Functions
Compare and Contrast
Grade 8

Rationale

- Recognizing that functions can be represented in a variety of ways is critical in order for students to understand all the ways that functions can be used in a real-world context. Despite the fact that functions may appear in different forms (algebraically, graphically, numerically in tables, or by verbal descriptions), students must be able to compare and contrast them according to their attributes, such as their rates of change and their *y*-intercepts.

Goal

- To understand and compare functions represented in different formats

Standards

- **8.F.2** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

Objectives

- Students will determine the attributes of a function regardless of its form or representation.
- Students will compare attributes of two functions given in different forms.

Materials

- Pencils
- Scratch paper
- Graphs, tables, functions, and sentences cut into stacks from the ***Activity Set*** pages
- Blank coordinate grids for each student

Procedures

- In advance of the class, create four sets of function cards by cutting out the functions in the ***Activity Set*** pages. Each set should have 8 different functions, represented algebraically, graphically, numerically in tables, or with a verbal description.
- Divide the class into 4 groups of students. Assign a function format to each group: algebraic, graphic, numeric tables, or verbal description. Provide that group with the corresponding set of function cards. Each group will have the same set of functions, only their representations will differ.
- Say, "You will get to choose an investment in which to place your money. On each of these cards is a representation of what will happen to your money over time. As a group, you must put your cards in order from what you think will be the best investment to what you think will be the worst investment."
- Have students discuss within their own groups what constitutes a better investment among their functions. Do not provide too much support. Instead allow the students draw their own conclusions from the data.
- Ensure that students have access to blank coordinate grids in the event that they want to translate from their representations to a graphical representation. This may help students to compare the functions.
- Once all four groups of students have completed the task of ordering the functions, have a leader from each group describe the order of their functions, including an explanation for why the particular functions were deemed the *best* or *worst*. Students should compare their choices by recognizing their functions in each of the various formats. Have the students try to come up with a single class order for the functions across all formats.
- Students will most likely need to debate their order with the members of the other groups to convince the other groups that their group's order was correct. Encourage a student-led discussion that helps the students to consider the different ways that a function can be represented.
- Closing: Have students discuss which representations they found the easiest or hardest to compare. Ask students to think about and discuss how each of the formats contributes to the overall understanding of the functions.

Teacher Tips

- If students struggle with determining the rate of change of a linear function, remind them that the rate of change is the amount of change as the line moves one unit to the right. For some function tables where the x-coordinates do not increase by 1, students will not be able to use the data in the y-coordinates to determine the rate of change; they will first need to find consecutive x-values.
- Depending upon the dynamics of your class, you may choose to have more than four groups. You can create more groups by having duplicate sets of the cards. Students could work in small groups initially and then form larger groups with students who have the same set of cards.
- Instead of providing written sentences for some functions, you can choose to read aloud

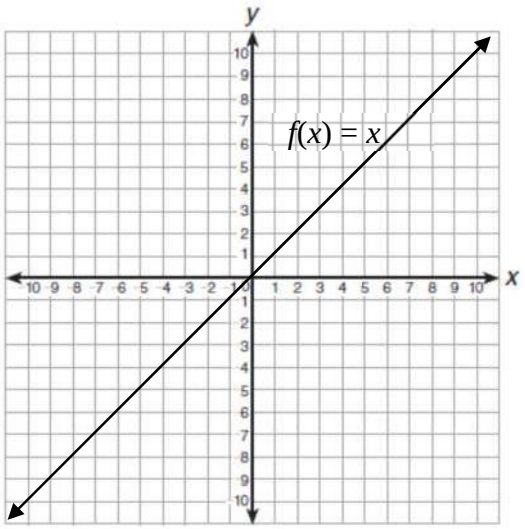
their descriptions so that they become truly *verbal* descriptions. You can choose to vary the language, so long as the necessary information for the function is provided.
- Some students with more experience will need an extra challenge. You can provide more complex functions, such as those including trinomials.
- The lesson is set up so that each group only has one type of representation. As an added challenge, you can group the cards by function and then mix up the various representations within each pile. Then have each group pick one from each pile resulting in each group still having one of each function but with a variety of representations to compare.

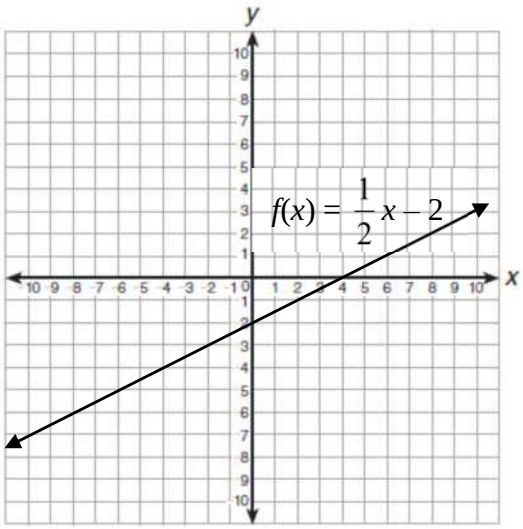
Extension Activities

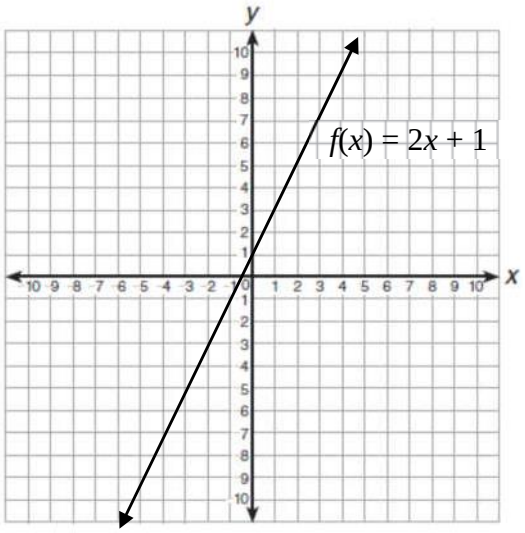
- For homework or additional practice, have students create their own functions (algebraically, graphically, numerically in tables, or by verbal descriptions). See the ***Additional Functions Represented Graphically*** worksheet for additional graphs for students' sketches.
- For additional practice, have students compare their own functions with other students' functions or with the functions provided in the activity.
- Students can use the function cards provided in the activity set to play a matching game. You can use a photocopied set and have students match the corresponding graphs, equations, tables, and sentences for the same functions.

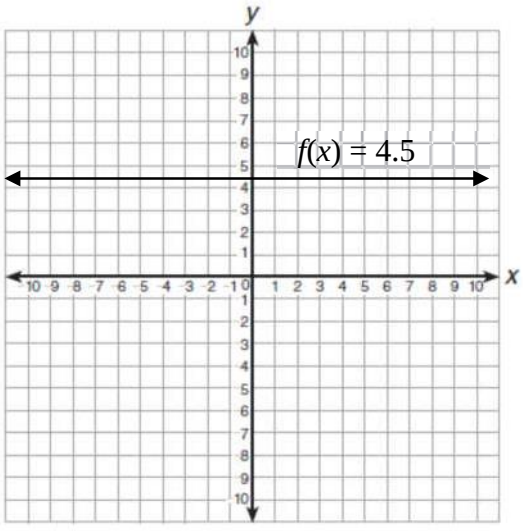
- Functions Represented Graphically (Activity Set)

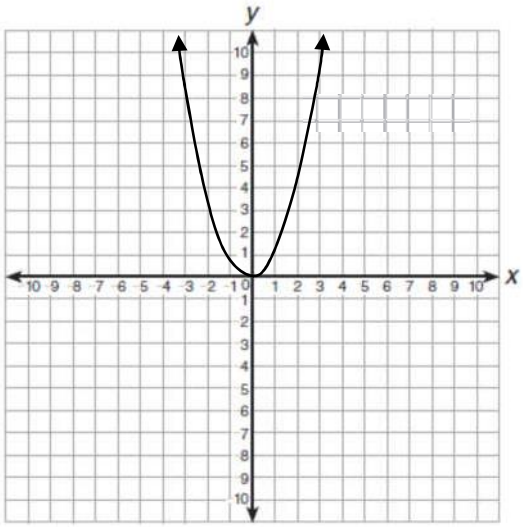
Preparation: Cut out the following functions and create stacks for students as directed.

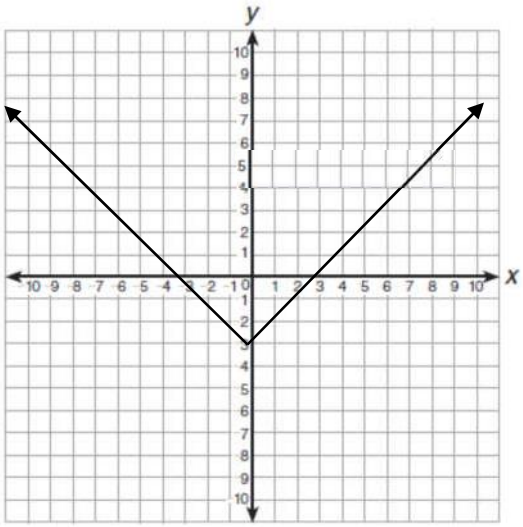


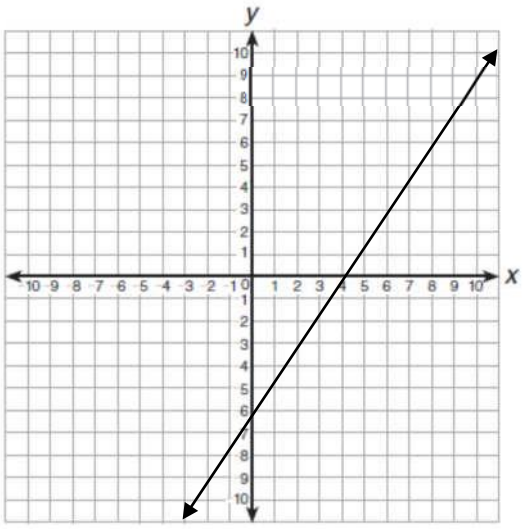


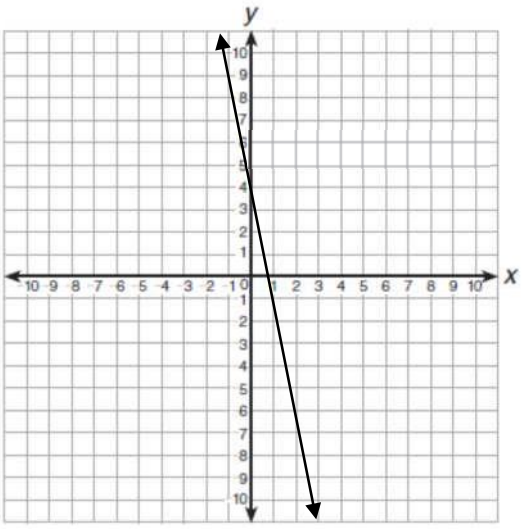












- Functions Represented in Tables (Activity Set)

x	$f(x)$
–2	–2
–1	–1
0	0
1	1
2	2
3	3

x	$f(x)$
–4	–2
–2	–1
0	0
2	1
4	2
6	3

x	$f(x)$
–2	–3
–1	–1
0	1
1	3
2	5
3	7

x	$f(x)$
–2	4.5
0	4.5
2	4.5
4	4.5
6	4.5
8	4.5

x	$f(x)$
–2	4
–1	1
0	0
1	1
2	4
3	9

x	$f(x)$
–5	2
–3	0
–1	–2
1	–2
3	0
5	2

x	$f(x)$
–3	–9
0	–6
2	–3
4	0
6	3
8	6

x	$f(x)$
–2	15
–1	10
0	5
1	0
2	5
3	10

- Functions Represented Algebraically (Activity Set)

$f(x) = x$ $\qquad$ $f(x) = \frac{1}{2}x - 2$

$f(x) = 2x + 1$ $\qquad$ $f(x) = 4.5$

$f(x) = x^2$ $\qquad$ $f(x) = |x| - 3$

$f(x) = 1\frac{1}{2}x - 6$ $\qquad$ $f(x) = -5x + 5$

- Functions Represented Verbally in Words (Activity Set)

A linear function has a rate of change of 1 and crosses the origin.

A linear function has a rate of change of $\frac{1}{2}$ and crosses the *y*-intercept at –2.

A linear function has a rate of change of 2 and crosses the *y*-intercept at 1.

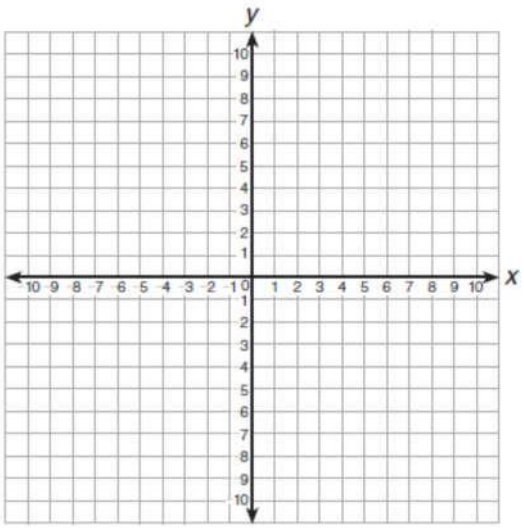
A linear function has a rate of change of 0 and crosses the *y*-intercept at 4.5.

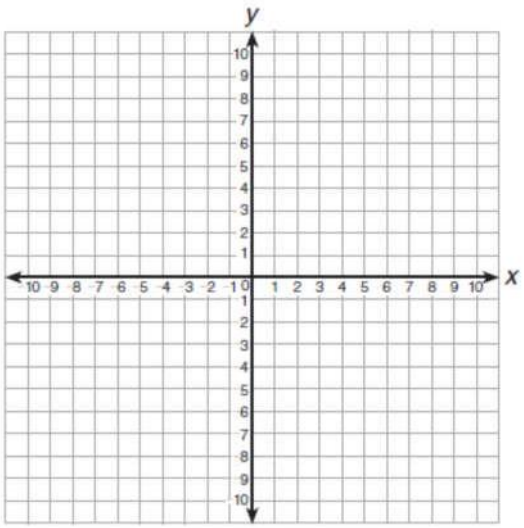
A nonlinear function is a parabola with a vertex of 0 and a coefficient of *x* of 1.

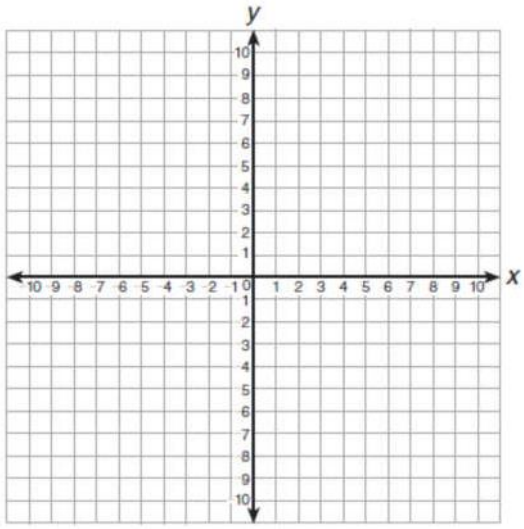
The function of *x* is equal to 3 subtracted from the absolute value of *x*.

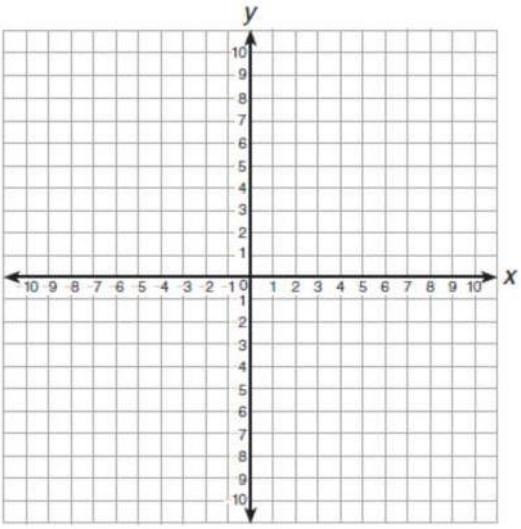
A linear function has a rate of change of $1\frac{1}{2}$ and crosses the *y*-intercept at –6.

A linear function has a rate of change of –5 and crosses the *y*-intercept at 5.









- Additional Functions Represented Graphically (Extension Activity