Investigation 1: Walking Rates

Standards:

- 7.RP.A.2b: Identify the constant of proportionality in proportional relationships.
- 7.RP.A.2c: Represent proportional relationships by equations.
- 7.EE.B.4: Use variables to represent quantities in the real world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

<table>
<thead>
<tr>
<th>Date</th>
<th>Learning Target/s</th>
<th>Classwork (Check Off Completed/ Corrected Items)</th>
<th>Homework (Check Off Completed/ Corrected Items)</th>
<th>Self-Assess Your Understanding of the Learning Target/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fri, Jan. 22</td>
<td>Write an equation to model the distance walked over time at a constant walking rate.</td>
<td>□ Pg. 2: MSA 1.1 – Walking Marathons</td>
<td>□ Pg. 3: MSA 1.1 Zaption</td>
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</tr>
<tr>
<td>Tues, Jan. 26</td>
<td>Represent linear relationships using tables, graphs, and equations.</td>
<td>□ Pg. 4-5: MSA 1.2 – Walking Rates</td>
<td>□ Pg. 6: MSA 1.2 Zaption</td>
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</tr>
<tr>
<td>Weds, Jan. 27</td>
<td>Examine the pattern of change in a linear relationship.</td>
<td>□ Pg. 7-8: MSA 1.3 – Using Linear Relationships</td>
<td>□ Pg. 9: MSA 1.3 Zaption</td>
<td></td>
</tr>
<tr>
<td>Thurs, Jan. 28</td>
<td>Determine if a linear relationship is increasing or decreasing.</td>
<td>□ Pg. 10-11: MSA 1.4: Recognizing Linear Relationships</td>
<td>□ Pg. 12: MSA 1.4 Zaption</td>
<td></td>
</tr>
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<td>Fri, Jan. 29</td>
<td>Additional practice with linear relationships concepts.</td>
<td>□ Pg. 13-16: Additional Practice</td>
<td>□ Complete Packet (All Pages)</td>
<td></td>
</tr>
<tr>
<td>Exit Ticket 1</td>
<td>Write an equation to model the distance walked over time at a constant walking rate. (7.RP.A.2c)</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Represent linear relationships using tables, graphs, and equations. (7.RP.A.2c)</td>
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</tr>
</tbody>
</table>

Parent/Guardian Signature: ___________________________ Due: ___________________
MSA 1.1: Walking Marathons – Finding and Using Rates

1. Anaya walks 10 meters in 15 seconds. What is her walking rate in meters per second?

2. Peter walks 40 meters in 1 minute. What is his walking rate in meters per second?

What is a **linear relationship**?

Ms. Chang’s class decides to participate in a walkathon. Each participant must find sponsors to pledge a certain amount of money for each kilometer the participant walks. Leanne suggests that they determine their walking rates in meters per second so they can make predictions.

<table>
<thead>
<tr>
<th>Walking rate in meters per second</th>
<th>Alex</th>
<th>Me</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2 meters per second</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How long would it take to walk 500 meters?

What distance would be reached after 30 seconds?

What distance would be reached after 10 minutes?

What distance would be reached after 1 hour?

Write an equation that represents the distance \( d \) in meters walked in \( t \) seconds with the constant walking rate.

Use the equation to predict the distance walked in 45 seconds.
Homework – MSA 1.1 – Complete and correct with Zaption

1. Hoshi walks 10 meters in 3 seconds.
   a. What is her walking rate?

   b. At this rate, how long does it take her to walk 100 meters?

   c. Write an equation that represents the distance \( d \) that Hoshi walks in \( t \) seconds.

2. Milo walks 40 meters in 15 seconds. Mira walks 30 meters in 10 seconds. Whose walking rate is greater?

3. Insert parentheses in the expression on the left side of each equation to make each number sentence true.
   a. \( 2 + -3 \times 4 = -10 \)

   b. \( 4 + -3 \times -4 = -4 \)

   c. \( -12 + 2 + -4 = 6 \)

4. Fill in the missing parts to make each number sentence true.
   a. \( 15(6 + 4) = (15 \times \text{___}) + (15 \times 4) \)

   b. \( 2(x +6) = (2 \times \text{___}) + (2 \times 6) \)

   c. \( (2x) + (6x) = \text{___}(2 + 6) \)
MSA 1.2: Walking Rates and Linear Relationships – Tables, Graphs, and Equations

Think about the effect a walking rate has on the relationship between time walked and distance walked. This will provide some important clues about how to identify linear relationships from tables, graphs, and equations.

A. Here are the walking rates that Gilberto, Alana, and Leanne found in their experiment:

<table>
<thead>
<tr>
<th>Name</th>
<th>Walking Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alana</td>
<td>1 meter per second</td>
</tr>
<tr>
<td>Gilberto</td>
<td>2 meters per second</td>
</tr>
<tr>
<td>Leanne</td>
<td>2.5 meters per second</td>
</tr>
</tbody>
</table>

1. Make a table showing the distance walked by each student for the first ten seconds.

<table>
<thead>
<tr>
<th>Time (sec)</th>
<th>Distance (meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Alana</td>
</tr>
<tr>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

How does the walking rate appear as a pattern in the table?

2. Graph the times and distances for the three students on the same coordinate axes. Use a different color for each student’s data.

How does the walking rate affect the graph?
3. Write an equation that gives the relationship between the time $t$ and the distance $d$ walked for each student.

   Alana:

   Gilberto:

   Leanne:

   How is the walking rate represented in the equations?

4. How can you predict that the graph will be a straight line from the patterns in the table? In the equation? Explain.

5. Are any of these proportional relationships? If so, what is the constant of proportionality?

B. For each student:
   1. If time $t$ increases by 1 second, by how much does the distance $d$ change? How is this change represented in a table? In a graph?

   2. If time $t$ increases by 5 seconds, by how much does the distance $d$ change? How is this change represented in a table? In a graph?

   3. What is the walking rate per minute? The walking rate per hour?
1. Four other friends who are part of the walkathon made the following representations of their data. Could any of these relationships be linear relationships? Explain.

2. Find the unit rate and use it to write an equation relating the two quantities.
   a. 150 dollars for 50 t-shirts
   b. 62 dollars to rent 14 video games
   c. 18 tablespoons of sugar in 3 glasses of Bolda Cola

3. The longest human-powered sporting event is the Tour de France cycling race. In a particular year, the average speed for the winner of this race was 23.66 miles per hour. In that same year, the race was 2,292 miles long. How long did it take the winner to complete the race?
Each student found sponsors who are willing to pledge money according to the following descriptions:

- Alana’s sponsors will make a $5 donation plus $0.50 per kilometer (km).
- Gilberto’s sponsors will donate $2 per kilometer (km).
- Leanne’s sponsors will donate $10 regardless of how far she walks.

The class refers to these as pledge plans. Tables, graphs, and equations will help you predict how much money might be raised with each plan.

A. Make a table for each student’s pledge plan. Show the amount of money each of his or her sponsors would donate if he or she walked distances from 0 to 6 kilometers.

<table>
<thead>
<tr>
<th>Distance (km)</th>
<th>Amount of Money</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Alana</td>
</tr>
<tr>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

What are the dependent and independent variables?

For each pledge plan, what pattern of change between the two variables do you observe in the table?

B. Graph the three pledge plans on the same coordinate axes. Use a different color for each plan.

For each pledge plan, what pattern of change between the two variables do you observe in the graph?
C. For each pledge plan, write an equation that represents the relationship between the distance walked and the amount of money donated. Explain what information each number and variable in the equations represents.

For each pledge plan, what pattern of change between the two variables do you observe in the equation?

D. Does each pledge plan represent a proportional relationship?

E. How can you determine if a relationship is linear from a table, a graph, or an equation?
Homework – MSA 1.3 – Complete and correct with Zaption

Use your graphs, tables, or equations from the lesson in class to help you.

1. Suppose each student walks 8 kilometers in the walkathon. How much money does each sponsor donate?
   Leanne:  
   Gilberto:  
   Alana:  

2. Suppose each student raises $10 from a sponsor. How many kilometers does each student walk?
   Leanne:  
   Gilberto:  
   Alana:  

3. On which graph does the point (12,11) lie? What information does this point represent?

4. In Alana’s plan, how is the fixed $5 donation represented in the table, graph, and equation?
   Table:  
   Graph:  
   Equation:  

5. Gilberto decides to give a t-shirt to each of his sponsors. Each shirt costs him $4.75. He plans to pay for each shirt with some of the money he raises from each sponsor.
   a. Write an equation that represents the amount of money Gilberto raises from each sponsor after he has paid for the t-shirt. Explain what information each number and variable represents.
   
   b. Graph the equation for distances between 0 to 5 kilometers. Compare this graph to the graph of Gilberto’s pledge plan from class.

   c. Is this relationship linear? Explain.
MSA 1.4: Raising Money – Using Linear Relationships

Ms. Chang’s class decides to use their money from the walkathon to provide books for the children’s ward at the hospital. The class puts the money in the school safe and withdraws a fixed amount each week to buy new books. To keep track of the money, Isabella makes a table of the amount of money in the account at the end of each week.

<table>
<thead>
<tr>
<th>Week</th>
<th>Amount of Money at the End of Each Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$144</td>
</tr>
<tr>
<td>1</td>
<td>$132</td>
</tr>
<tr>
<td>2</td>
<td>$120</td>
</tr>
<tr>
<td>3</td>
<td>$108</td>
</tr>
<tr>
<td>4</td>
<td>$96</td>
</tr>
<tr>
<td>5</td>
<td>$84</td>
</tr>
</tbody>
</table>

A. 1. How much money is in the account at the start of the project?

2. How much money is withdrawn from the account each week?

3. Suppose the students continue withdrawing the same amount of money each week. Sketch a graph of this relationship.

4. Write an equation that represents the relationship. Explain what information each number and variable represents.

5. Is the relationship between the number of weeks and the amount of money left in the account linear? Explain.
B. Mr. Mamer’s class also raised money from the walkathon. They used the money to buy games and puzzles for the children’s ward. Keenan uses a graph to keep track of the amount of money in the account at the end of each week.

1. What information does the graph represent about the money in Mr. Mamer’s class account?

2. Make a table of the data for the first 10 weeks. Explain why this table represents a linear relationship.

<table>
<thead>
<tr>
<th>Week</th>
<th>Amount of $</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

3. Write an equation that models the linear relationship. Explain what information each number and variable represents.

C. 1. How can you determine whether a relationship is linear from a graph, a table, or an equation?

2. Compare the patterns of change for the linear relationships in this problem to those in previous problems in this investigation.
1. The graph below represents the walkathon pledge plans for three sponsors.
   a. Describe each sponsor’s pledge plan.
      
      Sponsor A:
      
      Sponsor B:
      
      Sponsor C:
   
   b. What is the number of dollars per kilometer each sponsor pledges?
      
      Sponsor A:  
      Sponsor B:  
      Sponsor C:  
   
   c. What does the point where the line crosses the y-axis mean for each sponsor?
      
      Sponsor A:  
      Sponsor B:  
      Sponsor C:  
   
   d. Write the coordinates of two points on each line. What information does each point represent for the sponsor’s pledge plan?
      
      Sponsor A:  
      Sponsor B:  
      Sponsor C:  
   
   e. Does each relationship represent a proportional relationship?
      
      Sponsor A:  
      Sponsor B:  
      Sponsor C:  

2. The students in Ms. Chang’s class decide to order water bottles that advertise the walkathon. Hyun obtains two different quotes for the costs of the bottles.
   a. For each company, write an equation to calculate the cost for any number of bottles.
      
      Fill it Up, Inc:  
      Bottles by Bob, Co:  
   
   b. On the same set of axes, graph both equations from part a.
      i. Which variable is the independent variable?
      ii. Which variable is the dependent variable?
   
   c. From which company do you think the class should buy water bottles? What factors influenced your decision.
Additional Practice

Jose, Mario, Melanie, Mike, and Alicia are on a weeklong cycling trip. The table below gives the distance Jose, Mario, and Melanie travel for the first 3 hours. Cycling times include only biking time, not time to eat, rest, and so on.

1. Assume that each person cycles at a constant rate. Find the rate at which each person travels during the first 3 hours.

<table>
<thead>
<tr>
<th>Cycling Time (hours)</th>
<th>Distance (miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jose</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
</tr>
</tbody>
</table>

Jose: Mario: Melanie:

2. Find the distance each person travels in 7 hours.

Jose: Mario: Melanie:

3. Graph the time and distance data for all three riders on the same coordinate axes. Use different colors for each person.

4. Use the graphs to find the distance each person travels in 6 ½ hours.

Jose: Mario: Melanie:

5. Use the graphs to find the time it takes each person to travel 70 miles.

Jose: Mario: Melanie:

6. How does the rate at which each person rides affect the graph?
7. For each rider, write an equation to calculate the distance traveled after a given number of hours.

Jose: 

Mario: 

Melanie: 

8. Use your equations from the previous question to calculate the distance each person travels in 6 ½ hours.

Jose: 

Mario: 

Melanie: 

9. How does a person’s cycling rate show up in his or her equation?

10. Are any of these proportional relationships? If so, what is the constant of proportionality?

11. Mike makes the following table of the distances he travels during the first day of the trip.
   a. Suppose Mike continues riding at this rate. Write an equation for the distance \(d\) Mike travels after \(t\) hours.
   
   b. Sketch a graph of the equation.
      
      i. How did you choose the range of values for the time axis?
      
      ii. How did you choose the range of values for the distance axis?
c. How can you find the distances Mike travels in 7 hours and 9 ½ hours using the table?

d. How can you find the distances Mike travels in 7 hours and 9 ½ hours using the graph?

e. How can you find the distances Mike travels in 7 hours and 9 ½ hours using the equation?

f. How can you find the number of hours it takes Mike to travel 100 miles and 237 miles using the table?

g. How can you find the number of hours it takes Mike to travel 100 miles and 237 miles using the graph?

h. How can you find the number of hours it takes Mike to travel 100 miles and 237 miles using the equation?

i. What are the advantages and disadvantages of using each model in parts c-h?

<table>
<thead>
<tr>
<th></th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graph</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
j. Compare the rate at which Mike rides with the rates at which Jose, Mario, and Melanie ride. Who rides the fastest?

i. How can you determine this from the tables?

ii. How can you determine this from the graphs?

iii. How can you determine this from the equations?

12. The distance in miles Alicia travels in $t$ hours is represented by the equation $d = 7.5t$.

a. At what rate does Alicia travel? Explain.

b. Suppose the graph of Alicia’s distance and time is put on the same set of axes as Mike’s, Jose’s, Mario’s, and Melanie’s graphs. Where would it be located in relationship to each of the graphs? Describe the location without actually making a graph.

Compared to Mike’s:

Compared to Jose’s:

Compared to Mario’s:

Compared to Melanie’s: