Longrun Production Function

all are variable inputs

↓

two variable inputs

that is $Q = f(L, K)$
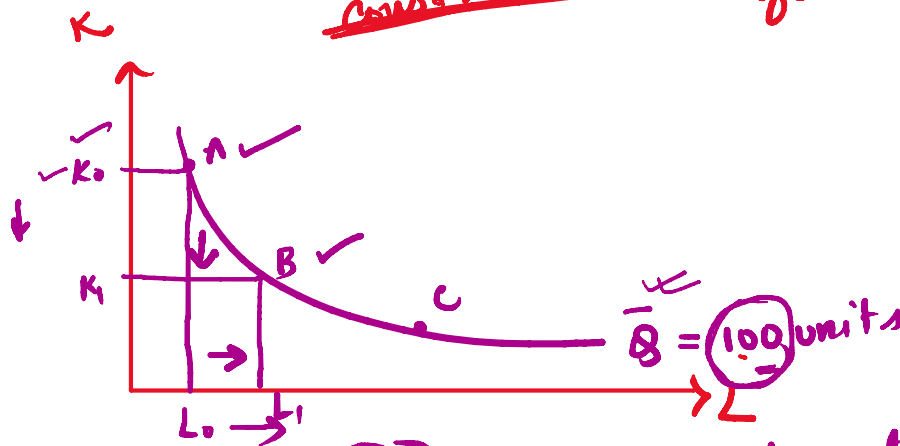
output ↑   Labour and capital ↓

graphical representation of longrun production function is **Isoquant**

$Q = f(L, K)$

along an isoquant output is always **constant**

different combination of inputs used for same level of production

K

K_0 A

K_1 B

C

$\overline{Q} = 100$ units

L_0

1. An isoquant is a **line** joining different points (like A, B and C) showing different alternative combinations of labour & capital used for producing **same** level of **output**.

   ie along an isoquant, output level is constant.

2. Slope of isoquant is $\dfrac{\Delta K}{\Delta L} = -\dfrac{MP_L}{MP_K} < 0$

2. Slope of isoquant is $\frac{\Delta K}{\Delta L} = -\frac{MP_L}{MP_K} < 0$

where $MP_L = \frac{\Delta Q}{\Delta L}$

and $MP_K = \frac{\Delta Q}{\Delta K}$

∴ ==isoquant is downward sloping==
because the change in labour and capital moves in opposite direction.

$\boxed{L = \hat{1} \rightarrow K \downarrow}$

3. <u>Isoquant is convex to the origin.</u>

$\boxed{MRTS_{L,K}}$ → Marginal <u>Rate</u> of Technical Substitution of Labour and Capital.
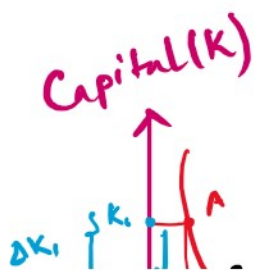
It is defined as the amount of capital given up or substituted for every additional unit of labour employed such that the level of production is constant (remain same).

i.e. $MRTS_{LmK} = \left|\frac{\Delta K}{\Delta L}\right| = \boxed{\frac{MP_L}{MP_K}}$

Here the rate of substitution of capital for labour with every additional unit of labour is diminishing. That is $MRTS_{LK}$ is diminishing.
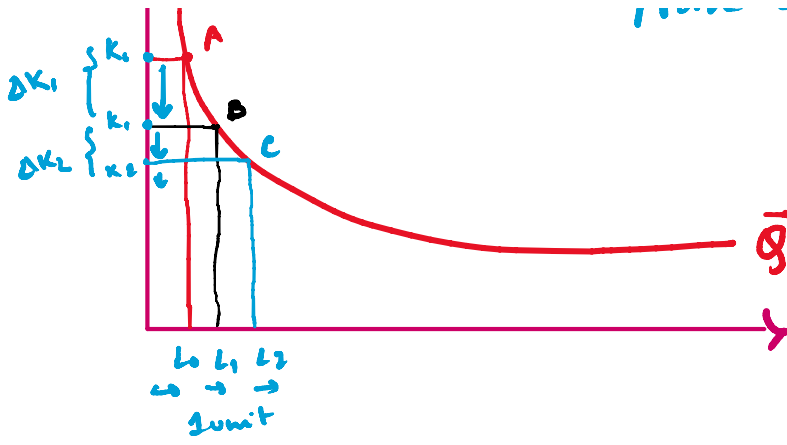
∴ It is $\boxed{\text{convex}}$ to the origin.

Capital(K)

from diagram

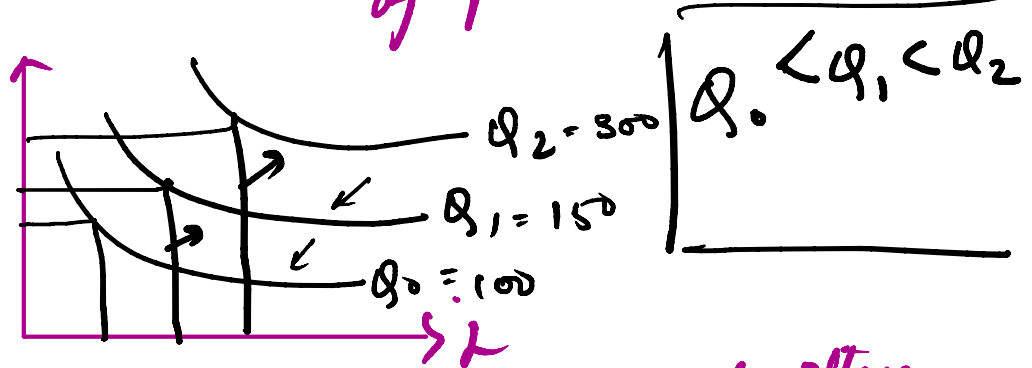$\Delta K_1 > \Delta K_2$

... . = 1 unit

$\Delta K_1 > \Delta K_2$

$\Delta L_1 = \Delta L_2 = 1 \text{ unit}$

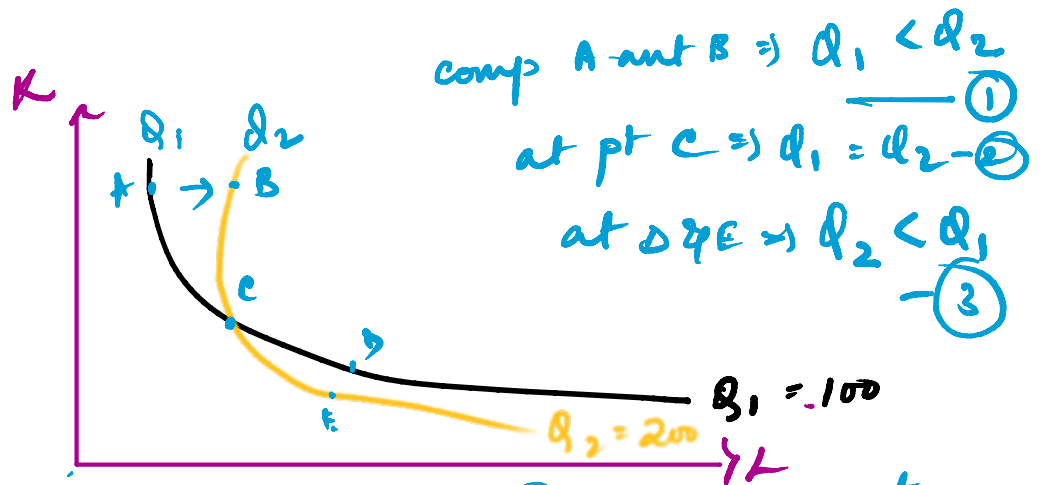$\therefore \dfrac{\Delta K_1}{\Delta L_1} > \dfrac{\Delta K_2}{\Delta L_2}$

$\boxed{MRTS^1 > MRTS^2 > \ldots}$

$MRTS_{L,K}$ is diminishing.

③ Higher the isoquant $\Rightarrow$ higher is the level of production.

$q_2 = 300$

$q_1 = 150$

$q_0 = 100$

$q_0 < q_1 < q_2$

④ Two isoquants cannot intersect each other.

$q_1 \quad q_2$

$q_1 = 100$

$q_2 = 200$

comp A and B $\Rightarrow q_1 < q_2$ ——①

at pt c $\Rightarrow q_1 = q_2$ ——②

at pt E $\Rightarrow q_2 < q_1$ ——③

Isoquant same

① and ② and ③ contradicts each other and violates the property of isoquants.

(Iso)cost line :

↳ same.

{
$\frac{\downarrow}{\downarrow}$ k , L , w

$\frac{\downarrow}{r}$ K , r

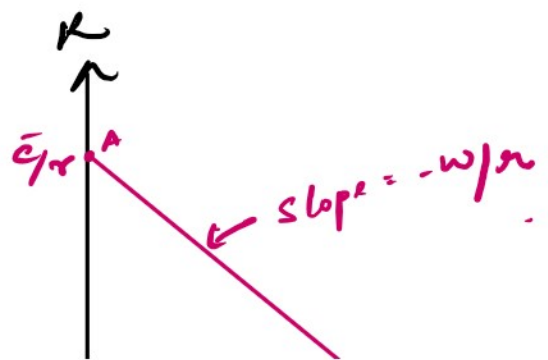$$\boxed{TC = (wL) + (Kr)}$$

↓
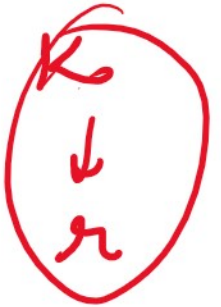
equation of isocost line. →

$$\boxed{\bar{C} = wL + rK}$$

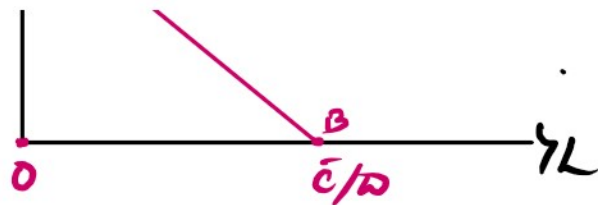(Slope) of isocost line, $\frac{\Delta k}{\Delta L} = -\frac{w}{r} < 0$

↳ it is the ratio of the price of inputs

def : Isocost line is defined as the locus joining different points showing alternative combination of Labour and Capital employed by a firm so that the cost of production remains same.

$\bar{C} = wL + rK$

if $L = 0$ then $K = \bar{C}/r$

and $K = 0$ then $L = \bar{C}/w$

and $K=0$ then $L = c/w$

and $Slope = -w/r < 0$

firm's objective : To maximise profit

d

max output $\Big/$ min cost.

Producer's Equilibrium :

Maximising output production

with given cost of production

or Minimising cost of production

with given level of output
production.

At producer's equilibrium.

✓ $MRTS_{L,K} = \dfrac{w}{r}$ ✓

or $\boxed{\dfrac{MP_L}{MP_K} = \dfrac{w}{r}}$ ✓

v.imp !