $W=35t$

Rubric: (1 point) The student selects the correct answer (e.g., B).

Response Type: Multiple Choice, single correct response

Claim 1 8.F.A.2 DOK Level 2

Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.

Evidence Required

The student compares properties of two functions, each represented in a different way (algebraic, graphic, tabular, or verbal).

Question Type 1: The student is presented with linear functions represented in different ways.

1. Each relation shown defines y as a function of x . Which function has the greatest rate of change?

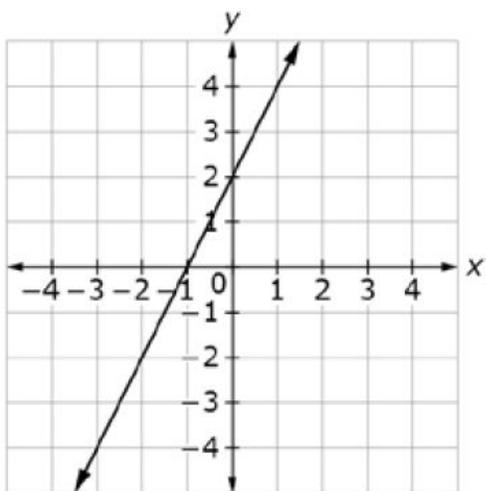
A. $y = \frac{7}{3}x + 4$

B. $y = 3x - 1$

C.

x	y
0	4
2	12
4	20
6	28

D.



Rubric: (1 point) The student identifies the correct function (e.g., C).

Response Type: Multiple choice, single correct response

Claim 1 8.F.A.3 DOK Level 2

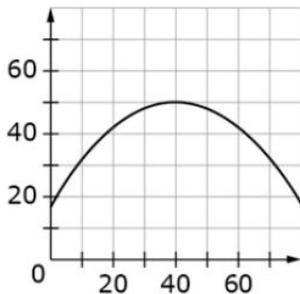
Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1, 1), (2, 4) and (3, 9), which are not on a straight line.

Evidence Required

The student recognizes and gives examples of functions that are not linear.

Question Type 1: The student is presented with linear and nonlinear functions represented in different ways.

- 1. Several functions are represented in the table. Determine whether each function could be linear.

Function	Could be linear	Cannot be linear												
$y = \frac{3}{4}x + 2$														
														
<table border="1"><thead><tr><th>x</th><th>y</th></tr></thead><tbody><tr><td>-2</td><td>5</td></tr><tr><td>-1</td><td>9</td></tr><tr><td>0</td><td>13</td></tr><tr><td>1</td><td>17</td></tr><tr><td>2</td><td>21</td></tr></tbody></table>	x	y	-2	5	-1	9	0	13	1	17	2	21		
x	y													
-2	5													
-1	9													
0	13													
1	17													
2	21													

Rubric: (1 point) The student selects the correct box to identify whether the functions are linear or nonlinear (e.g., L, N, L).

Response Type: Matching Tables

Claim 2 Problem Solving Question Banks

[Claim Descriptors and Targets](#)

Students can solve a range of complex well-posed problems in pure and applied mathematics, making productive use of knowledge and problem-solving strategies.

Example 1

Helga wants to have a lot of helium-filled balloons at her party.

- The helium tank costs \$58 to rent.
- Balloons cost \$0.29 each.
- She wants to have 5 helium-filled balloons for each party guest.

Enter an equation that represents the total cost, C , in dollars of the helium-filled balloons for n party guests.

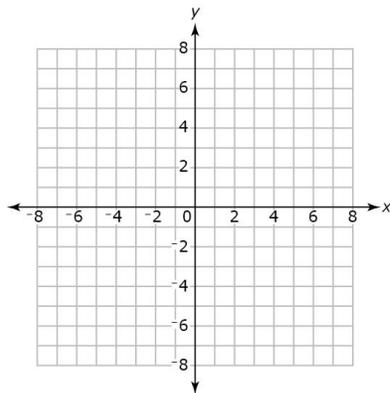
Rubric: (1 point) The student enters a correct equation in the response box (e.g., $C=58+1.45n$).

Response Type: Equation/Numeric

Example 2

This table shows some values of a linear function.

x	y
-1	-5
1	-1
3	3



Use the Add Arrow tool to draw the graph of a different function that has the same rate of change as the one shown in the table of values.

Rubric: (1 point) The student draws a line with the correct slope and does not pass through the points shown in the function table (e.g., slope of 2, passes through any y-intercept except (0, -3))

Response Type: Graphing