

KEY.

7

Take Home Quiz 1
Due: January 23, 2015

Print off this sheet. For the following story problem, answer questions 1-6 below in the spaces provided.

It takes a barge 8 hours to travel 24 miles upstream and 8 hours to travel 88 miles downstream. Let x be the average speed of the barge in still water, and let y be the speed of the current.

(1 pt)

1. Write out the 2x2 linear system of equations with respect to x and y .

Distance = Rate \times Time! $24 = 8x - 8y$
So: $88 = 8x + 8y$

(2 pts)

2. Find x and y . SHOW YOUR WORK!

Dividing both equations by 8:

$$\begin{aligned}x - y &= 3 \\x + y &= 11\end{aligned}$$

$R_2 \leftarrow -R_1 + R_2$ gives

$$\begin{aligned}x - y &= 3 \\2y &= 8\end{aligned}$$

so $\boxed{y = 4}$

Plugging $\boxed{y = 4}$ into the 1st equation:

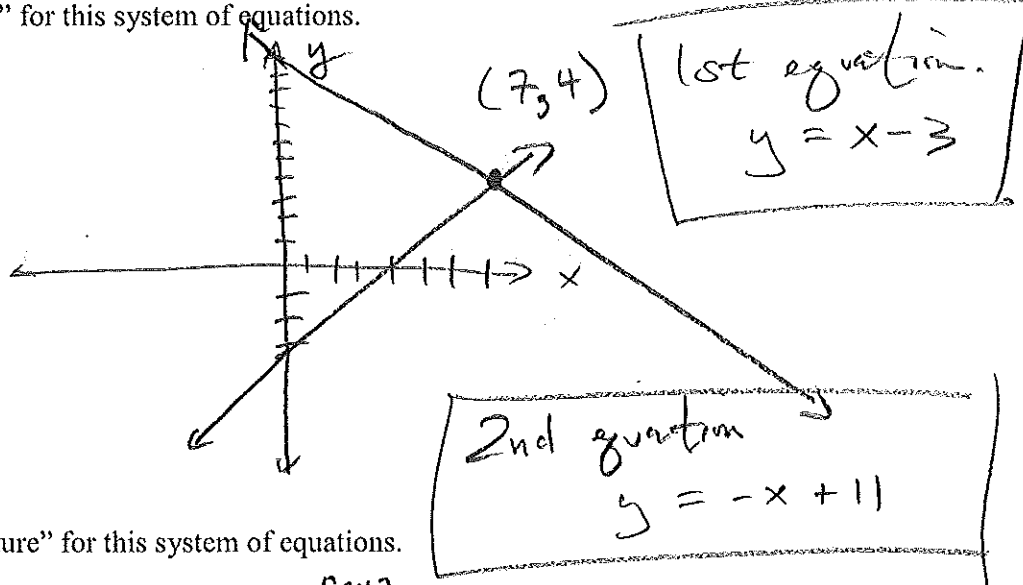
$$x - 4 = 3 \Rightarrow \boxed{x = 7}$$

(1 pt)

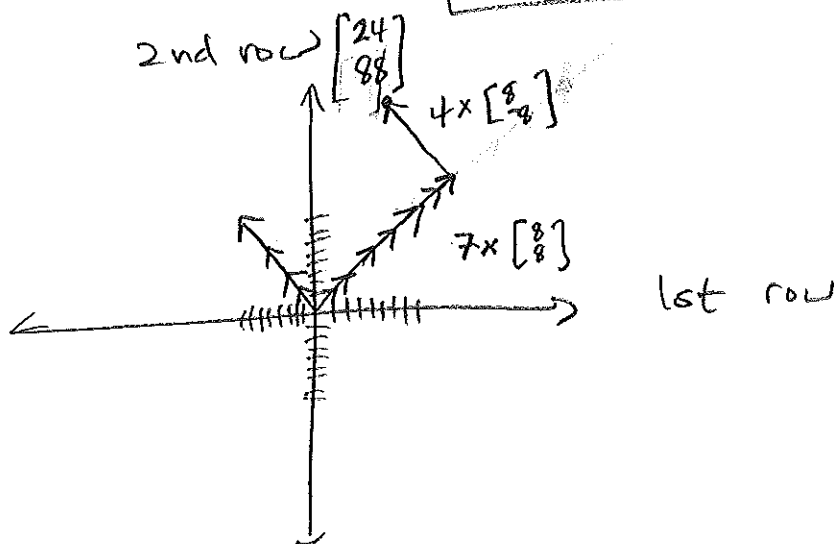
3. Write out the matrix equation, $Ax = b$, for this linear system of equations. Carefully identify A , x and b .

$$\begin{array}{ccc} \begin{bmatrix} 8 & -8 \\ 8 & 8 \end{bmatrix} & \begin{bmatrix} x \\ y \end{bmatrix} & = \begin{bmatrix} 24 \\ 88 \end{bmatrix} \\ \nearrow & \uparrow & \uparrow \\ A & x & b \end{array}$$

- (1 pt) 4. Draw the "row picture" for this system of equations.



- (1 pt) 5. Draw the "column picture" for this system of equations.



- (1 pt) 6. Write the vector on the RHS, \mathbf{b} , as a linear combination of the columns of the coefficient matrix, \mathbf{A} .

$$7 \begin{bmatrix} 8 \\ 8 \end{bmatrix} + 4 \begin{bmatrix} 8 \\ -8 \end{bmatrix} = \begin{bmatrix} 24 \\ 88 \end{bmatrix}.$$