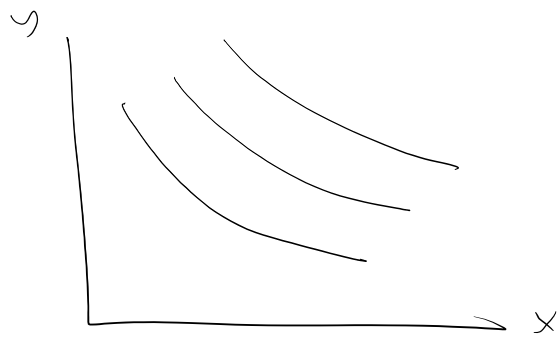
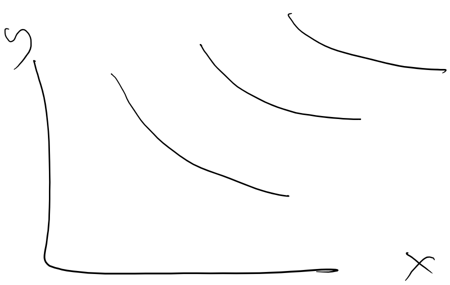
$$U(x,y) = 3x + y$$

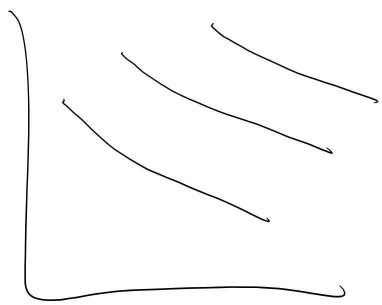
$$U(x,y) = (xy)^{\frac{1}{2}}$$

$$U(x,y) = x^2 y^2$$

$$U(x,y) = \log(x) + \log(y)$$







$$U = (xy)^{1/2}$$

$$V = U^4 = \{(xy)^{1/2}\}^4 = (xy)^2$$

$\Rightarrow$ U & V are monotonic transform

$\Rightarrow$ same preference

$$W = \log U = \frac{1}{2}\{\log x + \log y)$$

$$z = 2W = \log x + \log y$$

U, W, V, Z are of same preference

$$U = 3x + y$$

$\boxed{MU_x = 3}$ $\boxed{MU_y = 1}$ } constant MU

$\Rightarrow MRS = \frac{3}{1} = 3$

$$U = (xy)^{1/2} = x^{1/2} y^{1/2}$$

$$MU_x = \frac{1}{2} x^{-1/2} y^{1/2} = \frac{1}{2} \frac{y^{1/2}}{x^{1/2}} \Rightarrow x \uparrow \rightarrow MU_x \downarrow$$

$$MU_y = \frac{1}{2} x^{1/2} y^{-1/2} = \frac{1}{2} \frac{x^{1/2}}{y^{1/2}} \Rightarrow y \uparrow \rightarrow MU_y \downarrow$$

} dec. MU

$$U = \log x + \log y$$

$$\underbrace{MU_x = \frac{1}{x} > 0 ; MU_y = \frac{1}{y} > 0}_{C.S.}$$

$$U(x,y) = 3x + y$$

$$U(ax, ay) = 3(ax) + (ay)$$

$$= a\{3x + y\}$$

$$U(ax, ay) = a * U(x,y) \Rightarrow \text{degree } 1$$

$$U(x,y) = (xy)^{1/2}$$

$$U(ax, ay) = ((ax)(ay))^{1/2} = a^{1/2} x^{1/2} a^{1/2} y^{1/2}$$

$$= a[(xy)^{1/2}]$$

$u(ax, ay) = a * u(x, y) \longrightarrow$ degree 1.

$u(x, y) = (xy)^2$

$u(ax, ay) = \left[(ax)(ay)\right]^2 = a^4 (xy)^2$

$= a^4 u(x, y) \Rightarrow$ degree $\underline{\underline{4}}$

$u(x, y) = \log x + \log y = \log(xy)$

$u(ax, ay) = \log(ax) + \log(ay)$

$= [\log a + \log x] + [\log a + \log y]$

$= 2 \log a + [\underline{\log x + \log y}]$

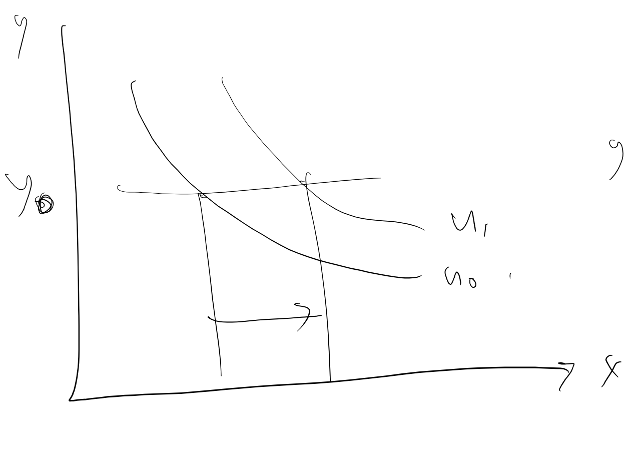
$u(ax, ay) = \log a^2 + (\log x + \log y)$

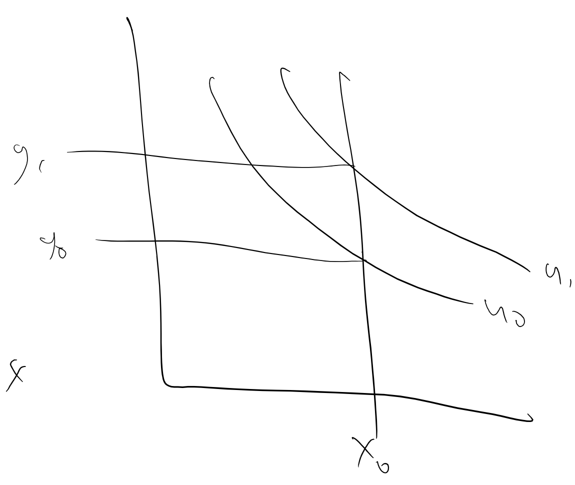
$= \log[a^2 x y]$

$\log(m \cdot n)$

$= \underline{\log m + \log n}$

$\log(m^n) = n \log m$





$U = 3x + y$

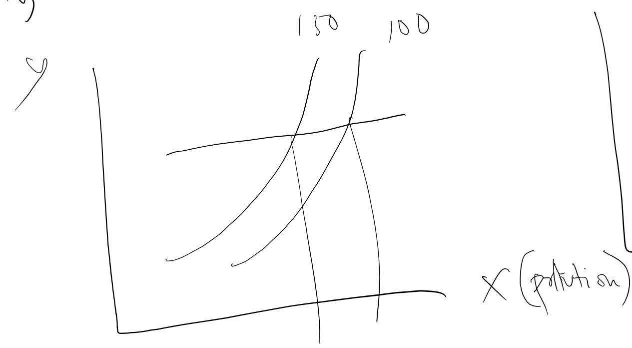
$MU_x = 3 > 0$ } convex pref.

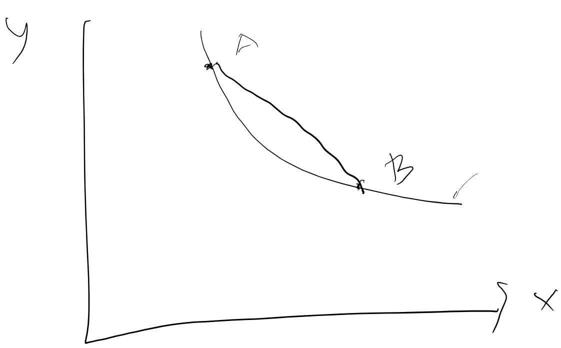
$MU_y = 1 > 0$

150 100

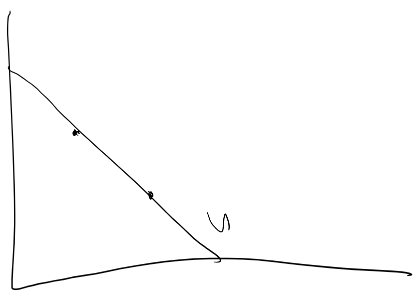
150 100

$MU_y = 1 > 0$

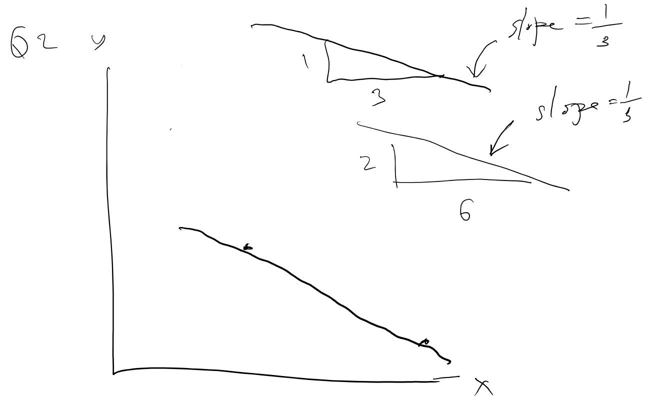




convex if line is higher than the IC



Q2



Q3

$U = W_f^{2/3} W_c^{1/3}$

$$U = W_f^{2/3} \; W_c^{1/3}$$

$P_f = 40 \quad P_c = 8 \; , \; B = 600$

$$\max \; \underline{U = W_f^{2/3} \; W_c^{1/3}} \quad \text{(O.F.)}$$

$$\text{s.t} \quad 600 = 40 W_f + 8 W_c \quad \text{(constraint)}$$

$$\mathcal{L} = \underline{W_f^{2/3} \; W_c^{1/3}} + \lambda \left[600 - 40 W_f - 8 W_c \right]$$

FOC

$$\mathcal{L}_{W_f} = \frac{2}{3} W_f^{-1/3} \; W_c^{1/3} + \lambda \left[-40 \right] = 0 \rightarrow \frac{2}{3} W_f^{-1/3} \; W_c^{1/3} = 40\lambda \quad (1)$$

$$\mathcal{L}_{W_c} = \frac{1}{3} W_f^{2/3} \; W_c^{-2/3} + \lambda \left[-8 \right] = 0 \rightarrow \frac{1}{3} W_f^{2/3} \; W_c^{-2/3} = 8\lambda \quad (2)$$

$$\mathcal{L}_\lambda = 600 - 40 W_f - 8 W_c = 0$$

$$(1)/(2) \quad \frac{2/3 \, W_f^{-1/3} \; W_c^{1/3}}{1/3 \, W_f^{2/3} \; W_c^{-2/3}} = \frac{40\lambda}{8\lambda} \quad \Bigg\} \quad \frac{a^x}{a^y} = a^{x-y}$$

$$\frac{2 W_c}{W_f} = 5 \rightarrow \boxed{W_f = \frac{2 W_c}{5}}$$

$$\rightarrow W_c = \frac{5 W_f}{2}$$

$$600 = 40 W_f + 8 W_c$$

$$600 = \cancel{40} \left[\frac{2 W_c}{\cancel{5}} \right] + 8 W_c$$

$$600 = 24 W_c \rightarrow W_c = \frac{600}{24} = 25$$

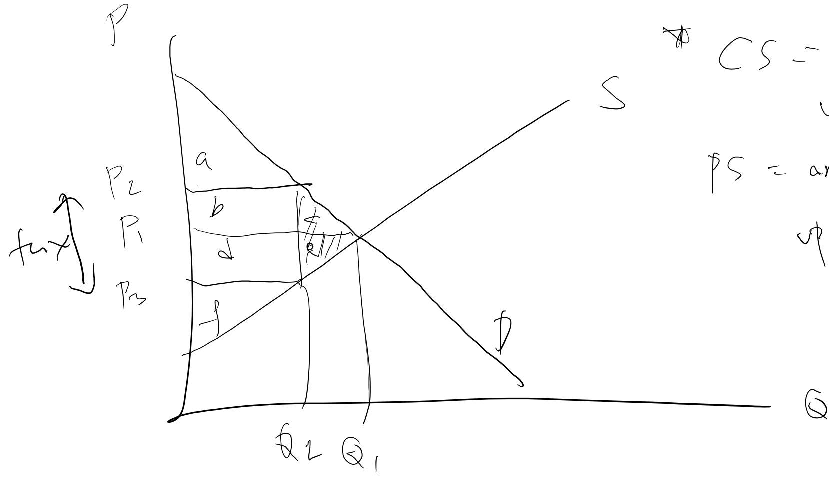
$$600 = 40 W_f + \cancel{8} \left[\frac{5 W_f}{\cancel{2}} \right]$$

$$600 = 60 W_f \rightarrow W_f = 10$$

$$U = x^a y^b \Longrightarrow V = a \log x + b \log y$$

P

* CS = area above P^b, below D



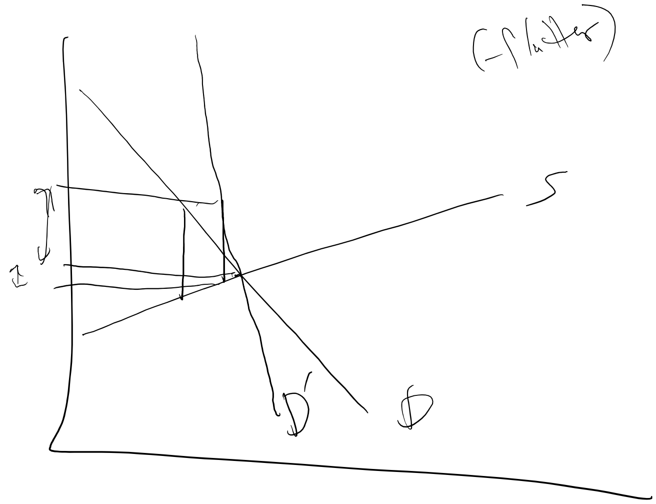
* CS = area above P^b, below D up to Q_D

PS = area below P^S, above S up to Q_S

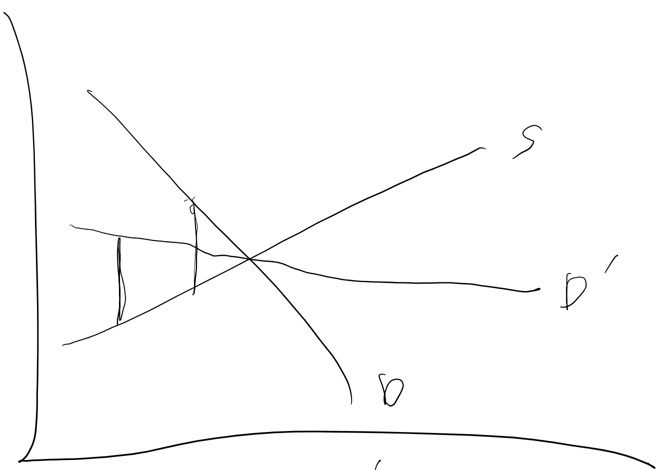
	no tax	tax	
Q_D	Q_1	Q_2	
Q_S	Q_1	Q_2	
P^b	P_1	P_2	
P^S	P_1	P_3	
tax Rev.	0	bd	
CS	abc	a	↓
PS	def	f	↓
DWL	0	ce	↑
TS	abcdef	abdf	↓

(steeper) Inelastic D (lower DWL)

(flatter) elastic D (higher DWL)

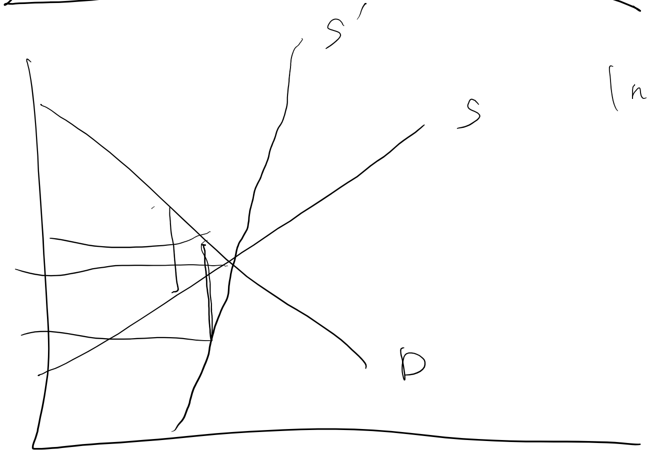


… E demand → higher



more E demand → higher DWL → TS lower

more inelastic D → lower DWL → TS higher



Inelastic S → seller pays more of tax.

1 firm & 2 plants: (G, D)

$$\left.\begin{array}{l} q_G = 10 l_g^{.5} \\ q_d = 50 l_d^{.5} \end{array}\right\}$$

$$\text{Profit} = P(q_g + q_d) - c(q_g + q_d)$$

$$\max_{l_g,\, l_d} \text{Profit} = P\left[10 l_g^{.5} + 50 l_d^{.5}\right] - c(q_g + q_d)$$

$$\frac{d\,\text{Profit}}{d l_g} = P\left[.5(10) l_g^{-.5}\right] - c = 0$$

$$\frac{d\,\text{Profit}}{} = P\left[.5(50) l_d^{-.5}\right] - c = 0$$

$$\frac{\partial\, \text{Profit}}{\partial\, l_d} = P\left[.5(50)\, l_d \quad\right] - c = 0$$

$$.5(10)\, l_g^{-.5} = \frac{c}{P}$$

$$.5(50)\, l_d^{-.5} = \frac{c}{P}$$

$$\cancel{.5}\left(10\, l_g^{-.5}\right) = \cancel{.5}(50)\, l_d^{-.5}$$

$$\frac{1}{\sqrt{l_g}} = \frac{5}{\sqrt{l_d}}$$

$$\frac{1}{l_g} = \frac{25}{l_d} \Rightarrow \boxed{25\, l_g = l_d}$$

$$\text{Profit} = P\left[q_g + q_d\right] - c\left(q_g + q_d\right)$$

$$\frac{\partial\, \text{Profit}}{\partial\, l_g} = P \times \underbrace{\frac{d q_g}{d l_g}}_{MPl_g} - c \underbrace{\frac{d q_g}{d q_l}}_{MPl_g} = 0$$

$$q = q_g + q_d$$

$$l = l_g + l_d \Rightarrow l = l_g + (25\, l_g) = 26\, l_g$$

$$q = 10\, l_g^{.5} + 50\, l_d^{.5} \;;\; l_d = 25\, l_g$$

$$q = 10\, l_g^{.5} + 50\left[25\, l_g\right]^{.5}$$

$$q = \left(10 + 50(5)\right) l_g^{.5}$$

$$q = 260\, l_g^{.5} \quad ; \quad l = 26\, l_g \rightarrow l_g = \frac{l}{26}$$

$$q = 260 \left[\frac{l}{26}\right]^{.5} = \frac{(10)(26)}{26^{.5}} l^{.5} = 10\left(26^{.5}\right) l^{.5}$$

$$\Rightarrow \boxed{q = 10\,(26\, l)^{.5}} = 10\sqrt{26\, l}$$