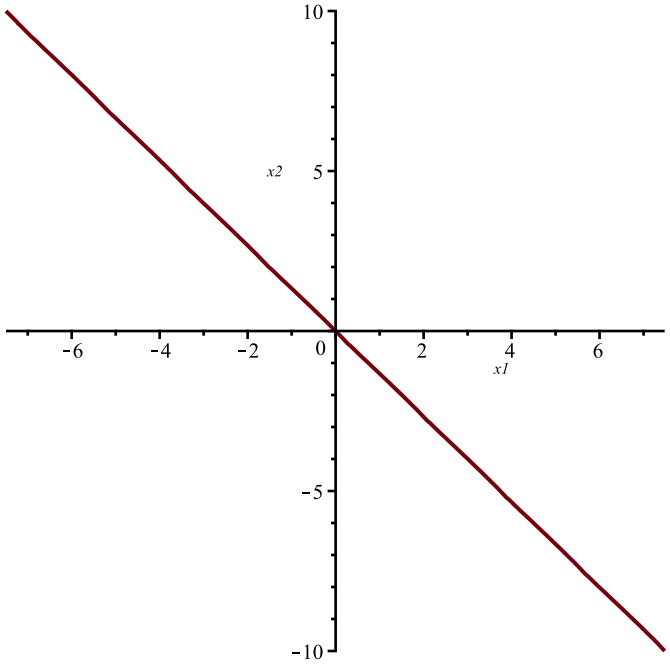
 # *Sec II Q 2:*

restart;

$y := 100 - 100\cdot\left(4^{-4\cdot x1}\right)\cdot\left(8^{(-2\cdot x2)}\right)$;

$$y := 100 - 100\,4^{-4\,x1}\,8^{-2\,x2} \tag{1}$$



 # *2.a:*

$APP1 := simplify\left(\frac{y}{x1}\right)$; #*Average physical productivity of x1.*

$$APP1 := \frac{100 - 100\,2^{-8\,x1 - 6\,x2}}{x1} \tag{2}$$

$APP2 := simplify\left(\frac{y}{x2}\right)$; #*Average physical productivity of x2.*

$$APP2 := \frac{100 - 100\,2^{-8\,x1 - 6\,x2}}{x2} \tag{3}$$

 # *2. b:*

$f1 := diff(y, x1)$; #*Marginal Physical productivity of x1*

$$f1 := 800\,4^{-4\,x1}\ln(2)\,8^{-2\,x2} \tag{4}$$

$f2 := (diff(y, x2))$; #*Marginal Physical productivity of x2*

$$f2 := 600\,4^{-4\,x1}\ln(2)\,8^{-2\,x2} \tag{5}$$

$f12 := diff(f1, x2)$; #*factor Interdependence is negative.*

$$f12 := -4800\,4^{-4\,x1}\ln(2)^2\,8^{-2\,x2} \tag{6}$$

#2.c: *Diminishing marginal returns:*

$f11 := diff(f1, x1)$; $f22 := diff(f2, x2)$; $f12 := diff(f1, x2)$;

$$f11 := -6400\,4^{-4\,x1}\ln(2)^2\,8^{-2\,x2} \tag{7}$$

$$f22 := -3600\,4^{-4\,x1}\ln(2)^2\,8^{-2\,x2} \tag{7}$$

$$f12 := -4800\,4^{-4\,x1}\ln(2)^2\,8^{-2\,x2} \tag{7}$$

$SOC := simplify(f2\cdot f2\cdot f11 - 2\cdot f1\cdot f2\cdot f12 + f1\cdot f1\cdot f22)$;

$$SOC := 0 \quad \textbf{(8)}$$

 # Since f11, f22, f12 are negative and also Second Order Condition is Zero, the function exhibit diminishing marginal returns. SOC should be zero or negative for diminishing marginal returns.

 # 2. d:

$$Factor\_Elasticity\_x1 := simplify\left(\frac{f1}{APP1}\right); \#\frac{MPP1}{APP1} = E1$$

$$Factor\_Elasticity\_x1 := -\frac{8\,2^{-8\,x1-6\,x2}\ln(2)\,x1}{-1+2^{-8\,x1-6\,x2}} \quad \textbf{(9)}$$

$$Factor\_Elasticity\_x2 := simplify\left(\frac{f2}{APP2}\right); \#\frac{MPP2}{APP2} = E2$$

$$Factor\_Elasticity\_x2 := -\frac{6\,2^{-8\,x1-6\,x2}\ln(2)\,x2}{-1+2^{-8\,x1-6\,x2}} \quad \textbf{(10)}$$

 # 2.e:

$$Functional\_Coefficient := simplify(Factor\_Elasticity\_x1 + Factor\_Elasticity\_x2); \# = E1 + E2$$

$$Functional\_Coefficient := \frac{(-8\,x1-6\,x2)\ln(2)\,2^{-8\,x1-6\,x2}}{-1+2^{-8\,x1-6\,x2}} \quad \textbf{(11)}$$