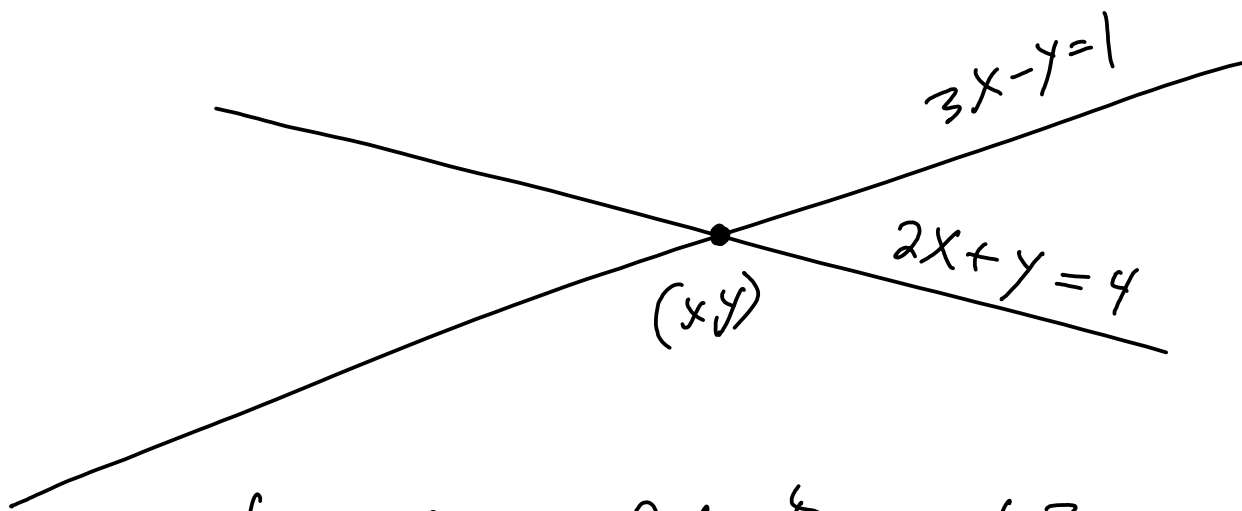


# Handout on systems of linear equations

Two lines with unequal slopes must intersect at exactly one point



how do we find this point?

Write the equations on top of one another and eliminate one variable.

$$\begin{array}{r} 3x - y = 1 \\ + 2x + y = 4 \\ \hline \end{array} \quad \begin{array}{l} \text{add equations} \\ \text{to eliminate } y \end{array}$$

$$5x + 0 = 5$$

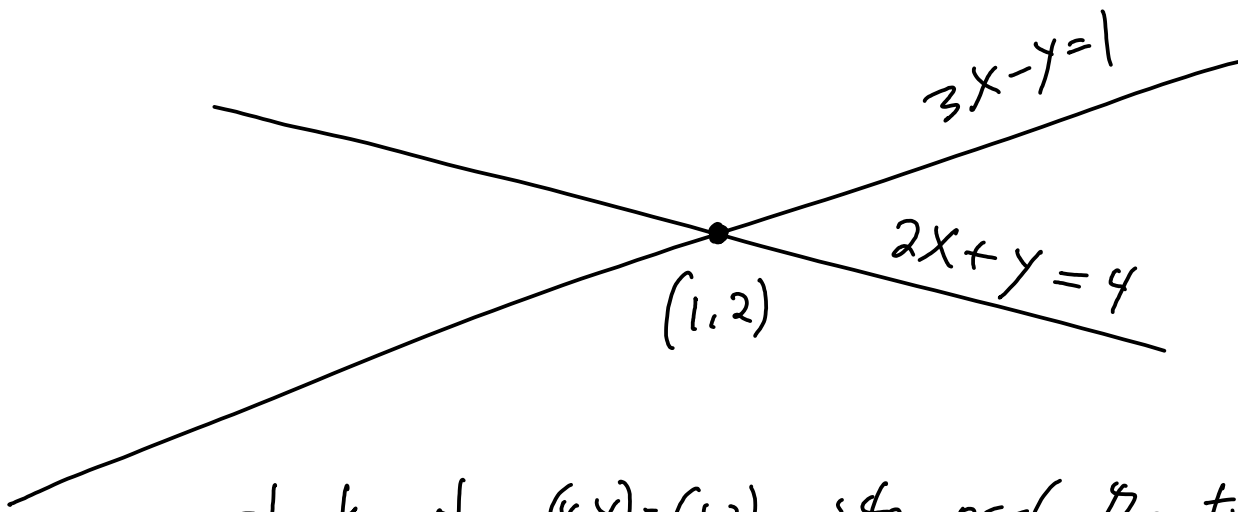
$$5x = 5$$

$$\boxed{x = 1}$$

put  $x=1$  into either equation above

$$3(1) - y = 1$$

$$\begin{array}{r} 3 - y = 1 \\ \hline \boxed{2 = y} \end{array}$$



Check plug  $(x, y) = (1, 2)$  into each the two original equations.

$$\begin{array}{ll} 3x - y = 1 & 3(1) - (2) = 3 - 2 = 1 \quad \checkmark \\ 2x + y = 4 & 2(1) + 2 = 2 + 2 = 4 \quad \checkmark \end{array}$$

Example Find the solution to system

$$3x + 2y = 1$$

$$4x - y = 6 \quad \leftarrow \text{multiply by 2 and add together}$$

$$\begin{array}{r} 3x + 2y = 1 \\ + 2(4x - y = 6) \\ \hline 11x + 0 = 13 \end{array}$$

$$11x = 13$$

$$\boxed{x = \frac{13}{11}}$$

$$4\left(\frac{13}{11}\right) - y = 6$$

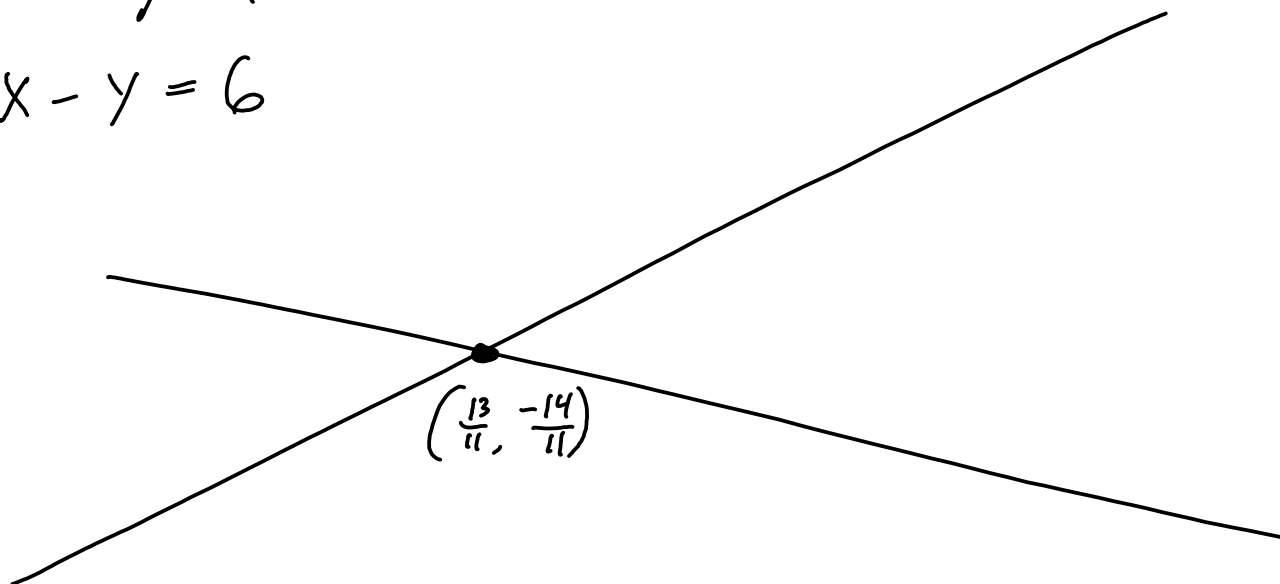
$$\begin{array}{r} \frac{52}{11} - y = 6 \\ -6 + y \quad -6 + y \end{array}$$

$$\frac{52}{11} - 6 = y$$

$$\boxed{\frac{-14}{11} = y}$$

$$3x + 2y = 1$$

$$4x - y = 6$$



Check

$$3\left(\frac{13}{11}\right) + 2\left(-\frac{14}{11}\right) = \frac{39}{11} - \frac{28}{11} = \frac{11}{11} = 1 \quad \checkmark$$

$$4\left(\frac{13}{11}\right) - \left(-\frac{14}{11}\right) = \frac{52}{11} + \frac{14}{11} = \frac{66}{11} = 6 \quad \checkmark$$