EXAMPLE 1 👁 Compare Two Linear Functions

An auto assembly factory needs to purchase new welding robots. The factory manager has information on two different models of welding robots. The welding rates for each model are shown below. How do the welding rates for the two robots compare?

MODEL GNX007

PRODUCT SHEET MODEL T1000

STEP 1 Find the welding rate, or the constant rate of change, for each robot.

Model T1000

Time (minutes)	Number of Welding Tasks
2	20.8
5	52
7	72.8
12	124.8

(handwritten: (2, 20.8) (5, 52))

Model GNX007

$$\frac{52 - 20.8}{5 - 2} = \frac{31.2}{3} = \boxed{10.4}$$

The constant rate of change is 11.2.

The constant rate of change is 10.4. *tasks/min*
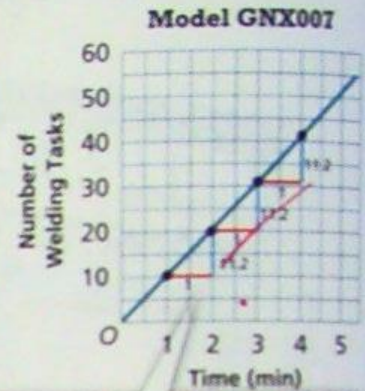
STEP 2 Find the initial value for each robot.

At 0 minutes, each robot has performed 0 tasks, so the initial value is 0.

The data for the model GXN007 robot has a greater constant rate of change, or welding rate, so it can complete more welding tasks per minute than the Model T1000 robot.

Look for Relationships
What properties of functions can be used to compare functions? 🅖 MP.7

✅ Try It!

The welding rate of a third robot is represented by the equation $\boxed{w = 10.8t}$, where t represents the time in minutes and w represents the number of welding tasks. How does it compare to the other two?

(handwritten: The 3rd robot is faster than T1000 (10.4) and slower than GNX007 (11.2))

Convince Me! How can linear equations help you compare linear functions?

(handwritten: Compare the rate (slope) and the starting point (y-intercept))

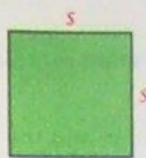EXAMPLE **2**

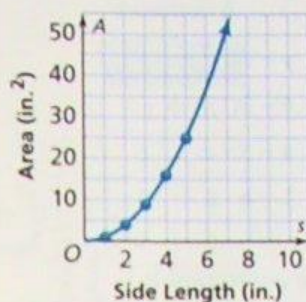**Compare a Linear and a Nonlinear Function**

ACTIVITY   ASSESS

A square with side length *s* is shown. The table shows the relationship between the side length and perimeter as the side length increases. The graph shows the relationship between the side length and area. How do the two relationships compare?

Side Length, s (in.)	Perimeter, P (in.)
0	0
1	4
2	8
3	12
4	16

(+1 between each side length row; +4 between each perimeter row)

Area (in.²) vs Side Length (in.)

This relation is a function. It has a constant rate of change. It is a *linear* function.

This relation is a function, but it does not have a constant rate of change. It is a *nonlinear* function.

Both relationships are functions. Both perimeter and area are functions of side length.

EXAMPLE **3**

Compare Properties of Linear Functions

Two linear functions are represented below. Compare the properties of the two functions.
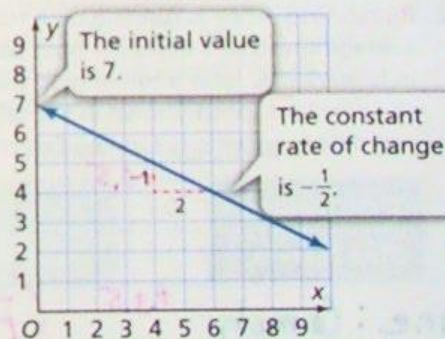
Function A

The constant rate of change is 2.

$y = 2x - 3$ The initial value is −3.

Function B

The initial value is 7.

The constant rate of change is $-\frac{1}{2}$.

Function A has a greater rate of change. Function B has a greater initial value.

$$m = \frac{14.5 - 1}{11 - 2} = \frac{13.5}{9} = 1.5$$

- Function 2 has the larger rate.
- Function 1 has the larger initial value

✓ **Try It!**

Compare the properties of these two linear functions.

Function 1 (11, 14.5) (2, 1)

x	2	5	9	11	14
y	1	5.5	11.5	14.5	19

$b = -2$

Function 2 $m = 2$

$y = 2x - 4$ $b = -4$

0 1
−2 −0.5

You can compare functions in different representations by using the properties of functions.

Compare the constant rate of change and the initial value.

$+1 \quad +1 \quad +1$

x	1	2	3	4
y	4	7	10	13

$+3 \quad +3 \quad +3$

$y = 3x + b$

$4 = 3(1) + b$

$4 = 3 + b$

$1 = b$

The slope is 3.

The y-intercept is 1.

The slope is $\frac{2}{3}$.

$y = \frac{2}{3}x - 4$

The y-intercept is −4.

The slope is 2.5.

The y-intercept is 10.
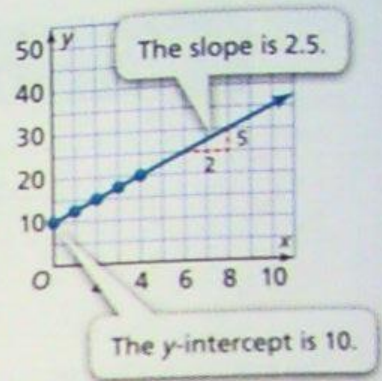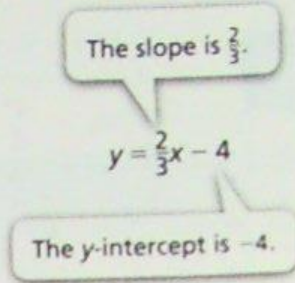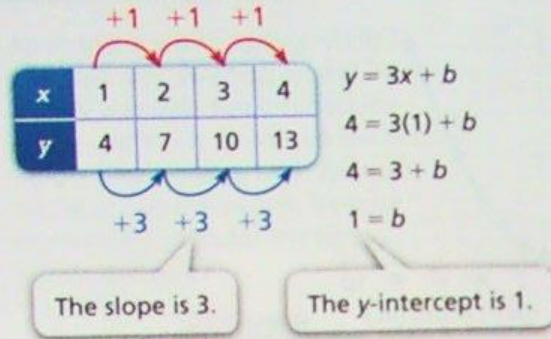
Do You Understand?

1. **Essential Question** How can you compare two functions?

slope (rate)

y-intercept (beginning #, where x = 0)

2. **Reasoning** Anne is running on a trail at an average speed of 6 miles per hour beginning at mile marker 4. John is running on the same trail at a constant speed, shown in the table. How can you determine who is running faster? ⒸMP.2

+0.5

Time (hours), x	0	0.5	1	1.5
Mile Marker, y	1	4.5	8	11.5

+3.5

Anne: 6 mph

John: $\frac{3.5}{0.5}$ = 7 mph *(Find the slopes)*

John is faster by 1 mph.

3. **Reasoning** In Item 2, how do Anne and John's starting positions compare? Explain. ⒸMP.2

Anne Starts: 4
John Starts: 1

(y-intercepts)

Do You Know How?

Felipe and Samantha use a payment plan to buy musical instruments. Felipe writes the equation $y = -30x + 290$ to represent the amount owed, y, after x payments. The graph shows how much Samantha owes after each payment.
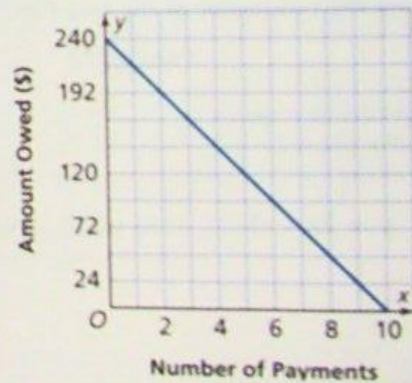
4. Whose musical instrument costs more, Felipe's or Samantha's? Explain.

5. Who will pay more each month? Explain.

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