17 November 2023 10:28 PM

1. What is a homogenous fn ?
2. What do you mean by IRS, CRS, DRS
3. What is Euler's theorem
or, define " "
4. Interpretation of 'λ' (lagrangian fn) → $\boxed{\text{shadow price}}$
5. Producer's equilibrium condition.
6. What is a convex function?
7. What is a convex set

Multivariate function (two variable case) for maximisation and minimisation (without constraints)

$$z = f(x_1, x_2)$$

Maximisation:

F.O.C : $f_1 = \frac{\partial z}{\partial x_1} = 0$ and $f_2 = \frac{\partial z}{\partial x_2} = 0$

S.O.C : $f_{11} = \frac{\partial^2 z}{\partial x_1^2} < 0$

$f_{22} = \frac{\partial^2 z}{\partial x_2^2} < 0$

what is $f_{12} = \frac{\partial^2 z}{\partial x_1 \partial x_2}$

$f_{22} = \frac{\partial^2 z}{\partial x_2^2} < 0$

and $f_{11} \cdot f_{22} > (f_{12})^2$

what is $f_{12} = \frac{\partial^2 z}{\partial x_1 \partial x_2}$

Minimisation : F.O.C $f_1 = 0$ and $f_2 = 0$

S.O.C $f_{11} = \frac{\partial^2 z}{\partial x_1^2} > 0$ and $f_{22} = \frac{\partial^2 z}{\partial x_2^2} > 0$

and $f_{11} \cdot f_{22} > (f_{12})^2$

special case Note:

(a) a $\boxed{\text{saddle point}}$ if $f_{11} \cdot f_{22} < (f_{12})^2$
and f_{11} & f_{22} have different signs.

(b) an inflexion point if $f_{11} \cdot f_{22} < (f_{12})^2$
and, f_{11} and f_{22} have same sign

Q find the stationary values and test whether they are maximum or minimum for they are maximum or minimum for

$$\boxed{z = 3x^2 + 6xy + 7y^2}$$

F.O.C

$f_x = \frac{\partial z}{\partial x} = 6x + 6y = 0$ — ①

$f_y = \frac{\partial z}{\partial y} = 6x + 14y = 0$ — ②

solving ① and ②

$$\begin{array}{r} \cancel{6x} + 6y = 0 \\ \cancel{6x} + 14y = 0 \\ - \quad\quad - \\ \hline -8y = 0 \end{array}$$

$\Rightarrow y = 0$

$\therefore x = 0$

stationary points are, $x = 0$, $y = 0$

$\frac{\partial z}{\partial x} = 6x + 6y$

dy

S.O.C

$f_{xx} = \frac{\partial^2 z}{\partial x^2} = 6 > 0$

$f_{yy} = \frac{\partial^2 z}{\partial y^2} = 14 > 0$

$f_{xy} = \frac{\partial^2 z}{\partial x \partial y} = 6$

$f_{xx} f_{yy} = 6 \times 14 = 84$

$$f_{xx} f_{yy} = 6 \times 14 = 84$$

$$f_{xy}^2 = 6^2 = 36$$

$$\therefore \boxed{f_{xx} f_{yy} > (f_{xy})^2}$$

$\therefore$ At (x,y) i.e $(0,0)$ function z is maximised

Quotient Rule: (u/v rule)

$$z = \frac{x^2 - y^2}{3x+2y}$$

$$z = \frac{x^2}{3x+2y} - \frac{y^2}{3x+2y}$$

$$\frac{\partial z}{\partial x} = \frac{(3x+2y)(2x) - x^2(3)}{(3x+2y)^2} - \frac{(3x+2y) \cdot 0 - y^2(3)}{(3x+2y)^2}$$

$$= \frac{6x^2 + 4xy - 3x^2 + 3y^2}{(3x+2y)^2}$$

$$= \frac{3x^2 - 4xy + 3y^2}{(3x+2y)^2} \quad \text{(ans)}$$

$$z = \frac{u}{v}$$

$$\frac{\partial z}{\partial x} = \frac{v \cdot \frac{\partial u}{\partial x} - u \frac{\partial v}{\partial x}}{v^2}$$

∂z

$$\frac{\partial z}{\partial y} =$$

$$\frac{\partial z}{\partial x} = \frac{\quad}{v^2}$$