

1.3 Intersection of 2 Lines

Ex: Find the intersection of the lines
(i.e. solve the system)

$$\begin{aligned} 3x + 2y &= 2 \\ 9x - 2y &= 18 \end{aligned}$$

$$\begin{aligned} 2y &= -3x + 2 \\ y &= -\frac{3}{2}x + 1 \end{aligned}$$

$$\begin{aligned} -2y &= -9x + 18 \\ y &= \frac{9}{2}x - 9 \end{aligned}$$

$$\begin{aligned} y &= y \\ -\frac{3}{2}x + 1 &= \frac{9}{2}x - 9 \\ -\frac{3}{2}x - \frac{9}{2}x &= -9 - 1 \end{aligned}$$

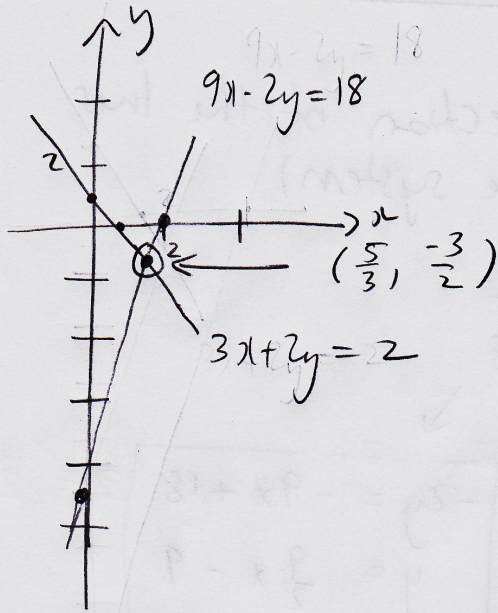
$$-6x = -10$$

$$x = \frac{-10}{-6} = \frac{5}{3}$$

Sub into either equation

$$\begin{aligned} x = \frac{5}{3} \rightarrow y &= \frac{9}{2}x - 9 \\ y &= \frac{9}{2}\left(\frac{5}{3}\right) - 9 \\ y &= \frac{45}{6} - 9 \\ y &= \frac{15}{2} - \frac{18}{2} \\ y &= -\frac{3}{2} \end{aligned}$$

$$(x, y) = \left(\frac{5}{3}, -\frac{3}{2}\right)$$



$$3x + 2y = 2$$

$$\begin{array}{c|c} x & y \\ \hline 0 & 1 \\ \frac{2}{3} & 0 \end{array}$$

$$9x - 2y = 18$$

$$\begin{array}{c|c} x & y \\ \hline 2 & 0 \\ 0 & -9 \end{array}$$

Ex: Solve

$$\begin{cases} x = -1 \\ y = -3x + 2 \end{cases}$$

$$x = -1 \rightarrow y = -3x + 2$$

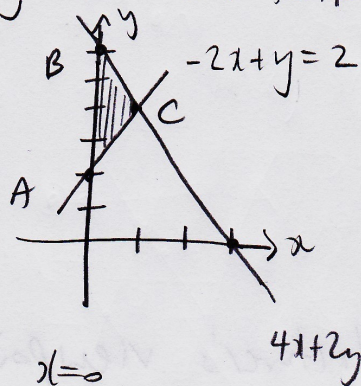
$$y = -3(-1) + 2$$

$$y = 5$$

$$(x, y) = (-1, 5)$$

$$\left(\frac{5}{3}, -\frac{3}{2}\right) = (x, y)$$

Ex: Find the coordinates of the vertices given the following feasible set



$$A: \begin{cases} x=0 \\ -2x+y=2 \end{cases}$$

$$x=0 \rightarrow -2x+y=2$$

$$y=2$$

$$A=(0,2)$$

$$B: \begin{cases} x=0 \\ 4x+2y=12 \end{cases}$$

$$x=0 \rightarrow 4x+2y=12$$

$$2y=12$$

$$y=6$$

$$B=(0,6)$$

$$C: \begin{cases} 4x+2y=12 \\ -2x+y=2 \end{cases}$$

$$2y = -4x + 12$$

$$y = -2x + 6$$

$$y = 2x + 2$$

$$y = y$$

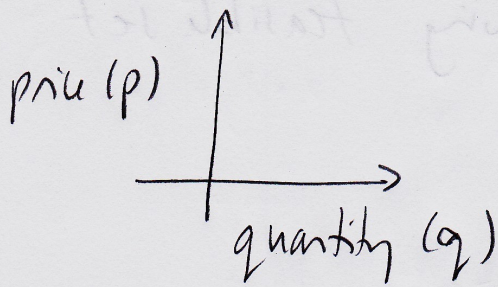
$$-2x + 6 = 2x + 2$$

$$-4x = -4$$

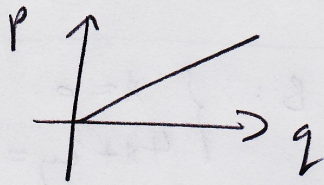
$$x = 1$$

$$x=1 \rightarrow \text{either equation } y=4 \quad C=(1,4)$$

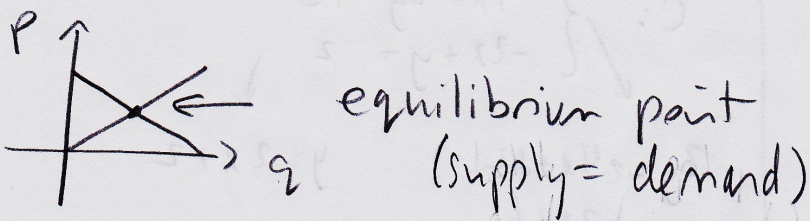
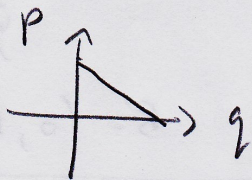
Supply and Demand



Supply: from manufacturer's viewpoint



Demand: from consumer's viewpoint



Ex: Supply curve: $p = 0.005q + 2.5$
Demand " : $p = -0.002q + 6.7$

p is in \$ and q is in thousands of units

Find equilibrium quantity and price

$$p = p$$

$$0.005q + 2.5 = -0.002q + 6.7$$

$$0.007q = 4.2$$

$$q = 600$$

$$q = 600 \rightarrow \text{either equation } p = 5.5$$

Equilibrium: 600,000 units at \$5.5

Ex: Manufacturer A can produce a product for \$300 plus \$10 per unit.

" B " \$200 plus \$12 per unit.

How many units result in the costs being equal? What is the cost?

Let y : Cost (\$)
 x : # of units

$$A : y = 300 + 10x$$

$$B : y = 200 + 12x$$

Find x and y

$$y = y$$

$$300 + 10x = 200 + 12x$$

$$100 = 2x$$

$$x = 50$$

$x = 50 \rightarrow$ either
equation

$$y = 800$$

For an order of 50 units, both
manufacturers have a cost of \$800.