

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 <u>stagecoach</u> was driven in miles. <div style="text-align: center;">$8x$</div>	b. Use the variable y to write an expression to represent the distance the <u>Pony Express</u> rode in miles. <div style="text-align: center;">$10.7y$</div>	c. Write an expression for the distance that was traveled using both of these methods on one trip. <div style="text-align: center;">$8x + 10.7y$</div>
d. Write an equation that represents using both methods to deliver mail from St. Louis to Denver. <div style="text-align: center;">$8x + 10.7y = 782$</div>		

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 ? 71	y 20 	$8x + 10.7(20) = 782$ $8x + 214 = 782$ $\underline{-214 \quad -214}$ $8x = 568$	<div style="border: 1px solid black; padding: 5px; display: inline-block;">$y = 71 \text{ hours}$</div>
----------------	---------------	---	--

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 	y ? 36	$8(50) + 10.7y = 782$ $400 + 10.7y = 782$ $\underline{-400 \quad -400}$ $\frac{10.7y}{10.7} = \frac{382}{10.7}$	<div style="border: 1px solid black; padding: 5px; display: inline-block;">$y = 35.7 \text{ OR } \approx 36 \text{ hours}$</div>
---------------	----------------	---	---

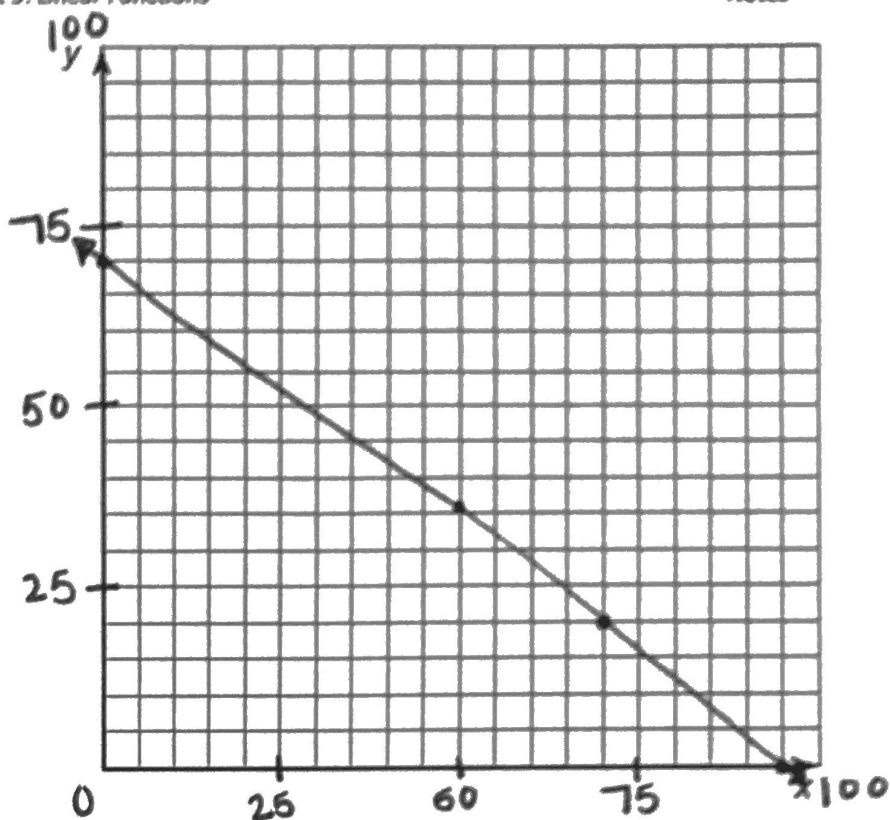
c. If mail was delivered by stagecoach only, how long would it take the stagecoach to get the mail from St. Louis to Denver?

x ? 98	y 0 	$8x + 10.7(0) = 782$ $\frac{8x}{8} = \frac{782}{8}$	<div style="border: 1px solid black; padding: 5px; display: inline-block;">$x = 97.75 \text{ OR } \approx 98 \text{ hours}$</div>
----------------	--------------	---	--

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 	y ? 73	$8(0) + 10.7y = 782$ $\frac{10.7y}{10.7} = \frac{782}{10.7}$	<div style="border: 1px solid black; padding: 5px; display: inline-block;">$y = 73 \text{ hours}$</div>
--------------	----------------	--	--

X Time the mail was in a Stagecoach (hours)	Y Time the mail was with the Pony Express (hours)
71	20
50	36
98	0
0	73



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	Stagecoach hours
y	Pony Express hours
8x	Stagecoach distance (miles)
10.7y	PE distance (miles)
8x + 10.7y	Stagecoach + PE distance (miles)
782	distance b/w St. Louis + Denver (miles)
x-intercept	98 hours; time (hours) it takes for SC to deliver by itself
y-intercept	73 hours; time (hours) it takes for PE to deliver by itself

When $y=0$

When $x=0$

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?

Equation: $2x + 3y = 30$

Solve: plug in 6 for y and solve for x: $2x + 3(6) = 30$

$$\begin{array}{r} 2x + 3(6) = 30 \\ 2x + 18 = 30 \\ -18 \quad -18 \\ \hline 2x = 12 \\ \frac{2x}{2} = \frac{12}{2} \end{array}$$

$x = 6$ 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?

Equation: $50 + 5x = y$

Solve: plug in 115 for y and solve for x: $50 + 5x = 115$

$$\begin{array}{r} 50 + 5x = 115 \\ -50 \quad -50 \\ \hline 5x = 65 \\ \frac{5x}{5} = \frac{65}{5} \end{array}$$

$x = 13$ guests

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?

Equation: $4x + 10y = 100$

Solve: plug in 6 for y and solve for x: $4x + 10(6) = 100$

$$\begin{array}{r} 4x + 10(6) = 100 \\ 4x + 60 = 100 \\ -60 \quad -60 \\ \hline 4x = 40 \\ \frac{4x}{4} = \frac{40}{4} \end{array}$$

$x = 10$ student tickets

d. It costs \$4 to order a chicken sandwich and \$3 to order a cheeseburger from the local fast food restaurant down the street 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.

Equation: $4x + 3y = 60$

Solve:

x-intercept (y=0): $4x + 3(0) = 60$

$$\begin{array}{r} 4x + 0 = 60 \\ \frac{4x}{4} = \frac{60}{4} \end{array}$$

$x = 15$ chicken sandwiches if no cheeseburgers

y-intercept (x=0): $4(0) + 3y = 60$

$$\begin{array}{r} 0 + 3y = 60 \\ \frac{3y}{3} = \frac{60}{3} \end{array}$$

$y = 20$ cheeseburgers if no chick sandwiches