Compare Properties of Functions

Lesson 4.5
Functions can be represented by a table, graph, equation, or words.

You can compare two functions represented in different forms by comparing the rate of change for each function.
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.

a) Find the rate of change for each situation:

Lion - 53 ft/s

Zebra - Find the slope of the line by choosing two points from the graph.

\[
\begin{align*}
(2, 118) & \quad \text{and} \quad (4, 236) \\
\end{align*}
\]

\[
\frac{x_2 - x_1}{y_2 - y_1} = \frac{118 - 118}{4 - 2} = \frac{59}{1} = 59 \text{ ft/s}
\]

b) Write a sentence comparing the speeds:

A zebra can travel at a rate of 59 feet per second which is greater than a lion which has a speed of 53 feet per second.
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.

\[
\begin{align*}
\text{Car -} & \quad 22 \text{ mpg} \\
\text{SUV -} & \quad (2, 38) \text{ and } (1, 19) \\
& \quad \frac{38 - 19}{2 - 1} = \frac{19}{1} \quad 19 \text{ mpg}
\end{align*}
\]

b) Write a sentence comparing the gas mileage:

The car has a gas mileage of 22 mpg which is greater than the SUV with a gas mileage of 19 mpg.
2. The function \( m = 140h \), where \( m \) is the miles traveled in \( h \) hours, represents the speed of the first Japanese high speed train. The speed of a high speed train operating today in China is shown in the table. Assume the relationship between the two quantities is linear.

<table>
<thead>
<tr>
<th>Train Rate in China</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

\[ \frac{217 \text{ miles}}{1 \text{ hour}} = 217 \text{ miles per hour} \]

The Chinese train has a speed of 217 mph which is greater than the Japanese train with a speed of 140 mph.

a) Compare the functions’ y-intercepts:
At 0 hours no distance has been covered. The y-intercepts are the same.

b) Compare the functions’ rate of change:

Japan - 140 miles per hour

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

<table>
<thead>
<tr>
<th>Hours</th>
<th>Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>217</td>
</tr>
<tr>
<td>2</td>
<td>434</td>
</tr>
<tr>
<td>3</td>
<td>651</td>
</tr>
</tbody>
</table>

+1 \(\rightarrow\) +217

\begin{align*}
\text{Train Rate in China} \\
\text{Hours} & \quad \text{Miles} \\
1 & \quad 217 \\
2 & \quad 434 \\
3 & \quad 651
\end{align*}

\[ m = 140h \]

Japan - Write the function. Replace $h$ with 5. Simplify.

\[ m = 140(5) \]

\[ m = 700 \]

700 miles

China - Write the function. Replace $h$ with 5. Simplify.

\[ m = 217h \]

\[ m = 217(5) \]

\[ m = 1085 \]

1,085 miles

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

<table>
<thead>
<tr>
<th>Week</th>
<th>Number of New Games</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
</tr>
</tbody>
</table>

a) Compare the functions’ y-intercepts:

The movies has a y-intercept of 2 and the games has a y-intercept of 0.

b) Compare the functions’ rate of change:

The store receives 7 movies and 3 games each week. The rate of change for the movies is greater.

c) How many new movies and games will the store have in week 6?

\[
\text{Movies} = 7(6) + 2 = 44 \quad \text{movies}
\]
\[
\text{Games} = 3(6) + 0 = 18 \quad \text{games}
\]
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 functions’ y-intercepts:**

Angela has a y-intercept of 49 and the Ben has a y-intercept of 60. Ben has a greater initial cost.

b) **Compare the functions’ rate of change:**

Angela - $0.15$ per minute

Ben - $0.10$ per minute

The rate of change for Ben’s bill is $0.10$ per minute and Angela’s is $0.15$ per minute. Angela pays more per minute.
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.

**c) What will be the monthly cost for Angela and Ben for 200 minutes?**

Angela - \( 0.15x + 49 \)

\[ 0.15(200) + 49 \]

\[ 30 + 49 \]

\[ $79 \]

Ben - Use the graph to find the cost at 200 minutes.

\[ $80 \]
Financial Literacy  Mandy and Sarah each have a membership to the gym. Mandy’s membership is represented by the function $y = \frac{3}{2}x + 29$, where $x$ represents the hours with a trainer and $y$ represents the cost. The cost of Sarah’s membership is shown in the graph.

a) Compare the functions’ y-intercepts:

Mandy has a y-intercept of 29 and the Sarah has a y-intercept of 39. Sarah has a greater initial cost.

b) Compare the functions’ rate of change:

The rate of change for Mandy’s membership is $3$ and Sarah’s is $3$. Mandy and Sarah pay the same amount per hour.

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

\[
\begin{align*}
\text{Mandy} & \quad 3(4) + 29 \quad \boxed{41} \\
\text{Sarah} & \quad 3(4) + 39 \quad \boxed{51}
\end{align*}
\]
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?

a) Find the cost of Ron’s Rentals:

   - Find the rate of change in the table

   - Extend the table using the rate of change

<table>
<thead>
<tr>
<th>Miles</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>30</td>
<td>75</td>
</tr>
</tbody>
</table>

   

   \[ $75 + 25 = \$100 \]
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

- **y-intercept = 30**

### Ron’s Rentals

<table>
<thead>
<tr>
<th>Miles</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>30</td>
<td>75</td>
</tr>
</tbody>
</table>

b) Find the cost of Cross Town Movers:

- Find the y-intercept of the graph:
  
  \[ y \text{-intercept} = 30 \]

- Find the slope of the line:
  
  \[
  \frac{45 - 35}{30 - 10} = \frac{10}{20} = 0.5
  \]

- Write a function:
  
  \[ y = 0.5x + 30 \]
  
  \[ = 0.5(40) + 30 \]
  
  \[ = 20 + 30 \] \[ \text{($50$)} \]
c) Compare the two costs:

- Ron’s Rentals = $100
- Cross Town Movers = $50

Cross Town Movers would cost $50 for 40 miles and Ron’s Rentals would cost $100. She should use Cross Town Movers because it would cost less.
Got It? Do this problem to find out.

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?

<table>
<thead>
<tr>
<th>Ryan's Rafts</th>
<th>Water's Edge Rafts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Time (h)</strong></td>
<td><strong>Total Cost ($)</strong></td>
</tr>
<tr>
<td>1</td>
<td>15.00</td>
</tr>
<tr>
<td>2</td>
<td>17.25</td>
</tr>
<tr>
<td>3</td>
<td>19.50</td>
</tr>
<tr>
<td>4</td>
<td>21.75</td>
</tr>
<tr>
<td>5</td>
<td>24.00</td>
</tr>
</tbody>
</table>

a) Find the cost of Ryan’s Rafts: $33

b) Find the cost of Water’s Edge Rafts: $54

c) Compare the costs to answer the question:

Ryan’s Rafts costs $33 for 9 hours and Water’s Edge Rafts costs $54. Ryan’s Rafts is a better deal.
Homework:

Pg. 315-318
#2-14 (even) and #16-21 (all)