8.AF.7 Compare properties of two linear functions given in different forms, such as a table of values, equation, verbal description, and graph (e.g., compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed).

Reporting Category: Algebra and Functions | **Subdomain**: Linear Functions

8.AF.7 Instructional Framework

Assessed On:

☐ Checkpoint 1   ☑ Checkpoint 2   ☐ Checkpoint 3   ☑ Summative

Content Limits:
- Include only linear functions.
- Include exactly two functions (not more).

Clarifications:
- Examples of properties are rate of change, starting point (y-intercept), and values at specific inputs.
- Any real-world context describing two related linear quantities may be used, but is not required for all items.
- These words can be used interchangeably: starting value = initial value = y-intercept.
- Only continuous graphs may be used. Discrete graphs may not be used.
- The keypad in the ILEARN testing system does not allow students to enter a comma between each period in a multi-digit number. (Example: 13,323 would be entered as 13323.)

Calculator Availability: Allowed

Expected Academic Vocabulary: linear functions

Examples of Context and Varying Difficulty Levels[+]	
Context: Easy	Limit to whole numbers The rate of change and y-intercept are given.
Context: Medium	Limit to integers. Calculations are needed to determine the rate of change.
Context: Difficult	Rational numbers may be used. Comparisons of graphs and tables are used.

Proficiency Level Descriptors and Example Items	
Looking Back: 7.RP.3 ILEARN Item Specification	**Looking Ahead**: AI.L.3 AI.SEI.1 AI.QE.1

Below Proficiency: Given a linear function, identify an equivalent function in a different form.

Which table of values represents y = 2x + 5?

a.

x	y
-5	-5
-4	-3
-3	-1
-2	1
-1	3

b.

x	y
-8	13
-7	11
-6	9
-5	7
-4	5

c.

x	y
0	9
1	7
2	5
3	3
4	1

d.

x	y
-3	-3

This is a DOK 2 item because students must analyze the values of each table to determine if they satisfy the linear function given as an equation.

This is a medium difficulty item because it involves integers.
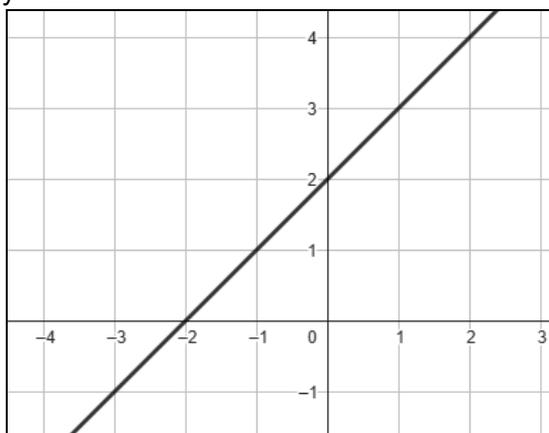
5	-2
7	-1
9	0
11	1

Answer: a

The table shown represents a function.

x	-2	-1	0	1
y	-3	-1	1	3

Which model is equivalent to the function represented in the table?

   a. y = 2x

   b.
   c. y = 2x + 1
   d. y is equal to 2 times x plus 2.

Answer: c

This is a DOK 2 item because students must identify an equivalent form of a linear function given in a table.

This is a medium difficulty item because it involves integers.

Approaching Proficiency: Compare properties of two functions each represented in the same way (algebraically, graphically, numerically in tables, or by verbal descriptions).

Functions *J* and *K are* each given in the tables.

   Function *J*

x	*y*

This is a DOK 2 because students must identify the rate of change of each function and then

- 5	5
1	-3
4	-7

Function K

x	y
-6	-8
-1	-2
4	4

Enter the difference in the rates of change for these two functions.

Answer: -38/15

calculate the difference.

This is a difficult item because the rates of changes and final answer are rational numbers.

The speed and distance of two cars can be represented by two different linear equations.

Car A: y = 3x + 2

Car B: y = -2x + 5

Which statement is true about both cars?

a. Car A is moving forward at 2 miles per hour; Car B is moving forward at 5 miles per hour.
b. Car A is moving forward at 3 miles per hour; Car B is moving forward at 2 miles per hour.
c. Car A is moving backward at 3 miles per hour; Car B is moving backward at 2 miles per hour.
d. Car A is moving forward at 3 miles per hour; Car B is moving backward at 2 miles per hour.

Answer: d

This is a DOK 2 item because students must interpret two linear equations and identify the correct comparison of one common property.

This is an easy item because the rate of change is given within the equation.

At Proficiency: Compare properties of two functions, each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

The two functions represent the distance traveled by two runners over time.

- Runner A's distance is represented by the equation y = 4x + 10, where y is the distance in miles and x is the time in hours.

This is a DOK 3 item because students must compare two functions in different forms to draw a conclusion.

- Runner B's distance is represented by the following table:

Time (hours)	Distance (miles)
0	5
1	9
2	13
3	17

Which runner is traveling faster? Explain your reasoning using the properties of the functions.

Answer: Students' answers may vary. Students should include that the slope, or rate of change, for Runner A is 4, which means the runner runs 4 miles per hour. The rate of change, or slope, of the distance Runner B runs each hour, is also 4 miles per hour (5 to 9, 9 to 13, and 13 to 17). Therefore, both runners run 4 miles per hour resulting in neither being faster.

This is medium difficulty because the rate of change for the table of values must be calculated.

The two functions represent the temperature change throughout one day.

Graph 1 represents the temperature change throughout one day, where y is the temperature in degrees Fahrenheit and x is the time in hours since midnight.

Graph 1: Change in Temperature on April 14

This is a DOK 3 because students must use two functions in different forms to draw a conclusion.

This is a difficult item because it involves comparing a graph and a table.
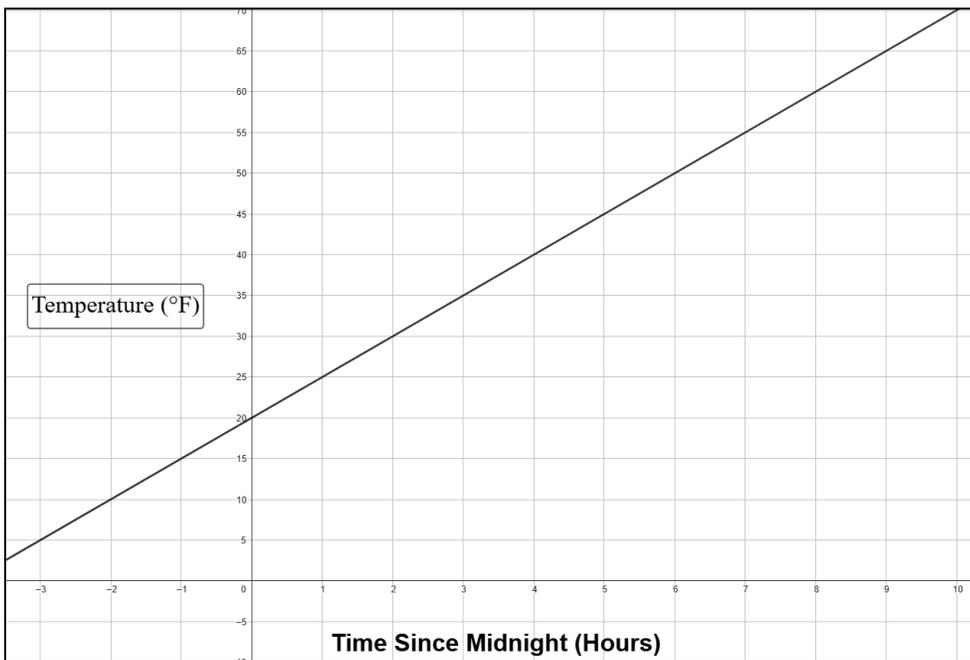
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Table 1 shows the temperature change represented by another function.

Table 1: Change in Temperature on April 15

Time (hours)	Temperature (degrees Fahrenheit)
0	15
1	20
2	25
3	30
4	35
5	40

Compare the slopes of both functions. What do the slopes indicate about the rate of temperature change for each day?

Answer: Student answers may vary. Students should indicate that both

functions have the same slope of 5. This means that both functions indicate an identical rate of temperature change, therefore, the temperature rises at a consistent rate of 5 degrees per hour in both functions.

Antonio and Paul are each saving money for a class trip. The balance of each account is growing at a constant rate.

The equation $y = 25x + 350$ represents the growth in Antonio's account, where y is the balance of the account and x is the number of weeks.

The table below represents the growth in Paul's account.

Week	Balance ($)
0	250
1	300
2	350
3	400
4	450
5	500
6	550

Which statement about the increase in the balance of the two accounts is true?

   a. Antonio's and Paul's accounts had the same starting balance.
   b. Antonio's account had a higher starting balance and both accounts increased at the same rate.
   c. Antonio's account had a higher starting balance than Paul's and Paul's account balance grows at a faster rate than Antonio's.
   d. Paul's account had a higher starting balance than Antonio's and Antonio's account balance grows at a faster rate than Paul's.

Answer: c

> This is a DOK 3 because students must use two functions in different forms to draw a conclusion.
>
> This is medium difficulty because the rate of change for the table of values must be calculated.

Above Proficiency: Create a different representation of a linear function that has a greater or lesser slope and y-intercept.

Function G is given in the form of a table of values.

x	y
-5	-10

> This is a DOK 3 item because students must create a different representation of a linear function that has a greater y-intercept.

1	-2
7	6

Write a function that has the same rate of change as function *G* and a greater *y*-intercept than function *G*.

Answer: Fill in the blank $y = 4/3x +$ (any value greater than -3 ⅓) OR $y = 8/6x +$ (any value greater than -3 ⅓) OR any equivalent value for 4/3 or 8/6

This is a difficult item because a range of rational numbers may be used.

Two friends, Alex and Jamie, are comparing the costs of driving their cars for a road trip. Alex drives a compact car with excellent gas mileage, while Jamie drives a larger SUV that drives fewer miles per gallon of gas.

- Alex's compact car costs $0.10 per mile for gas, and the insurance and maintenance costs amount to $5.00 per trip.

Create an equation that could represent Jamie's cost per trip based on these facts:
- Jamie's cost per mile is more than Alex's cost per mile.
- Jamie's insurance and maintenance costs are less per trip than Alex's.

Answer: Use math editor to create an equation in $y = mx + b$ form, where m is any value greater than 0.10 and b is any value between 0 and 5.

This is a DOK 3 item because students must create a different representation of a linear function based on a real-world situation.

This is a difficult item because a range of rational numbers may be used.