Foundations of Algebra Unit 5: Linear Functions Notes

Applications of Slope Intercept Form

Y	=	M	X	+	B
Output		Slope = $\frac{y_2-y_1}{x_2-x_1}$	Input		Y-intercept (0, b) cross y-axis, x=0
Dependent Variable		Rate = $\frac{rise}{run}$ ROC	Independent Variable		Starting Amount One Time Fee
Range		$\frac{change\ in\ y}{change\ in\ x}$	Domain		Beginning

*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.*

$y = mx + b$

Example 1: An airplane 30,000 feet above the ground begins descending 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? $x = 5$

Independent Quantity: x = # of min

Dependent Quantity: y = altitude (ft)

Slope: (ROC): $-\frac{2000 ft}{min}$

Y-intercept: b 30,000 ft

Equation: $y = -2000x + 30{,}000$

$-2000\frac{ft}{min}$

$y = -2000x + 30{,}000$

$y = -2000(5) + 30{,}000$

$y = -10{,}000 + 30{,}000$

$y = 20{,}000$ ft

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?

Independent Quantity:

Dependent Quantity:

Slope:

Y-intercept:

Equation:

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Day 14 – 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.

782 = St. Louis → Denver

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 x = # hrs (stage c.)	10.7y y = # hr (pony ex.)	total combine 8x + 10.7y

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

8x + 10.7y = 782 — distance (total)

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?

y = 20

X	Y
stage c.	pony ex
71	20

$8x + 10.7y = 782$
$8x + 10.7(20) = 782$
$8x + 214 = 782$
$-214 \quad -214$
$8x = 568$
$\frac{8x}{8} = \frac{568}{8}$
$x = 71$ 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 = 50

X	Y
50	35.7

$8x + 10.7y = 782$
$8(50) + 10.7y = 782$
$400 + 10.7y = 782$
$-400 \quad -400$
$10.7y = 382$
$\frac{10.7y}{10.7} = \frac{382}{10.7}$
$y = 35.7$ 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?

y = 0

X	Y
97.8	0

$8x + 10.7y = 782$
$8x + 10.7(0) = 782$
$8x = 782$
$\frac{8x}{8} = \frac{782}{8}$
$x = 97.8$ hrs

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?

x = 0

X	Y
0	73.1

$8x + 10.7y = 782$
$8(0) + 10.7y = 782$
$10.7y = 782$
$\frac{10.7y}{10.7} = \frac{782}{10.7}$
$y = 73.1$ hrs

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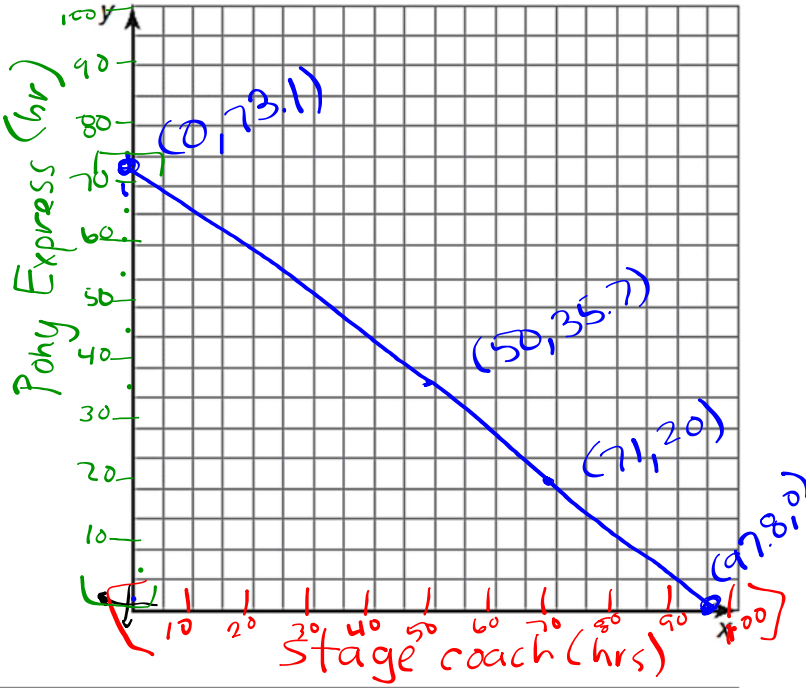
Time the mail was in a Stagecoach (hours)	Time the mail was with the Pony Express (hours)
71	20
50	35.7
97.8	0
0	73.1

Domain: [0, 97.8]
Range: [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	# hrs (stagecoach)
y	# hrs (pony express)
8x	total miles (stagecoach)
10.7y	total miles (pony express)
8x + 10.7y	combined total miles (s.c. + p.e.)
782	miles needed, St. Louis → Denver
x-intercept	y=0 # hrs for stage coach alone
y-intercept	x=0 # hrs for pony express alone

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Finding x & y intercepts

X –intercepts	**Y-intercepts**
Written as (a, 0)	Written as (0, b)
The value of the y-coordinate is always 0.	The value of the x-coordinate is always 0.
(cross x-axis)	(cross y-axis)

Practice: Find the x and y intercepts of each equation. Then graph.

a. $2x - 5y = 10$

x-intercept: $y = 0$

$2x - 5(0) = 10$

$\frac{2x}{2} = \frac{10}{2}$

$x = 5$

$(5, 0)$

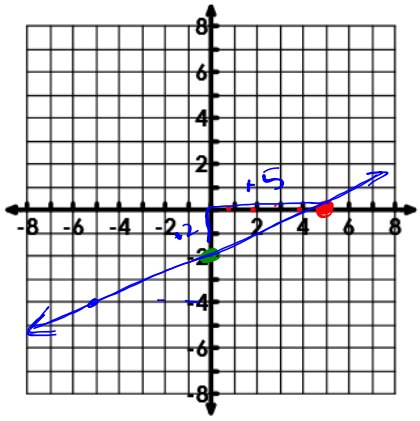
y-intercept: $x = 0$

$2(0) - 5y = 10$

$\frac{-5y}{-5} = \frac{10}{-5}$

$y = -2$

$(0, -2)$



b. $3x + 6y = -18$

x-intercept: $y = 0$

$3x + 6(0) = -18$

$\frac{3x}{3} = \frac{-18}{3}$

$x = -6$

$(-6, 0)$

y-intercept: $x = 0$

$3(0) + 6y = -18$

$\frac{6y}{6} = \frac{-18}{6}$

$y = -3$

$(0, -3)$