Technology

So far: consumers have preferences over consumption goods, we can derive demand given preferences, prices, and income

Now

- Firms supply consumption goods to the market
- How much will a firm supply?
- What price will they charge?

Production process

- Firms take inputs and transform them into output
- The way in which inputs are transformed into outputs is call technology

Factors of Production

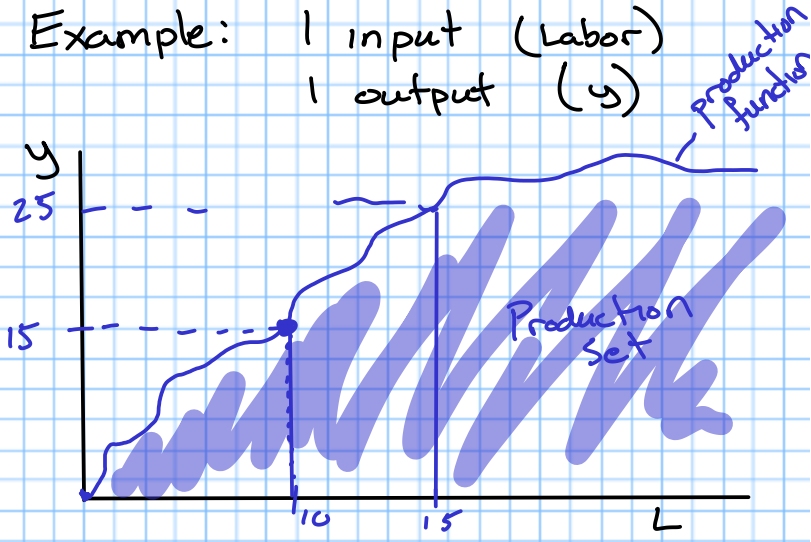
- An input to a production process is called a factor

- We will focus on two specific factors,
  1. Capital (K)
  2. Labor (L)
     - L: Hours worked per unit of time
     - K: Machine-hours per unit of time
- Capital is any productive factor that is itself an output to some other production process

Production sets

- Given a quantity of inputs (factors), how much output can a firm produce?

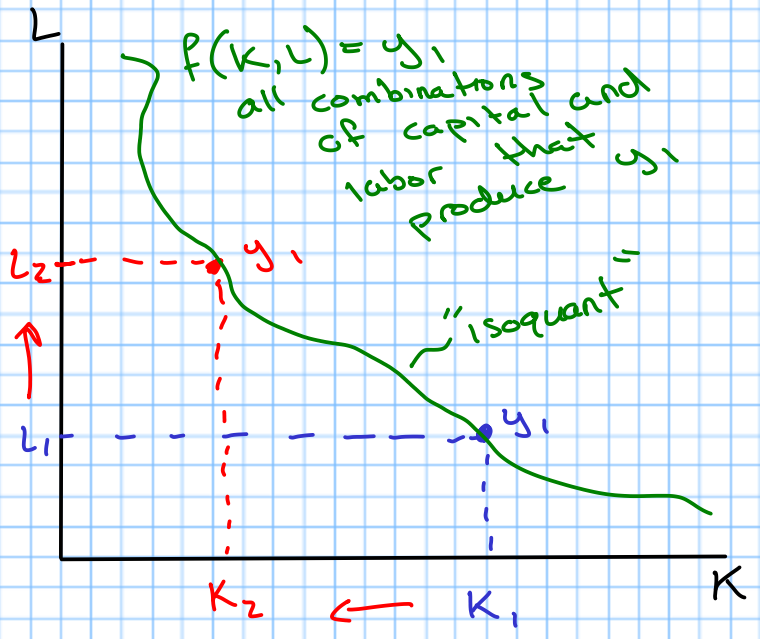
Example: 1 input (Labor)
1 output (y)



Production function

- The most output that can be produced from a given level of input
- Shape of the production function is determined by technology
- Inputs: K, L
- Output: y

$$y = f(K, L)$$



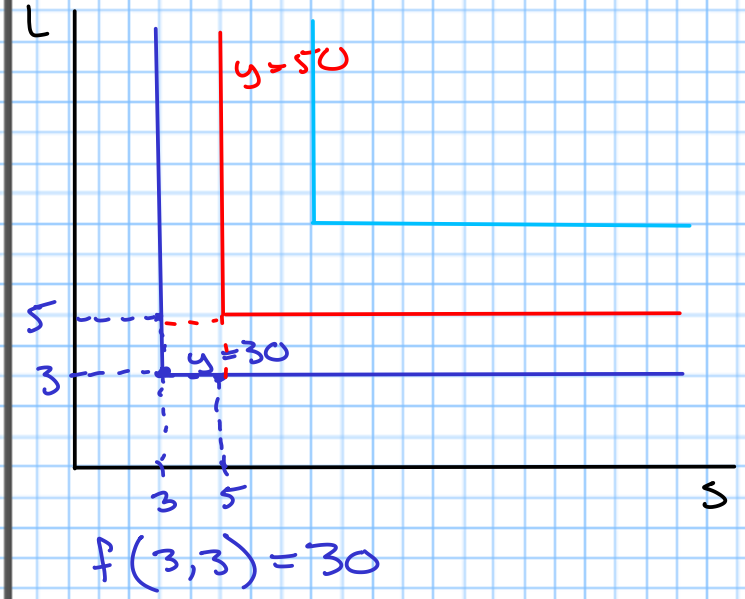
$$y_1 = f(K_1, L_1)$$

$$y_1 = f(K_2, L_2)$$

Examples

Fixed-proportion technology

- Output: Digging holes
- Inputs: Workers
  Shovels
- Workers without shovels can't do anything
- Shovels without workers can't do anything

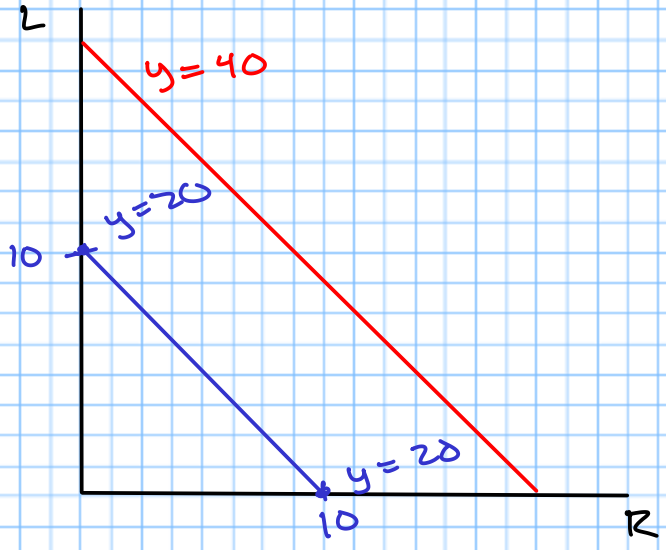


$f(3,3) = 30$

Example

Perfect substitutes

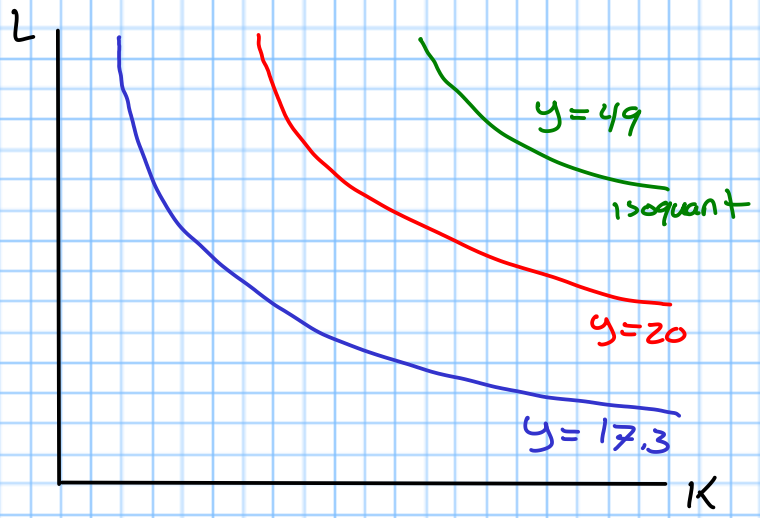
- Left-handed lawyers (L)
- Right-handed lawyers (R)



Example

- Cobb-Douglas production functions

$$y = f(K,L) = K^a L^b$$



Marginal Product

- Extra output that is produced after a small increase in one of the factors

$y = f(K, L)$

- MPK = Marginal productivity of capital

$$= \frac{\partial f(K,L)}{\partial K}$$

- $MPL = \frac{\partial f(K,L)}{\partial L}$

Example

$$y = K^2 L^3$$

$$MPK = 2KL^3$$

$$MPL = 3K^2 L^2$$

Example:

$$y = K^{1/3} L^{2/3}$$

$$MPK = \frac{1}{3} K^{-2/3} L^{2/3}$$

$$= \frac{L^{2/3}}{3K^{2/3}}$$

$$MPL = \frac{2}{3} K^{1/3} L^{-1/3}$$

Technical Rate of Substitution (TRS)

- Slope of the isoquant

- The rate at which the firm can substitute capital for labor such that production remains unchanged
- $TRS = \frac{MPK}{MPL}$