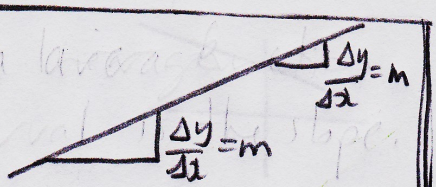
4.1 Linear Functions

$f(x) = mx + b$ (lines)



$f(x) = mx + b$ has $\frac{\Delta y}{\Delta x} = m$

Ex: Is it a line?

Yes if $\frac{\Delta y}{\Delta x}$ is the same for each interval.

a)

x	y
1	5.1
2	10.4
4	21

$\frac{\Delta y}{\Delta x} = \frac{10.4 - 5.1}{2 - 1} = 5.3$

$\frac{\Delta y}{\Delta x} = \frac{21 - 10.4}{4 - 2} = 5.3$

YES

b)

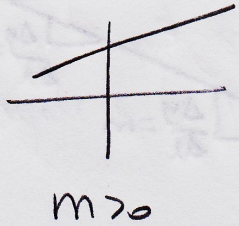
x	y
1	5.1
2	10.4
4	21.6

$\frac{\Delta y}{\Delta x} = \frac{10.4 - 5.1}{2 - 1} = 5.3$

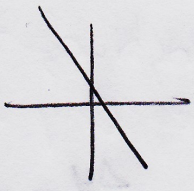
$\frac{\Delta y}{\Delta x} = \frac{11.2}{2} = 5.6$

NO

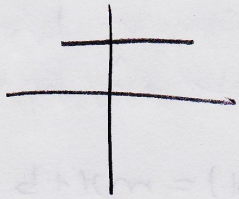
A linear function is increasing if $m > 0$
decreasing if $m < 0$
constant if $m = 0$



$m > 0$



$m < 0$



$m = 0$

Ex: Increasing, decreasing or constant?

$4x + 7y = 3$

$\rightarrow y = mx + b$

$7y = -4x + 3$

$y = -\frac{4}{7}x + \frac{3}{7}$

$m < 0$ **decreasing**

Depreciation

$V(x)$ = object's value ($)

x = time (years)

$\boxed{V(x) = mx + b}$

Ex: A laptop costs \$1200 and depreciates over 6 years.

a) Find $V(x)$

Given $V(0) = 1200$ $V(6) = 0$

$(0, 1200)$ $(6, 0)$

$m = \frac{\Delta y}{\Delta x} = \frac{0 - 1200}{6 - 0} = -200$ $b = y\text{-intercept} = 1200$

$V(x) = mx + b$

$V(x) = -200x + 1200$

b) domain of $V(x)$?
(x-values)

$0 \leq x \leq 6$

c) Value after 2 years?

$x = 2$

$V(2) = -200(2) + 1200$

$= \$800$

d) When will the value be \$600?

$y = 600$

$600 = -200x + 1200$

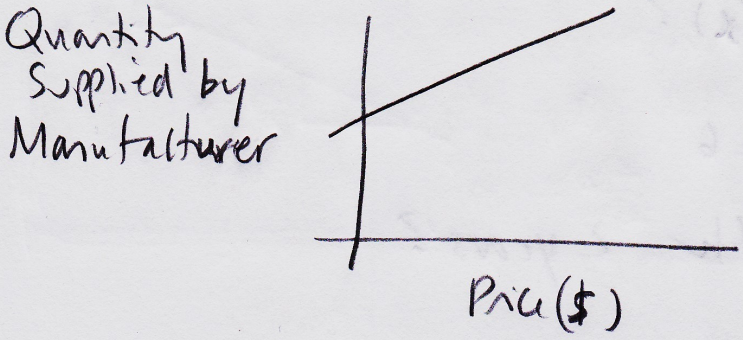
$-600 = -200x$

$x = 3$

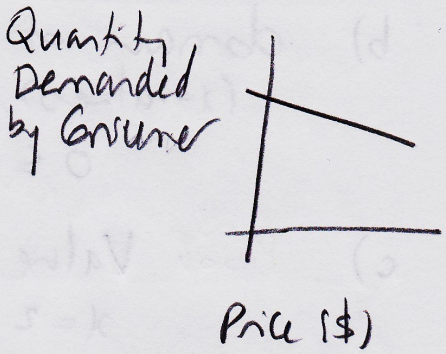
After 3 years.

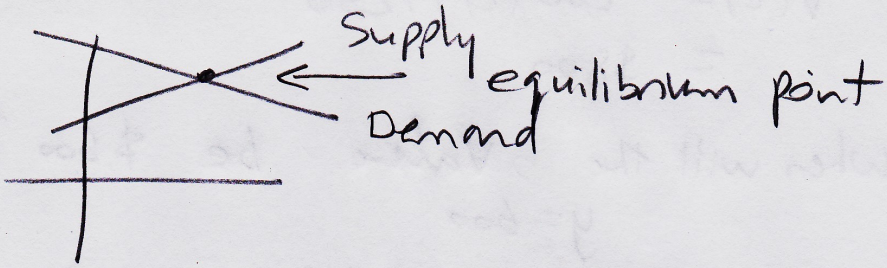
Supply and Demand

Supply



Demand





Ex: Drinks at a concert

Supply $S(p) = 3{,}000p - 2{,}000$

Demand $D(p) = -1{,}000p + 10{,}000$

a) Find equilibrium point

Set $S(p) = D(p)$

$3{,}000p - 2{,}000 = -1{,}000p + 10{,}000$

$4{,}000p = 12{,}000$

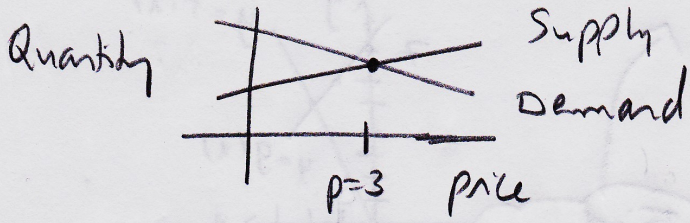
$p = 3$

Plug into either $S(p)$ or $D(p)$

$S(3) = D(3) = 7{,}000$

At a price of $3, supply and demand are 7,000 drinks

b) Solve $D(p) > S(p)$ (what prices ?) p.5



$0 \leq p < 3$

Ex: $f(x) = 3x - 1$ $\quad g(x) = -x + 7$

Solve:

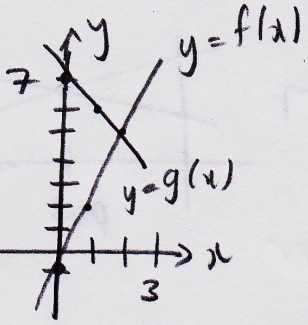
a) $f(x) = 2$

$\boxed{x = 1}$

b) $f(x) > 2$

$\boxed{x > 1}$

Find x-value(s)



c) $g(x) \geq 6$

$g(x) = 6 \Rightarrow x = 1$

$g(x) \geq 6 \Rightarrow \boxed{x \leq 1}$

$g(x)$ is decreasing!

d) $f(x) = g(x)$

$\boxed{x = 2}$

e) $f(x) > g(x)$

$\boxed{x > 2}$