KEY 10/21

Foundations of Algebra — Unit5: Linear Functions — Practice

Day 8 – Writing Equations from a Table

Name: _____

Warm up $m = \frac{\Delta y}{\Delta x}$ or $\frac{y_2 - y_1}{x_2 - x_1}$

Date: _____ **Block:** _____

Write the equation of the line using the tables below:

1. $y = 2x - 8$

x	0	1	2	3	4
y	-8	-6	-4	-2	0

$\frac{\Delta y}{\Delta x} = \frac{2}{1}$

2. $y = 8x + 4$

x	0	1	2	3	4
y	4	12	20	28	36

$\frac{8}{1} \to 8$

3. $y = 5x - 3$

x	0	1	2	3	4
y	-3	2	7	12	17

$\frac{y_2 - y_1}{x_2 - x_1}$ $\frac{7-2}{2-1} \to \frac{5}{1}$

4. $y = 5x + 9$

x	0	1	2	3	4
y	9	14	19	24	29

$\frac{5}{1} \to 5$

5. $y = 4x - 1$

x	y
0	-1
1	3
2	7
3	11
4	15

$\frac{4}{1} \to 4$

6. $y = -5x + 4$

x	y
0	4
1	-1
2	-6
3	-11
4	-16

$\frac{-5}{1} \to -5$

7. $y = -4x - 1$

x	y
0	-1
1	-3
2	-7
3	-11
4	-15

$\frac{-4}{1} \to -4$

8. $y = -1x - 5$

x	y
-3	-2
2	-7
7	-12
12	-17

$\frac{-5}{5} \to -1$

1 −6
0 −5

9. $y = -3x + 3$

x	y
-1	6
1	0
3	-6
5	-12

$\frac{-6}{2} \to -3$

0 3

10. $y = -1x - 2$

x	y
-1	-1
2	-4
5	-7
8	-10

$\frac{-3}{3} \to -1$

1 −3
0 −2

Day 8: Real World Applications

Slope-Intercept Form

y	=	m	x	+	b
Output		Slope	Input		Y-intercept (0, b)
Dependent Variable		Rate	Independent Variable		Starting Amount One Time Fee
Range		$\frac{\text{change in } y}{\text{change in } x}$	Domain		

*When a problem involves a **constant rate or speed and a beginning amount**, it can be written using slope intercept form. You need to recognize which value is the slope and which is the y-intercept.*

Example 1: An airplane 30,000 feet above the ground begins descending (negative) at a rate of 2000 feet per minute. Assume the plane continues at the same rate of descent. The plan's height and minutes above the ground are related to each. What is the altitude after 5 minutes?

Independent Quantity: x: # of minutes

Dependent Quantity: y: Altitude (feet)

Slope: -2,000

Y-intercept: 30000

Equation: $y = -2000x + 30000$

$y = -2000x + 30000$

$y = -2000(5) + 30000$

$y = 20{,}000$

At 5 minutes, the altitude is 20,000 feet.

Example 2: Suppose you receive $100 for a graduation present, and you deposit it into a savings account. Then each week after that, you add $20 to your savings account. When will you have $460? (total)

Independent Quantity: x: # of weeks

Dependent Quantity: y: total $ (end value)

Slope: 20

Y-intercept: 100

Equation: $y = 20x + 100$

$y = 20x + 100$

$460 = 20x + 100$

$-100 \quad -100$

$360 = 20x$

$\frac{360}{20} = \frac{20x}{20}$

$x = 18$

In 18 weeks, you will have $460

$Ax + By = C$

*use when you have a different unknowns (unit)

Standard Form of Equations

Scenario: In the mid 1800's, delivering mail and news across the American Great Plains was time consuming and made for a long delay in getting vital information from side of the country to the other. At the time, most mail and news traveled by stagecoach along the main stagecoach lines at about 8 miles per hour. The Pony Express Riders averaged about 10.7 miles per hour. The long stretch of 782 miles from the two largest cities on either side of the plains, St. Louis and Denver, was a very important part of this trail.

a. Use the variable x to write an expression to represent the distance the stagecoach was driven in miles.	b. Use the variable y to write an expression to represent the distance the Pony Express rode in miles.	c. Write an expression for the distance that was traveled using both of these methods on one trip.
$8x$	$10.7y$	$8x + 10.7y$

d. Write an equation that represents using both methods to deliver mail from St. Louis to Denver.

$8x + 10.7y = 782$

a. If the Pony Express Riders rode for 20 hours from St. Louis before handing off the mail to a stagecoach, how long would it take the stagecoach to get to Denver?

X	Y
71 hrs	20

$8x + 10.7(20) = 782$
$8x + 214 = 782$
$8x = 568$
$x = 71$ hrs

b. If the stagecoach rode for 50 hours from St. Louis before handing off the mail to a Pony Express Rider, how long would it take the rider to get to Denver?

X	Y
50	35.7 hrs

$8(50) + 10.7y = 782$
$400 + 10.7y = 782$
$10.7y = 382$
$y = 35.7$ hrs

c. If mail was delivered by stagecoach only, how long would it take the stagecoach to get the mail from St. Louis to Denver? (no Pony Express)

X	Y
97.75 hrs	Ø

$8x + 10.7(0) = 782$
$8x = 782$
$x = 97.75$

d. If mail was delivered by Pony Express Riders only, how long would it take a rider to get the mail from St. Louis to Denver? (no Stage coach)

X	Y
Ø	73.1 hrs

$8(0) + 10.7y = 782$
$10.7y = 782$
$y = 73.1$

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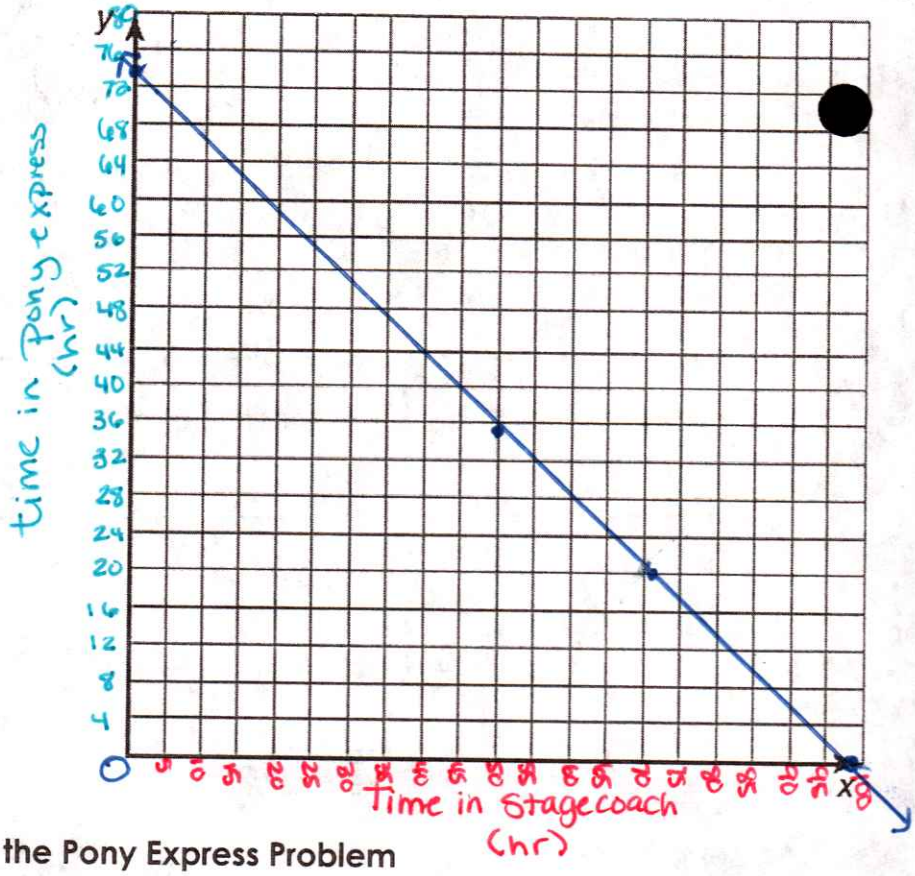
Time the mail was in a Stagecoach (hours)	Time the mail was with the Pony Express (hours)
71	20
50	35.7
91.75	0
0	73.1



The Parts of the Pony Express Problem

The equation, $8x + 10.7y = 782$ is in **standard form of a linear equation**, which is **Ax + By = C**. Below, describe what each variable or expression represents in this equation.

X	time in stage coach (hrs)
Y	time in Pony Express (hrs)
8x	distance in stagecoach (miles)
10.7y	distance in Pony Express (miles)
8x + 10.7y	total distance (miles)
782	distance between the two cities
x-intercept	time for stagecoach only (no Pony Express)
y-intercept	time when Pony Express only was used

Comparing Standard Form and Slope Intercept Form

	Standard Form	Slope Intercept Form
Form	$Ax + By = C$ a, b, and c are constants	$y = mx + b$ m = slope b = y-intercept
Information	Gives x intercept (when substituting 0 for y) Gives y-intercept (when substituting 0 for x)	Gives slope and y-intercept
Advantages	Easy to calculate x and y intercepts Helpful when we solve systems of equations (Unit 3) using elimination	Easily determine slope and y-intercept Easiest and fastest to graph the line Only form you can put in the graphing calculator
Disadvantages	Do not know the slope unless you convert to slope intercept form (solve for y) A, B, and C do not stand for anything obvious (like slope or y-intercept) Harder to graph a line	Finding the x-intercept takes a little more work Not every linear equation can be written in slope intercept form (like $x = 5$)
Context	Adding or subtracting two amounts and setting equal to a total *Example: Tickets for the school play cost \$5.00 for students and \$8.00 for adults. On opening night \$1600 was collected in ticket sales.* $5x + 8y = 1600$	Multiplying a constant to a changing amount and then adding or subtracting a starting amount *Example: Carl has \$200 in his bank account and each week he withdraws \$25 dollars.* $y = 200 - 25x$

Practice with Standard and Slope Intercept Form in a Context

Practice: For each scenario, create an equation and solve for the missing variable.

a. A bookstore has mystery novels on sale for $2 each and sci-fi novels on sale for $3 each. Bailey has $30 to spend on books. How many mystery novels can she buy if she buys 6 sci-fi novels?

x: mystery
y: sci-fi

$2x + 3y = 30$

$2x + 3(6) = 30$

$2x + 18 = 30$

$2x = 12$

$x = 6$

She can buy 6 mystery novels.

b. Your little brother is having a party at the local zoo. The zoo charges a party fee of $50 plus $5 for each guest. How many guests did he invite if the total cost was $115?

b

m

$5x + 50 = 115$

$5x = 65$

$x = 13$

Can invite 13 friends

c. Alex's goal is to sell $100 worth of tickets to the school play. The tickets are $4 for students and $10 for adults. How many student tickets does he need to sell if he sells 6 adult tickets?

total: 100
x: student tickets
y: adult tickets

$4x + 10y = 100$

$4x + 10(6) = 100$

$4x + 60 = 100$

$4x = 40$

$x = 10$

They need to Sale 10 Student tickets.

d. It costs $4 to order a chicken sandwich and $3 to order a cheeseburger form the local fast food restaurant down the street for dinner for the math team before their competition. They have $60 to spend on food. Calculate the x and y intercepts of this problem and interpret your answers in terms of the problem.

x: # chicken sandwiches
y: # cheeseburgers
total: $60

x-int

$4x + 3(0) = 60$

$4x = 60$

$x = 15$

If you only buy chicken, you can buy 15 sandwiches

y-int

$4(0) + 3y = 60$

$3y = 60$

$y = 20$

If you only buy cheeseburgers, you can purchase 20.