

4-4**Comparing Functions**

© CONTENT STANDARDS

8.F.2, 8.EE.5

What You'll Learn

To compare properties of two functions represented in different ways

You need a clicker and your notebook today.



Find the slope of the line through these points: (2,5) (3,7)

Text in your answer: Hint: use $\frac{y_2 - y_1}{x_2 - x_1}$



Find the slope of the line through these points $(-3, -1)$ $(1, 11)$

Text in your answer now



**What is the y-intercept?
 $y = 2x + 1$**

Text in your answer



Look at the graph; find slope

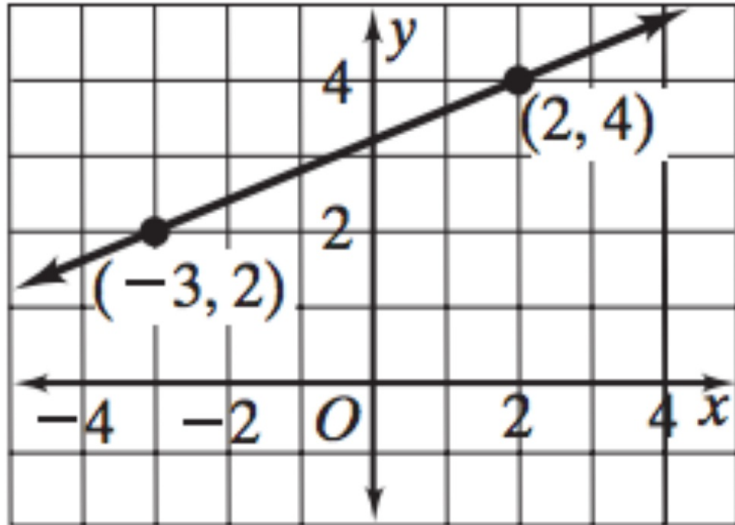
A $3/5$

B $2/3$

C $2/5$

D $5/2$

E $1/2$



Look at the graph. Find slope

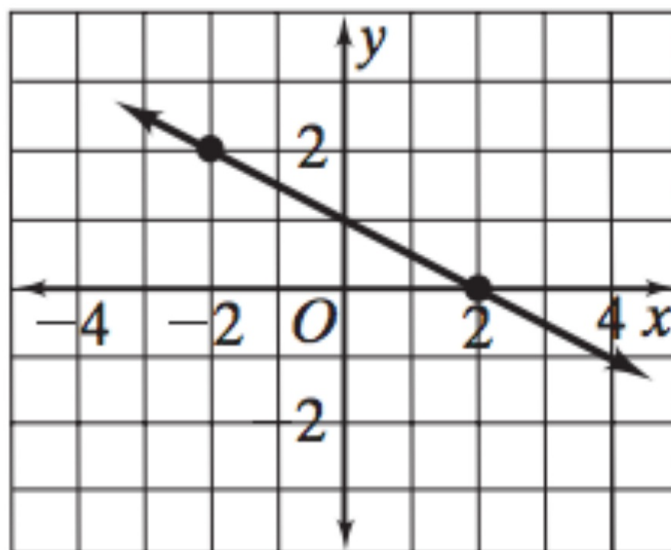
A $1/2$

B $-1/2$

C 2

D -2

E $-1/3$



Why Learn This?

Functions can be represented using words, graphs, tables, or equations. Learning the relationships among these representations can help you compare the properties of two functions each represented in a different way.



The slope of a line describes the rate of change of that line. You can compare slopes of lines represented in different ways.

EXAMPLE

Comparing Rates of Change of Linear Functions

- 1 Which function has the greater rate of change?

x	1	2	3	4
y	5	8	11	14

Step 1 Find slope from a table.

Use (1, 5) and (4, 14).

$$\text{slope} = \frac{14 - 5}{4 - 1} = \frac{9}{3} = 3$$

Since $4 > 3$, the function $y = 4x + 2$ has the greater rate of change.

$$y = 4x + 2$$

Step 2 Find the slope of an equation using $y = mx + b$.

$$y = mx + b$$

$$y = 4x + 2$$

The slope, m , is 4.

copy this into your notes

To compare two functions and their rates of change:

From a table: $\frac{\text{Changes in 2 y coordinates}}{\text{changes in 2 x coordinates}}$

From an equation in $y=mx+b$ form. Find the slope (the m).

Examples

1 Comparing Linear Functions Which function has a greater rate of change?

Rates of Change

x	1	2	3	4
y	4	9	14	19

$y = 6x + 1$

Step 1 Find the slope from the table.
Use the points (1, 4) and (4, 19).

$$\text{slope} = \frac{19 - 4}{4 - 1} = \frac{15}{3} \text{ or } 5$$

Step 2 Find the slope from the equation using $y = mx + b$.

$y = 6x + 1$

↑

$y = mx + b$ The slope is 6.

Since 6 > 5, the function $y = 6x + 1$ has a greater rate of change.

EXAMPLE**Comparing Initial Values of Linear Functions**

- 2 **Athletics** Aki is trying to decide what baseball camp to attend. For each camp, the relationship between number of days and total cost is linear. Which camp has the greater initial cost?

Bright Future Baseball Camp	Home Run Baseball Camp
<ul style="list-style-type: none"> \$18 per day \$89 registration fee 	<ul style="list-style-type: none"> 2 days cost \$121. 7 days cost \$236.

Bright Future Baseball Camp

According to the data in the table, there is a registration fee of \$89. This is the initial cost.

Home Run Baseball Camp

Write the data in the table as ordered pairs: (2, 121) and (7, 236). The y -intercept of the line through these two points represents the initial cost. Use the ordered pairs to write an equation in slope-intercept form.

$$m = \frac{236 - 121}{7 - 2} = \frac{115}{5} = 23 \quad \leftarrow \text{Find the slope.}$$

$$y = mx + b \quad \leftarrow \text{Use slope-intercept form.}$$

$$121 = 23(2) + b \quad \leftarrow \text{Substitute 23 for } m, 2 \text{ for } x, \text{ and } 121 \text{ for } y. \text{ Simplify.}$$

$$121 = 46 + b$$

$$75 = b \quad \leftarrow \text{Solve for } b.$$

The y -intercept is 75, so the initial cost is \$75.

Since $\$89 > \75 , the Bright Future Baseball Camp has the greater initial cost.

- 2 **Comparing Initial Values of Linear Functions** A company is deciding on its location for its annual employee appreciation dinner. A reception hall charges a \$300 rental fee and \$18 per person for meal service. Some rental rates for a hotel banquet room are the ordered pairs (20, 690) and (35, 1020) in the form (number of people, total cost in dollars). Which has the greater initial cost?

Reception Hall: The initial cost for the reception hall is represented by the **rental** fee, which is **\$300**.

Hotel Banquet Room: To find the initial cost of the hotel banquet room, use the ordered pairs to write an equation in slope-intercept form.

The **y -intercept** represents the initial cost.

Find the slope.

$$\text{slope} = \frac{1020 - 690}{35 - 20}$$

$$= \frac{330}{15} \text{ or } 22$$

Find the y -intercept using $y = mx + b$.

$$y = mx + b$$

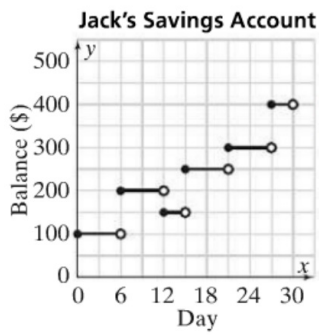
$$690 = 22(20) + b$$

$$690 = 440 + b$$

$$250 = b$$

The initial cost for the hotel is **\$250**.

Since **\$300** > **\$250**, the **reception hall** has a greater initial cost.



EXAMPLE

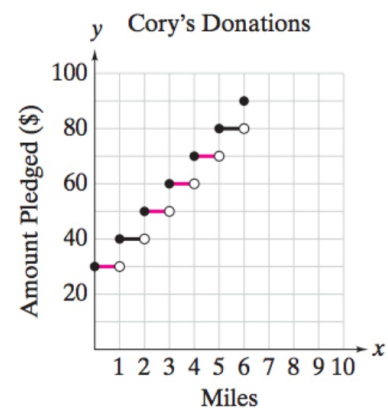
Comparing Nonlinear Functions

- 3 Jack and Manny each have a savings account. The graph at the left represents Jack's account. Manny deposited \$500 and withdrew \$20 each even-numbered day for 30 days. Compare the functions.

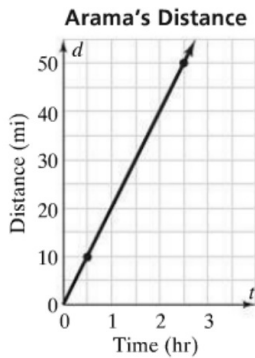
Jack's Account	Manny's Account
increases and decreases	decreases
not continuous	not continuous
maximum \$400; minimum \$100	maximum \$500; minimum \$200

- 3 **Comparing Nonlinear Functions** Maria and Cory are both participating in a 6-mile bike-a-thon to raise money for charity. Sponsors can give a flat donation or pledge a certain amount of money for each mile they complete. Maria has \$45 in flat donations and pledges totaling \$12.50 per mile. Cory's donations are represented in the graph. Compare the functions.

Maria's Donations	Cory's Donations
increases	increases
not continuous	not continuous
Minimum \$45	Minimum \$30
Maximum \$120	Maximum \$90



EXAMPLE Comparing Proportional Functions



- 4 Bicycle Racing** Arama and Francisco train for bicycle races. The graph at the left represents the distance Arama traveled during today's training session. Francisco's distance is given by the function $d = 18.5t$, where d represents distance in miles and t represents time in hours. Who traveled at the faster rate?

The rate is equal to the slope of the graph of the function.

Arama

Find the slope. Use the two points $(0.5, 10)$ and $(2.5, 50)$.

$$m = \frac{50 - 10}{2.5 - 0.5} = \frac{40}{2} = 20$$

Arama traveled 20 miles per hour.

Francisco

The equation $d = 18.5t$ is in slope-intercept form. The slope is 18.5.

Francisco traveled 18.5 miles per hour.

$20 > 18.5$, so Arama traveled at the faster rate.

Table talk about each of these problems

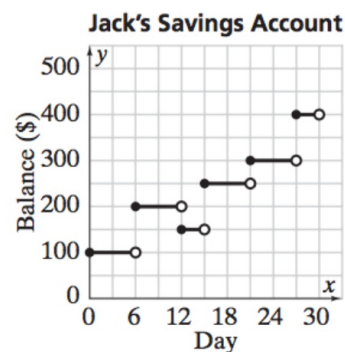
Quick Check

1. Which function has the greater rate of change?

x	1	3	4	6
y	5	13	17	25



$$y = 2x + 1$$

2. Vikram opened a savings account with \$150. He deposits \$150 every two weeks. Compare Vikram's account to Jack's account.



3. Steve's Scooter Rentals charges \$17 per hour plus a \$29 rental fee. Scooter World charges \$48 for 1 hour and \$108 for 4 hours. Both relationships are linear. Which company has the greatest initial cost?


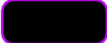


 **Check Your Understanding**

1. **Reasoning** How can you find the rate of change from the graph of a linear function? 


Match each linear function with its rate of change.

2.

x	2	5	6	10
y	6	15	18	30

 A. 1
B. 2
3. $y = 2x - 5$  C. 3
4. $(5, 6), (12, 34)$  D. 4
5. John earns \$25 plus \$1 for every magazine subscription he sells. 

**You have an assignment worksheet.
Powerdown your clickers and put
them away.**

Practice 4-4 **Comparing Functions**

1. Determine which function has the greater rate of change. _____

Function 1

x	2	3	5	6
y	6	10	18	22

Function 2

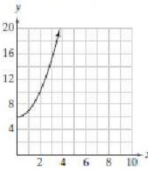
$$y = 3x + 8$$

2. Determine which function has the greater initial value? _____

Function 1

When the value of x is 0, the value of y is 3. Each time the value of x increases by 1, the value of y increases by 5.

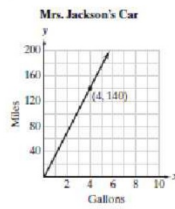
Function 2



3. The repair costs for two mechanic shops are shown below. Which shop has the greater initial cost?

GT Auto Shop	Capital City Auto Service
<ul style="list-style-type: none"> • \$75 to run a diagnostic test • \$60 per hour for labor 	The ordered pairs (2, 210) and (5, 435) are in the form (number of hours, total cost in dollars).

4. Which car gets better gas mileage (more miles per gallon)?



Mr. Padilla's Car

$m = 42g$ where m represents the number of miles and g represents the number of gallons