Get out your books and turn to p. 309.

Classwork - Comparing Functions

Real-World Link

Science Museum Carlos' annual membership to the science museum can be represented by the function $c = 29.99$, where c represents the cost in dollars. The cost for Stephanie to pay per visit is shown in the table.

Visits	Cost ($)
1	5
2	10
3	15
4	20
5	25

1. Make a table to represent Carlos' membership.

Months	Cost ($)
1	29.99
2	29.99
3	29.99
4	29.99

2. Describe the rate of change for each function.

_____

_____

_____

3. Who pays more for two visits? Explain.

_____

_____

4. Who pays more for six visits? Explain.

Example

1. **A zebra's main predator is a lion. Lions can run at a speed of 53 feet per second over short distances. The graph at the right shows the speed of a zebra. Compare their speeds.**
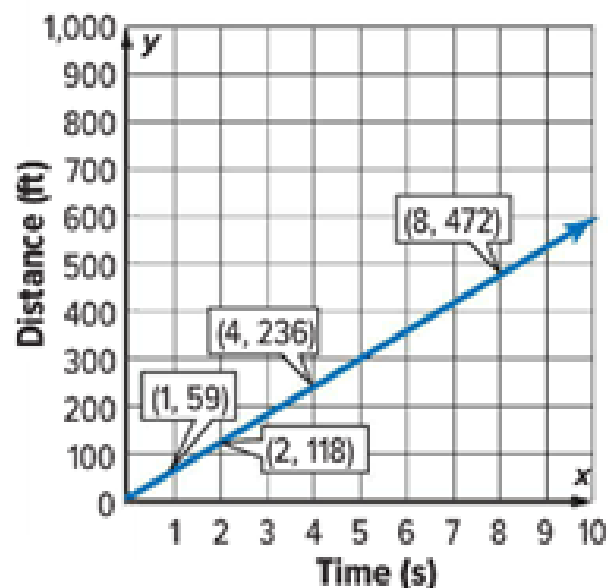
To compare their speeds, compare the rates of change.

A lion can travel at a rate of 53 feet per second.

To find the rate of change for a zebra, choose two points on the line and find the rate of change between them.

$$\frac{\text{Change in distance}}{\text{Change in time}} = \frac{118 - 59}{2 - 1} \text{ or } \frac{59}{1}$$

A zebra can travel at a rate of 59 feet per second. Since 59 > 53, the speed of a zebra is greater than the speed of a lion.

Graph showing Distance (ft) on the y-axis (0 to 1,000) and Time (s) on the x-axis (1 to 10) with points (1, 59), (2, 118), (4, 236), and (8, 472).

a. A certain car has a gas mileage of 22 miles per gallon. The gas mileage of a certain sport utility vehicle is represented by the function shown. Compare their gas mileage.

$Car = 22 mi/gal$

$22 > 19$

$SUV = \dfrac{38 - 19}{2 - 1} = 19 mi/gal$

The car gets better gas mileage than the SUV.

Tutor

$y = mx + b$

$m =$ slope (rate of change)
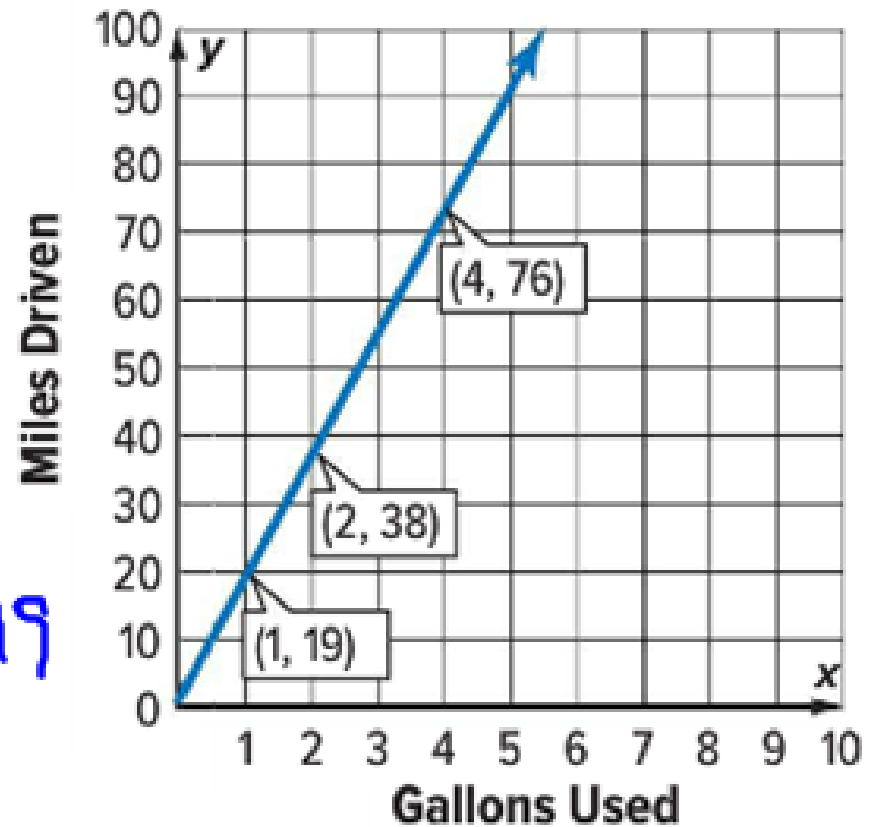
$b = y$-int (start value)

2. The function $m = 140h$, where m is the miles traveled in h hours, represents the distance traveled of the first Japanese high speed train. The distance traveled of a high speed train operating today in China is shown in the table. Assume the relationship between the two quantities is linear.

Train Rate in China

Hours	Miles
1	217
2	434
3	651

a. Compare the functions' y-intercepts and rates of change.

Compare the y-intercepts.

At 0 hours, no distance has been covered. So, the y-intercepts are the same, 0.

Compare the rates of change.

The speed of the Japanese train is 140 miles per hour.

Use the table to find the speed of the Chinese train.

The speed of the Chinese train is $\dfrac{217 \text{ miles}}{1 \text{ hour}}$ or 217 miles per hour.

Train Rate in China

Hours	Miles
1	217
2	434
3	651

+1   +217
+1   +217

Since 217 > 140, the function representing the Chinese high speed train has a greater rate of change than the function representing the Japanese high speed train.

b. If you ride each train for 5 hours, how far will you travel on each?

Find the distance on the Japanese train.

$m = 140h$ Write the function.

$m = 140(5)$ Replace h with 5.

$m = 700$ Simplify.

You will travel 700 miles in 5 hours on the Japanese train.

Find the distance on the Chinese train by extending the table.

You will travel 1,085 miles in 5 hours on the Chinese train.

Train Rate in China	
Hours	**Miles**
1	217
2	434
3	651
4	868
5	1,085

+1 +217
+1 +217
+1 +217
+1 +217

China

$m = 217h$

$m = 217(5)$

$m = 1085 miles$

The number of new movies a store receives can be represented by the function $m = 7w + 2$, where m represents the number of movies and w represents the number of weeks. The number of games the same store receives is shown in the table.

Week	Number of New Games
1	3
2	6
3	9

(handwritten annotations: +1, +1, +1 by Week column; +3, +3, +3 by Games column; ○ and □ above columns)

b. Compare the functions' y-intercepts and rates of change.

c. How many new movies and games will the store have in Week 6?

(handwritten work:)

B

Movies
y-int = 2 movies   rate = 7 movies/week

Games
y-int = 0 games   rate = 3 games/week

The store starts with more movies. They get more movies per week, then games per week.

3. **Financial Literacy** Angela and Benjamin each have a monthly cell phone bill. Angela's monthly cell phone bill is represented by the function $y = 0.15x + 49$, where x represents the minutes and y represents the cost. Benjamin's monthly cost is shown in the graph.
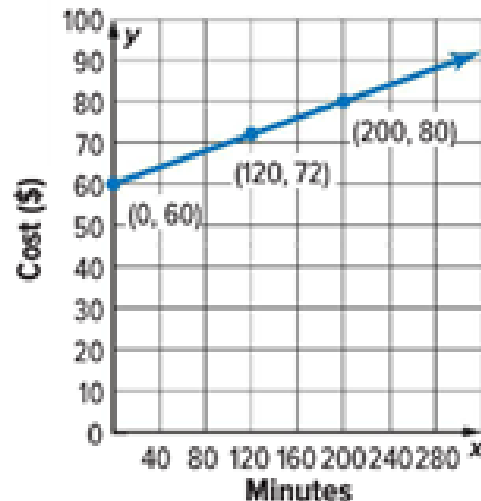
a. **Compare the y-intercepts and rates of change.**

The function for Angela's bill has a y-intercept of 49. You can see from the graph that the function for Benjamin's bill has a y-intercept of 60. So, Benjamin has a greater initial cost.

The rate of change for Angela's monthly bill is $0.15 per minute. Find the rate of change for Benjamin's bill.

$$\frac{\text{change in cost}}{\text{change in minutes}} = \frac{80 - 60}{200 - 0} \text{ or } 0.10$$

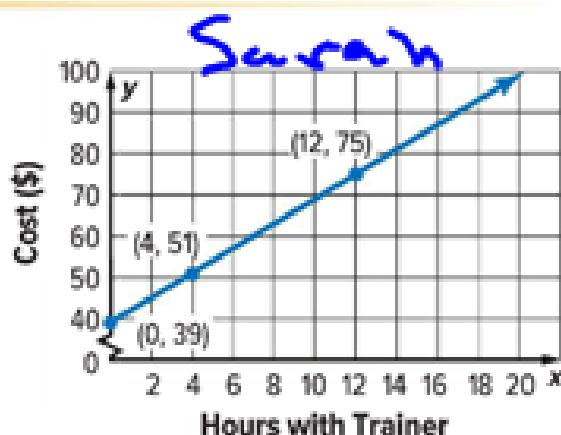The rate of change for Benjamin's bill is $0.10 per minute. So, Angela pays more per minute than Benjamin.

b. **What will be the monthly cost for Angela and Benjamin for 200 minutes?**

Angela's monthly cost is represented by $y = 0.15x + 49$. At 200 minutes, Angela will pay $0.15(200) + 49$ or $79.

Use the graph to find Benjamin's cost. At 200 minutes, Benjamin will pay $80.

Got it? Do these problems to find out.

Financial Literacy Mandy and Sarah each have a membership to the gym. Mandy's membership is represented by the function $y = 3x + 29$, where x represents the hours with a trainer and y represents the cost. The cost of Sarah's membership is shown in the graph.

Sarah

Cost ($)

(12, 75)

(4, 51)

(0, 39)

2 4 6 8 10 12 14 16 18 20 x

Hours with Trainer

d. Compare the y-intercepts and rates of change.

e. What will be the total cost for Mandy and Sarah if they each have 4 hours with a trainer?

Ⓔ <u>Mandy</u>
$y = 3x + 29$
$y = 3(4) + 29$
$y = \$41$

<u>Sarah</u>
$y = 3x + 39$
$y = \$51$

$m = \dfrac{51 - 39}{4 - 0} = \dfrac{12}{4}$

Ⓓ <u>Mandy</u>
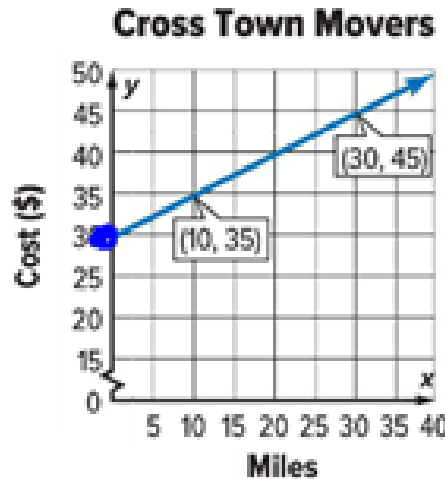y-int = $29   rate = $3/h

<u>Sarah</u>
y-int = $39   rate = $3/h

Sarah has a higher intial cost. The hourly rates are the same.

4. **Financial Literacy** Lorena's mother needs to rent a truck to move some furniture. The cost to rent a truck from two different companies is shown in the table and graph. Which company should she use to rent the truck for 40 miles?

Cross Town Movers

(30, 45)

(10, 35)

Cost ($) — Miles

Find the cost of renting a truck from Ron's Rentals by extending the table.

After 40 miles, the cost will be $75 + $25 or $100.

Ron's Rentals

Miles	Cost ($)
10	25
20	50
30	75

+10 ... +25

Find the cost of renting a truck from Cross Town Movers by analyzing the graph. The y-intercept of the graph is 30.

The slope or rate of change is $\frac{45 - 35}{30 - 10}$ or 0.5. The equation $y = 0.5x + 30$ where y represents the total cost and x represents the miles driven can be used to find the total cost of renting the truck. After 40 miles, the cost will be $0.5(40) + 30$ or $50.

So, Cross Town Movers would cost less for 40 miles.

Handwritten annotations:

$b = 30$

$m = \frac{45 - 35}{30 - 10} = \frac{10}{20} = 0.5$

$y = 0.5x + 30$

$y = 0.5(40) + 30$

$y = \$50$

$m = \frac{25}{10} = 2.5$

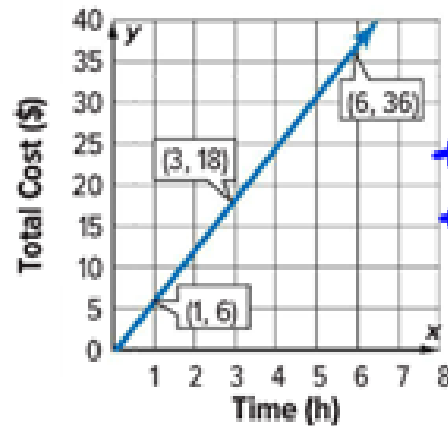$y = 2.5x \qquad y = 2.5(40)$

$y = \$100$

Guided Practice #3

3. The cost to rent a raft from two different companies is shown. Which company should you use if you rent the raft for 9 hours?

(Example 4) **Ryan's**

Water's Edge Rafts

Time (h)	Total Cost ($)
Ryan's Rafts	
1	15.00
2	17.25
3	19.50
4	21.75
5	24.00

6   12.75

+2.25
+2.25

Water Edge

y-int=0   rate = $6/1

$$y = 6x$$
$$y = 6(9)$$
$$y = \$54$$

Ryans

y-int = 12.75   rate = $2.25/h

$$y = 2.25x + 12.75$$
$$y = 2.25(9) + 12.75$$
$$y = \$33$$