Sec III Q5:
restart;

#2a.
$xc := 4\cdot ya^2 + 5\cdot yb^2;$

$$xc := 4\,ya^2 + 5\,yb^2 \tag{1}$$

 # 5a: *This is allocable multiple production problem.*

$Interdependence := \frac{\partial^2}{\partial ya\,\partial yb}(xc);$

$$Interdependence := 0 \tag{2}$$

 # They are technically independent because interdependence = 0.

 # 5b:

$LC := 16\cdot ya + 10\cdot yb + \lambda\cdot(336 - xc);$

$$LC := 16\,ya + 10\,yb + \lambda\left(-4\,ya^2 - 5\,yb^2 + 336\right) \tag{3}$$

$lc\_yb := diff(LC, yb);$

$$lc\_yb := -10\,\lambda\,yb + 10 \tag{4}$$

$lc\_ya := diff(LC, ya);$

$$lc\_ya := -8\,\lambda\,ya + 16 \tag{5}$$

$lc\_\lambda := diff(LC, \lambda);$

$$lc\_\lambda := -4\,ya^2 - 5\,yb^2 + 336 \tag{6}$$

$\lambda\_from\_lc\_yb := solve(lc\_yb = 0, \lambda);$

$$\lambda\_from\_lc\_yb := \frac{1}{yb} \tag{7}$$

$\lambda\_from\_lc\_ya := solve(lc\_ya = 0, \lambda);$

$$\lambda\_from\_lc\_ya := \frac{2}{ya} \tag{8}$$

$Isoproduction\_ya := solve(\lambda\_from\_lc\_yb = \lambda\_from\_lc\_ya, ya);$ *#ya Pseudo line equivalent*

$$Isoproduction\_ya := 2\,yb \tag{9}$$

$Isoproduction\_yb := solve(\lambda\_from\_lc\_yb = \lambda\_from\_lc\_ya, yb);$ *#yb Pseudoline equivalent.*

$$Isoproduction\_yb := \frac{ya}{2} \tag{10}$$

$ybStar\_Int := eval(lc\_\lambda, [ya = Isoproduction\_ya]);$

$$ybStar\_Int := -21\,yb^2 + 336 \tag{11}$$

$YbStar := solve(ybStar\_Int = 0, yb);$ *# Required production function Yb.* $= 4$

$$YbStar := -4, 4 \tag{12}$$

$YaStar := eval(Isoproduction\_ya, [yb = YbStar]);$ *# Required production function Ya. = 8*

$$YaStar := -8, 8 \tag{13}$$

 # 5c:

$Marginal\_Unit\_Of\_x\_yb := eval(\lambda\_from\_lc\_yb, yb = YbStar);$ *#* $= \frac{1}{4}$

$$Marginal\_Unit\_Of\_x\_yb := \frac{1}{-4, 4} \tag{14}$$

$Marginal\_Unit\_Of\_x\_ya := eval(\lambda\_from\_lc\_ya, ya = YaStar)$; #= $\frac{2}{8} = \frac{1}{4}$

$$Marginal\_Unit\_Of\_x\_ya := \frac{2}{-8, 8} \tag{15}$$

 # 5d:

$profit := 16 \cdot ya + 10 \cdot yb - 0.2 \cdot xc$

$$profit := 16\, ya + 10\, yb - 0.8\, ya^2 - yb^2 \tag{16}$$

$profit\_ya := diff(profit, ya);$

$$profit\_ya := 16 - 1.6\, ya \tag{17}$$

$profit\_yb := diff(profit, yb);$

$$profit\_yb := 10 - 2.0\, yb \tag{18}$$

$ya\_Unit\_For\_Profit\_max := solve(profit\_ya = 0, ya);$ #Unit of pineapple for profit maximization.= 10

$$ya\_Unit\_For\_Profit\_max := 10. \tag{19}$$

$yb\_Unit\_For\_Profit\_max := solve(profit\_yb = 0, yb);$ #Unit of banana for profit maximization. = 5

$$yb\_Unit\_For\_Profit\_max := 5. \tag{20}$$

$Input\_Level\_Of\_Input\_Used := eval(xc, [ya = ya\_Unit\_For\_Profit\_max, yb = yb\_Unit\_For\_Profit\_max]);$ #Unit of input used = 525.

$$Input\_Level\_Of\_Input\_Used := 525. \tag{21}$$