1.5 Functions

Relation	vs.	Function
defined by a set of ordered pairs (x,y)		a relation such that every input has exactly one output

domain $\Rightarrow$ set of allowable inputs

range $\Rightarrow$ set of outputs

Ex 1 Relation or Function?

(a) $x =$ person $\quad y =$ car owned by that person

(b) $x =$ person $\quad y =$ their kid

(c) $x =$ person $\quad y =$ their mom

(d) $x =$ student $\quad y =$ grade in Math 1090 class.

1.5 (cont)

Vertical Line Test

If we graph all the ordered pairs (of a relation) on a Cartesian coordinate system, and every vertical line goes through the graph at most one time, then it's a function.

Ex 2 Are these functions? Identify the domain.

(a) $y = f(x) = 6x^2$

(b) $y^2 = 4x^2$

Ex 3 Evaluate, given $f(x) = 4x^2 - 5x$

(a) $f(-2)$

(b) $f(2)$

(c) find the domain

(d) find the range

1.5 (cont)

Ex 4 Evaluate for $f(x) = \frac{x+3}{x-2}$

(c) find domain

(a) $f(1)$

(b) $f\left(\frac{2w+1}{w-1}\right)$

Ex 5 find domain

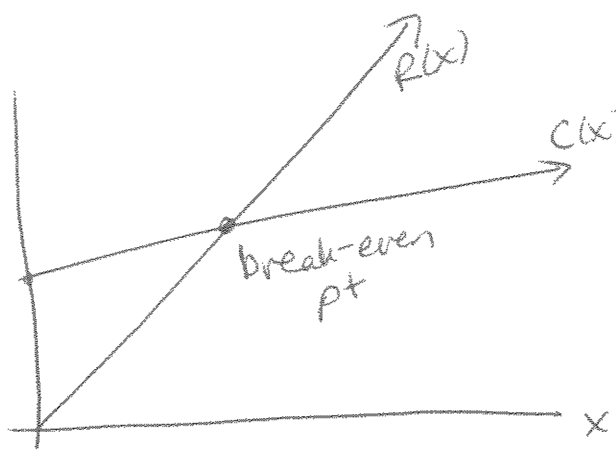
(a) $f(x) = \sqrt{2x-1}$

(b) $g(x) = \frac{3}{x^2-25}$

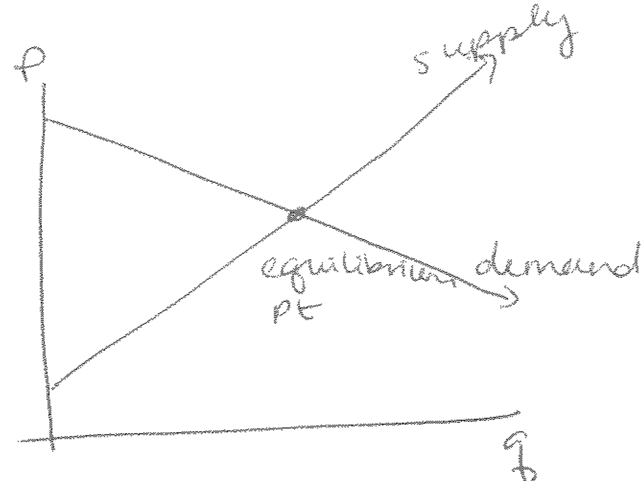
1.6 Linear Business Applications

Two Main Types

Profit / Revenue / Cost	Supply / Demand
$P = R - C$ x = # units produced & sold	p = price, q = quantity



break-even pt ⇒ where profit is zero



equilibrium pt ⇒ where quantity demanded = quantity supplied at a certain price

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Ex 1 (#4) Market research has shown for a sporting event, supply for tickets is $20p - q = 100$ & demand is $4p = 6260 - 5q$.

(a) How many tickets will be purchased if price is \$30? \$100?

1.6 (cont)

Ex 1 (cont) (b) How many tickets will the sponsors of the event be willing to sell if the ticket price is $30? 100 %

(c) what is the equilibrium pt for this market?

1.6 (cont)

Ex 2 Fixed costs are \$92,000 to publish a certain cookbook and variable costs are \$2.10 per book. If the book sells for \$15 each, (a) how many books must be sold to break even?

(b) What is marginal revenue, MR?

MR = slope of revenue line

(c) What is marginal profit? (MP)

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1.6 (cont)

Ex 3 Find market equilibrium pt for these demand + supply curves.

demand: $p = -4q + 300$

supply: $p = 21q + 50$

Ex 4 (#20) A distributor will supply 10,000 calendars if the price is \$2 each or will supply 8,000 calendars if the price is \$1.25. What is the supply equation?

1.7 Linear Inequalities in Two Variables

Vocab Linear Inequality $\Rightarrow$ can be written in form $ax+by<c$, $a,b,c\in\mathbb{R}$

Linear system of inequalities $\Rightarrow$ two or more linear inequalities we want to solve simultaneously.

Solution Set $\Rightarrow$ the region that solves all inequalities.

Ex 1 Graph solns.

(a) $2x-\frac{3}{5}y\geq\frac{-2}{5}$

(b) $4x+3y\leq 9$

1.7 (cont)

Ex 2 Solve + graph solutions (on 2d plane).

$$x + y < \frac{1}{2}$$

$$2x + \frac{3}{4}y < 3$$

$$\frac{1}{3}x + \frac{1}{2}y > -2$$

$$\frac{1}{3}y - \frac{2}{3}x < 5$$

1.7 (cont)

Ex 3 Solve + graph solutions.

$$x + 7y < -15$$
$$5x - y > -3$$
$$x - 2y < 12$$

1.7 (cont)

Ex 4 (#40) A furniture company makes and sells 2 types of tables, one small & one large. Each large table requires two hours of assembly and two hours of finish work. Each small table requires 3 hours of assembly and $1\frac{1}{4}$ hours of finish work. The assembly shop is open a maximum of 12 hours per day. The finishing shop is available for 10 hours per day. Find the system of linear inequalities to represent this and graph solutions.

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1.8 Graphical Linear Programming

<u>EX1</u> Find min & max values of objective fn $f = 4x + 3y$ on feasible region given by

$$\begin{cases} 2x + 3y \leq 12 \\ 4x - 2y \leq 8 \\ x \geq 0, \ y \geq 0 \end{cases}$$

feasible region $\Rightarrow$

closed & bounded $\Rightarrow$

optimal solution $\Rightarrow$

☆ optimal soln occurs at "corners"

☆ if no corners, may be no optimum values

1.8 (cont)

Ex 2 minimize $g = 22x - 17y$ subject to

constraints
$$\begin{cases} 8x + 5y \geq 100 \\ 12x + 25y \geq 360 \\ x \geq 0,\ y \geq 0 \end{cases}$$

1.8 (cont)

Ex3 A contractor builds two types of homes. The Carolina requires one lot, \$160,000 capital, and 160 worker-days of labor. The Savannah requires one lot, \$240,000 capital, and 160 worker-days of labor. The contractor owns 300 lots and has \$48,000,000 available capital and 43,200 worker-days of labor. The profit on the Carolina is \$40,000 and on the Savannah, it's \$50,000. How many of each type of home should be built to maximize profit? What is max profit?