**SOL 7.10 Task 1**

***\*Determine slope as a rate of change \* Write the proportional relationship as y = mx \****

***\* Graph a line of a proportional relationship\****

David walks at a rate of 10 yards in 4 seconds.

**NOTE: To highlight the importance and use of a double number line and to prevent students from using the ratio table to arrive at the answer, tell students to cover the table in question #2 to ensure they only use the number line for question #1. Using the table in question #2 promotes a guided strategy and does not allow for the creative reasoning about ratios that the double number line in question #1 intends.**

1. Use the double number line below to show how far Dave can walk in 14 seconds.

0 yds.

10 yds.

|  |  |
| --- | --- |
|  |  |
| 0 sec4 sec |  |

**Students should use ideas of doubling (**$\frac{10}{4} = \frac{20}{8} )$**, halving (**$\frac{10}{4}=\frac{5}{2} )$ **or unit rate to find the answer of 35 yards. This number line emphasizes reasoning about ratios as a composed unit. Allow students to reason through and share the many strategies that can be used to arrive at the answer.**

1. Use your thinking from the number line to complete the table below.

|  |  |
| --- | --- |
| **TIME****(seconds)** | **DISTANCE (yards)** |
| **1** | **2.5** |
| **2** | 5 |
| 4 | **10** |
| 8 | **20** |
| **12** | 30 |
| 14 | **35** |

1. Does this table represent a proportional or a non-proportional relationship? Explain your reasoning.

**Ask students if the ratios are equivalent? - Proportional - All ratios are equivalent.**

**Ask students to determine the distance David would walk for 0 seconds? - The idea of 0 yards walked for 0 seconds shows a proportional relationship exists within this context. The problem situation starts at (0,0)**

1. Determine the unit rate using your number line or the table.

**Focus students on the order of the ratio, Distance per Time.**

**As a reminder from 6th grade, unit rate for this situation is yards per 1 second (distance per time).**

**2.5 yards per second**

1. How could this unit rate be used to find the yards walked in 14 seconds?

**Multiply the unit rate of 2.5 by 14 seconds = 35 yards**

1. Write a rule to express how many yards (*y*) can be walked for any number of seconds (*x*).

**Have students generalize in words how they would have solved for question #5:**

***The total distance traveled is equal to the unit rate times the time traveled.***

 $y=2.5x$

1. Graph the points from your table on the coordinate grid below and connect them with a line.

**Y**

**Distance (yards)**

**X**

**Time (seconds)**

1. Should your line include the origin? Why?

**Refer back to discussion in question #3**

**Yes - At 0 seconds David has not traveled any distance**

1. What does this line represent?

**The distance Dave walked is dependent upon**

**the time.**

1. What do the points (2, 5) to (4, 10) represent? Describe how the y-value changes as the x-value changes.

**Note: It is not the intention to use the slope**

**formula but have students reason using the**

**graph. The goal is to have students in the habit of looking first at how the y-value changes and then note the change in the corresponding x-values. This sets them up to understand that linear functions compare the change in y dependent upon the change in x.**

**Have students start with the y-value of 5 and count the spaces traveled to reach the y-value of 10 (up 5 units).**

**Repeat this process with the x-value of 2 to the x-value of 4 (the travel is 2 units to the right).**

1. Draw a triangle that shows this change on your graph.
2. **Continue drawing these triangles** to show the rate of change along the line.
3. These rate of change triangles are also known as **SLOPE**  ***m***, of the line.
4. How is this ratio related to the unit rate?

**Referring back to question #6 (the unit rate of 2.5 yards/second) ask students how 2.5 is related to 5/2? - Students must understand that 5 yards traveled for every 2 seconds is double the rate of 2.5 yards per 1 second. The purpose is to link the idea that unit rate and slope are the same quantity.**

**They are equivalent.**

$2.5 = \frac{5}{2}$

**NOTE: for graphing purposes, using the rate of 5/2 allows students to use slope triangles to travel 5 units up for each y-value and 2 units to the right for each x-value for each point.**

1. Write the equation of the line in the form *y=mx.*

$y=\frac{5}{2}x$ *or y=2.5x*

1. Draw a line on the graph above that represents Dave walking at a slower pace. What could be a value for slope to represent Dave walking at a slower pace? Explain your reasoning.

**Any value less than 5/2 will be flatter showing less distance as time increases. Example:** $\frac{5}{4}$ **(5 yards in 4 seconds)**

1. Given that a line includes the point (2, 6) and has a slope of *m* = 3, graph the line using slope triangles.

**X**

**Y**

**How could we think of a slope of 3**

**as a ratio?** $\frac{3}{1}$

**Start at point (2,6), go up 3 and right 1**

**Continue in that pattern.**

**To draw the line toward the origin ask:**

**How can I use the same ratio and**

**determine y when x = 1, when x = 0?**

 **Go down 3 and to left 1** $\frac{-3}{-1}$ **=** $\frac{3}{1}$

1. What is the equation of this line?$y=3x$
2. Graph $y= \frac{1}{3}x$ on the grid below.

**How does the steepness of the line in question #17 (m=3) compare to this graph (m=1/3)?**

 **- Less steep**

**Using slope triangles for both question #17 and #19, have students discuss the difference with graphing a slope of 3:1 as compared to 1:3.?**

* **3:1, rise up 3 for every 1 unit to the right**
* **1:3, rise up 1 for every 3 units to the right**

**Ask students to generalize the difference between slopes that are a proper fraction versus a whole number or improper fraction?**

* **Proper fractions will have a shorter rise as compared to the run**
* **Whole number or improper fractions will have a greater increase in rise as compared to the run**

**y**

**X**

**SOL 7.10 Task 2**

***\* Determine y-intercept \* Write the additive relationship as y = x+b \* Graph a line of an additive relationship \****

An iPad game will cost $3 to download. In order to increase levels within the game, you will be charged $1 per level to advance.

1. Complete the table below.

|  |  |
| --- | --- |
| **Number of Levels Purchased (x)** | **Total Cost (y)** |
| 1 | **4** |
| 2 | **5** |
| 3 | **6** |
| 4 | **7** |
| 5 | **8** |

1. Does this table show a proportional or a non-proportional relationship? Explain your reasoning.

**NON-Proportional. There are no equivalent ratios within the table. There is not a constant number that can be multiplied to the x-value to arrive at the y-value. Because there is an initial cost, the situation represents an ADDITIVE relationship.**

1. Using the ordered pairs from the table, graph them below.

**Y**

**X**

**Total Cost ($)**

**Number of Levels Purchased**

1. Should the points in the graph be connected?

**No. This context does not allow for purchasing half a game.**

1. Write an equation to represent the total cost (*y*) for number of levels purchased (x) for this game. $y=x+3$
2. What is the total cost if 0 levels are purchased? **$3**
3. Graph this point and discuss what it represents in the problem.

**For 0 levels purchased, the total cost will still include the initial cost of the app.**

1. The point at which the graph intersects the y-axis is known as the **y-intercept.**
2. How would the graph change if there were no fee to purchase the game?

**The graph would represent a PROPORTIONAL relationship (all ratios of cost per level purchased to number of levels would be equivalent) and start at the origin (0, 0).**

What would be the y-intercept? **(0, 0)**

1. Graph the equation $y=x-4.$

**NOTE: Students may create a ratio table of ordered pairs, or some students may recognize the y-intercept (see answer to #11) and use slope triangles (from Task 1) to graph the line.**

1. What is the y-intercept? **(0, -4)**

**NOTE: Students may have created a table of values that included x=0 and y=4.**

**Suggest that students rewrite the equation using the Inverse Property of Addition** $y=x+(-4)$ **.**

**This will allow students to recognize the value for the y-intercept,** $b, $ **is -4.**

**Y**



**X**