10.1287/MKSC.1080.0368ec

#1: $[x1 :\varepsilon \text{ Real } [0, 1], x2 :\varepsilon \text{ Real } [0, 1], x3 :\varepsilon \text{ Real } [0, 1], p1 :\varepsilon \text{ Real } [0, \infty), p2 :\varepsilon \text{ Real } [0, \infty), p3 :\varepsilon \text{ Real } [0, \infty)]$ User

#2: $F(p) := \alpha \cdot \hat{e}^{-\beta \cdot p}$ User

#3: $\begin{bmatrix} x1 & 1 - x1 \end{bmatrix} \cdot \begin{bmatrix} F(p2) + a & 1 - F(p2) - a \\ F(p2) & 1 - F(p2) \end{bmatrix} = \begin{bmatrix} x2 & 1 - x2 \end{bmatrix}$ User

#4: $\begin{bmatrix} x2 & 1 - x2 \end{bmatrix} \cdot \begin{bmatrix} F(p3) + a & 1 - F(p3) - a \\ F(p3) & 1 - F(p3) \end{bmatrix} = \begin{bmatrix} x3 & 1 - x3 \end{bmatrix}$ User

#5: $\begin{bmatrix} x3 & 1 - x3 \end{bmatrix} \cdot \begin{bmatrix} F(p1) + a & 1 - F(p1) - a \\ F(p1) & 1 - F(p1) \end{bmatrix} = \begin{bmatrix} x1 & 1 - x1 \end{bmatrix}$ User

#6: $\left[\alpha \cdot \hat{e}^{-\beta \cdot p2} + a \cdot x1 = x2 \quad - \alpha \cdot \hat{e}^{-\beta \cdot p2} - a \cdot x1 + 1 = 1 - x2 \right]$ Simp(#3)

#7: $\left[\alpha \cdot \hat{e}^{-\beta \cdot p3} + a \cdot x2 = x3 \quad - \alpha \cdot \hat{e}^{-\beta \cdot p3} - a \cdot x2 + 1 = 1 - x3 \right]$ Simp(#4)

#8: $\left[\alpha \cdot \hat{e}^{-\beta \cdot p1} + a \cdot x3 = x1 \quad - \alpha \cdot \hat{e}^{-\beta \cdot p1} - a \cdot x3 + 1 = 1 - x1 \right]$ Simp(#5)

#9: $\text{SOLVE}(\left[\alpha \cdot \hat{e}^{-\beta \cdot p2} + a \cdot x1 = x2, \alpha \cdot \hat{e}^{-\beta \cdot p3} + a \cdot x2 = x3, \alpha \cdot \hat{e}^{-\beta \cdot p1} + a \cdot x3 = x1\right], [x1, x2, x3])$ User

Simp(#9)

#10: $\left[x1 = \frac{\alpha \cdot \hat{e}^{-\beta \cdot (p1 + p2 + p3)} \cdot (a \cdot \hat{e}^{\beta \cdot p1} \cdot (\hat{e}^{\beta \cdot p2} + a \cdot \hat{e}^{\beta \cdot p3}) + \hat{e}^{\beta \cdot (p2 + p3)})}{1 - a^3} \quad x2 = \frac{\alpha \cdot \hat{e}^{-\beta \cdot (p1 + p2 + p3)} \cdot (\hat{e}^{\beta \cdot p1} \cdot (a \cdot \hat{e}^{\beta \cdot p2} + \hat{e}^{\beta \cdot p3}) + a \cdot \hat{e}^{\beta \cdot (p2 + p3)})}{1 - a^3} \quad x3 = \frac{\alpha \cdot \hat{e}^{-\beta \cdot (p1 + p2 + p3)} \cdot (\hat{e}^{\beta \cdot p1} \cdot (\hat{e}^{\beta \cdot p2} + a \cdot \hat{e}^{\beta \cdot p3}) + a \cdot \hat{e}^{\beta \cdot (p2 + p3)})}{1 - a^3} \right]$

User

#11: $\left[x1st := \frac{\alpha \cdot \hat{e}^{-\beta \cdot (p1 + p2 + p3)} \cdot (a \cdot \hat{e}^{\beta \cdot p1} \cdot (\hat{e}^{\beta \cdot p2} + a \cdot \hat{e}^{\beta \cdot p3}) + \hat{e}^{\beta \cdot (p2 + p3)})}{1 - a^3} \quad x2st := \frac{\alpha \cdot \hat{e}^{-\beta \cdot (p1 + p2 + p3)} \cdot (\hat{e}^{\beta \cdot p1} \cdot (a \cdot \hat{e}^{\beta \cdot p2} + \hat{e}^{\beta \cdot p3}) + a \cdot \hat{e}^{\beta \cdot (p2 + p3)})}{1 - a^3} \quad x3st := \frac{\alpha \cdot \hat{e}^{-\beta \cdot (p1 + p2 + p3)} \cdot (\hat{e}^{\beta \cdot p1} \cdot (\hat{e}^{\beta \cdot p2} + a \cdot \hat{e}^{\beta \cdot p3}) + a \cdot \hat{e}^{\beta \cdot (p2 + p3)})}{1 - a^3} \right]$

#12: $p1 \cdot x1st + p2 \cdot x2st + p3 \cdot x3st$ User

#13: $\frac{\alpha \cdot \hat{e}^{-\beta \cdot (p1 + p2 + p3)} \cdot (\hat{e}^{\beta \cdot p1} \cdot (\hat{e}^{\beta \cdot p2} \cdot (a \cdot p2 + a \cdot p1 + p3) + \hat{e}^{\beta \cdot p3} \cdot (a \cdot p1 + a \cdot p3 + p2)) + \hat{e}^{\beta \cdot (p2 + p3)} \cdot (a \cdot p3 + a \cdot p2 + p1))}{1 - a^3}$ Simp(#12)

#14: $\frac{\alpha \cdot \hat{e}^{-\beta \cdot (p1 + p2 + p2)} \cdot (\hat{e}^{\beta \cdot p1} \cdot (\hat{e}^{\beta \cdot p2} \cdot (a \cdot p2 + a \cdot p1 + p2) + \hat{e}^{\beta \cdot p2} \cdot (a \cdot p1 + a \cdot p2 + p2)) + \hat{e}^{\beta \cdot (p2 + p2)} \cdot (a \cdot p2 + a \cdot p2 + p1))}{1 - a^3}$ Sub(#13)

#15: $$\frac{\alpha\cdot\hat{e}^{-\beta\cdot(p1+p2)}\cdot\left(\hat{e}^{\beta\cdot p1}\cdot\left(a^2\cdot(p1+p2)+a\cdot(p1+p2)+2\cdot p2\right)+\hat{e}^{\beta\cdot p2}\cdot\left(a^2\cdot p2+a\cdot p2+p1\right)\right)}{1-a^3}$$ Simp(#14)

#16: rev := $$\frac{\alpha\cdot\hat{e}^{-\beta\cdot(p1+p2)}\cdot\left(\hat{e}^{\beta\cdot p1}\cdot\left(a^2\cdot(p1+p2)+a\cdot(p1+p2)+2\cdot p2\right)+\hat{e}^{\beta\cdot p2}\cdot\left(a^2\cdot p2+a\cdot p2+p1\right)\right)}{1-a^3}$$ User

#17: $$\left[\frac{d}{d\,p1}\,rev,\ \frac{d}{d\,p2}\,rev\right]$$ User

Simp(#17)

#18: $$\left[\frac{\alpha\cdot\hat{e}^{-\beta\cdot p1}\cdot\left(a^2\cdot\beta\cdot p2+a\cdot\beta\cdot p2+\beta\cdot p1-1\right)}{a^3-1}+\frac{a\cdot\alpha\cdot\hat{e}^{-\beta\cdot p2}\cdot(a+1)}{1-a^3},\ \frac{a\cdot\alpha\cdot\hat{e}^{-\beta\cdot p1}\cdot(a+1)}{1-a^3}+\right.$$
$$\left.\frac{\alpha\cdot\hat{e}^{-\beta\cdot p2}\cdot\left(a^2\cdot(\beta\cdot(p1+p2)-1)+a\cdot(\beta\cdot(p1+p2)-1)+2\cdot(\beta\cdot p2-1)\right)}{a^3-1}\right]$$

Sub(#18)

#19: $$\left[\frac{\alpha\cdot\hat{e}^{-\beta\cdot(1/\beta)}\cdot\left(a^2\cdot\beta\cdot\frac{1}{\beta}+a\cdot\beta\cdot\frac{1}{\beta}+\beta\cdot\frac{1}{\beta}-1\right)}{a^3-1}+\frac{a\cdot\alpha\cdot\hat{e}^{-\beta\cdot(1/\beta)}\cdot(a+1)}{1-a^3},\ \frac{a\cdot\alpha\cdot\hat{e}^{-\beta\cdot(1/\beta)}\cdot(a+1)}{1-a^3}+\right.$$
$$\left.\frac{\alpha\cdot\hat{e}^{-\beta\cdot(1/\beta)}\cdot\left(a^2\cdot\left(\beta\cdot\left(\frac{1}{\beta}+\frac{1}{\beta}\right)-1\right)+a\cdot\left(\beta\cdot\left(\frac{1}{\beta}+\frac{1}{\beta}\right)-1\right)+2\cdot\left(\beta\cdot\frac{1}{\beta}-1\right)\right)}{a^3-1}\right]$$

#20: [0, 0] Simp(#19)

#21: $$\begin{bmatrix}\left(\frac{d}{d\,p1}\right)^2 rev & \frac{d}{d\,p2}\frac{d}{d\,p1}\,rev\\ \frac{d}{d\,p1}\frac{d}{d\,p2}\,rev & \left(\frac{d}{d\,p2}\right)^2 rev\end{bmatrix}$$ User

#22: $$\begin{bmatrix}\frac{\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot p1}\cdot\left(a^2\cdot\beta\cdot p2+a\cdot\beta\cdot p2+\beta\cdot p1-2\right)}{1-a^3} & \frac{a\cdot\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot p1}\cdot(a+1)}{a^3-1}+\frac{a\cdot\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot p2}\cdot(a+1)}{a^3-1}\\ \frac{a\cdot\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot p1}\cdot(a+1)}{a^3-1}+\frac{a\cdot\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot p2}\cdot(a+1)}{a^3-1} & \frac{\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot p2}\cdot\left(a^2\cdot(\beta\cdot(p1+p2)-2)+a\cdot(\beta\cdot(p1+p2)-2)+2\cdot(\beta\cdot p2-2)\right)}{1-a^3}\end{bmatrix}$$ Simp(#21)

#23:
$$\begin{bmatrix} \dfrac{\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot(1/\beta)}\cdot\left(a^2\cdot\beta\cdot\frac{1}{\beta}+a\cdot\beta\cdot\frac{1}{\beta}+\beta\cdot\frac{1}{\beta}-2\right)}{1-a^3} & \dfrac{a\cdot\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot(1/\beta)}\cdot(a+1)}{a^3-1}+\dfrac{a\cdot\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot(1/\beta)}\cdot(a+1)}{a^3-1} \\ \dfrac{a\cdot\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot(1/\beta)}\cdot(a+1)}{a^3-1}+\dfrac{a\cdot\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot(1/\beta)}\cdot(a+1)}{a^3-1} & \dfrac{\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot(1/\beta)}\cdot\left(a^2\cdot\left(\beta\cdot\left(\frac{1}{\beta}+\frac{1}{\beta}\right)-2\right)+a\cdot\left(\beta\cdot\left(\frac{1}{\beta}+\frac{1}{\beta}\right)-2\right)+2\cdot\left(\beta\cdot\frac{1}{\beta}-2\right)\right)}{1-a^3} \end{bmatrix}$$
Sub(#22)

#24:
$$\begin{bmatrix} \dfrac{\alpha\cdot\beta\cdot\hat{e}^{-1}\cdot(a^2+a-1)}{1-a^3} & \dfrac{2\cdot a\cdot\alpha\cdot\beta\cdot\hat{e}^{-1}\cdot(a+1)}{a^3-1} \\ \dfrac{2\cdot a\cdot\alpha\cdot\beta\cdot\hat{e}^{-1}\cdot(a+1)}{a^3-1} & \dfrac{2\cdot\alpha\cdot\beta\cdot\hat{e}^{-1}}{a^3-1} \end{bmatrix}$$
Simp(#23)

User
#25: "We have just obtained the Hessian matrix of the profit fuction at the point p1 = p2 = p* =1/β. The Hessian is negative definite at a = 0, and remains so for small positive values of a. We now calculate the smllest value of a for which this will no longer be true"

#26: DET
$$\begin{bmatrix} \dfrac{\alpha\cdot\beta\cdot\hat{e}^{-1}\cdot(a^2+a-1)}{1-a^3} & \dfrac{2\cdot a\cdot\alpha\cdot\beta\cdot\hat{e}^{-1}\cdot(a+1)}{a^3-1} \\ \dfrac{2\cdot a\cdot\alpha\cdot\beta\cdot\hat{e}^{-1}\cdot(a+1)}{a^3-1} & \dfrac{2\cdot\alpha\cdot\beta\cdot\hat{e}^{-1}}{a^3-1} \end{bmatrix}$$
User

#27:
$$-\frac{2\cdot\alpha^2\cdot\beta^2\cdot\hat{e}^{-2}\cdot(2\cdot a^2+2\cdot a-1)}{(a-1)^2\cdot(a^2+a+1)^2}$$
Simp(#26)

#28:
$$\left[a=\frac{\sqrt{3}}{2}-\frac{1}{2},\ a=-\frac{\sqrt{3}}{2}-\frac{1}{2},\ a=\infty,\ a=-\infty\right]$$
Solve(#27,a)

#29: [a = 0.366025, a = -1.36602, a = ∞, a = -∞] 0.0s Approx(#28)

User

#1: $[x1 :\varepsilon \text{ Real } [0, 1],\ x2 :\varepsilon \text{ Real } [0, 1],\ x3 :\varepsilon \text{ Real } [0, 1],\ x4 :\varepsilon \text{ Real } [0, 1],\ p1 :\varepsilon \text{ Real } [0, \infty),\ p2 :\varepsilon \text{ Real } [0, \infty),\ p3 :\varepsilon \text{ Real } [0, \infty),\ p4 :\varepsilon \text{ Real } [0, \infty)]$

#2: $F(p) := \alpha \cdot \hat{e}^{-\beta \cdot p}$ User

#3: $\begin{bmatrix} x1 & 1 - x1 \end{bmatrix} \cdot \begin{bmatrix} F(p2) + a & 1 - F(p2) - a \\ F(p2) & 1 - F(p2) \end{bmatrix} = \begin{bmatrix} x2 & 1 - x2 \end{bmatrix}$ User

#4: $\begin{bmatrix} x2 & 1 - x2 \end{bmatrix} \cdot \begin{bmatrix} F(p3) + a & 1 - F(p3) - a \\ F(p3) & 1 - F(p3) \end{bmatrix} = \begin{bmatrix} x3 & 1 - x3 \end{bmatrix}$ User

#5: $\begin{bmatrix} x3 & 1 - x3 \end{bmatrix} \cdot \begin{bmatrix} F(p4) + a & 1 - F(p4) - a \\ F(p4) & 1 - F(p4) \end{bmatrix} = \begin{bmatrix} x4 & 1 - x4 \end{bmatrix}$ User

#6: $\begin{bmatrix} x4 & 1 - x4 \end{bmatrix} \cdot \begin{bmatrix} F(p1) + a & 1 - F(p1) - a \\ F(p1) & 1 - F(p1) \end{bmatrix} = \begin{bmatrix} x1 & 1 - x1 \end{bmatrix}$ User

#7: $\left[\alpha \cdot \hat{e}^{-\beta \cdot p2} + a \cdot x1 = x2 \quad -\alpha \cdot \hat{e}^{-\beta \cdot p2} - a \cdot x1 + 1 = 1 - x2\right]$ Simp(#3)

#8: $\left[\alpha \cdot \hat{e}^{-\beta \cdot p3} + a \cdot x2 = x3 \quad -\alpha \cdot \hat{e}^{-\beta \cdot p3} - a \cdot x2 + 1 = 1 - x3\right]$ Simp(#4)

#9: $\left[\alpha \cdot \hat{e}^{-\beta \cdot p4} + a \cdot x3 = x4 \quad -\alpha \cdot \hat{e}^{-\beta \cdot p4} - a \cdot x3 + 1 = 1 - x4\right]$ Simp(#5)

#10: $\left[\alpha \cdot \hat{e}^{-\beta \cdot p1} + a \cdot x4 = x1 \quad -\alpha \cdot \hat{e}^{-\beta \cdot p1} - a \cdot x4 + 1 = 1 - x1\right]$ Simp(#6)

#11: $\text{SOLVE}(\left[\alpha \cdot \hat{e}^{-\beta \cdot p2} + a \cdot x1 = x2,\ \alpha \cdot \hat{e}^{-\beta \cdot p3} + a \cdot x2 = x3,\ \alpha \cdot \hat{e}^{-\beta \cdot p4} + a \cdot x3 = x4,\ \alpha \cdot \hat{e}^{-\beta \cdot p1} + a \cdot x4 = x1\right],\ [x1, x2, x3, x4])$ User

Simp(#11)

#12:
$$\left[x1 = \frac{\alpha \cdot \hat{e}^{-\beta \cdot (p1 + p2 + p3 + p4)} \cdot (a \cdot \hat{e}^{\beta \cdot p1} \cdot (\hat{e}^{\beta \cdot p2} \cdot (\hat{e}^{\beta \cdot p3} + a \cdot \hat{e}^{\beta \cdot p4}) + a^2 \cdot \hat{e}^{\beta \cdot (p3 + p4)}) + \hat{e}^{\beta \cdot (p2 + p3 + p4)})}{1 - a^4}\right.$$

$$x2 = \frac{\alpha \cdot \hat{e}^{-\beta \cdot (p1 + p2 + p3 + p4)} \cdot (\hat{e}^{\beta \cdot p1} \cdot (a \cdot \hat{e}^{\beta \cdot p2} \cdot (\hat{e}^{\beta \cdot p3} + a \cdot \hat{e}^{\beta \cdot p4}) + \hat{e}^{\beta \cdot (p3 + p4)}) + a \cdot \hat{e}^{\beta \cdot (p2 + p3 + p4)})}{1 - a^4}$$

$$x3 = \frac{\alpha \cdot \hat{e}^{-\beta \cdot (p1 + p2 + p3 + p4)} \cdot (\hat{e}^{\beta \cdot p1} \cdot (\hat{e}^{\beta \cdot p2} \cdot (a \cdot \hat{e}^{\beta \cdot p3} + \hat{e}^{\beta \cdot p4}) + a \cdot \hat{e}^{\beta \cdot (p3 + p4)}) + a \cdot \hat{e}^{\beta \cdot (p2 + p3 + p4)})}{1 - a^4}$$

$$\left.x4 = \frac{\alpha \cdot \hat{e}^{-\beta \cdot (p1 + p2 + p3 + p4)} \cdot (\hat{e}^{\beta \cdot p1} \cdot (\hat{e}^{\beta \cdot p2} \cdot (\hat{e}^{\beta \cdot p3} + a \cdot \hat{e}^{\beta \cdot p4}) + a \cdot \hat{e}^{\beta \cdot (p3 + p4)}) + a^2 \cdot \hat{e}^{\beta \cdot (p2 + p3 + p4)})}{1 - a^4}\right]$$

User

$$\#13:\ \left[\begin{array}{l} x1st := \dfrac{\alpha\cdot\hat{e}^{-\beta\cdot(p1+p2+p3+p4)}\cdot\left(a\cdot\hat{e}^{\beta\cdot p1}\cdot\left(\hat{e}^{\beta\cdot p2}\cdot\left(\hat{e}^{\beta\cdot p3}+a\cdot\hat{e}^{\beta\cdot p4}\right)+a^{2}\cdot\hat{e}^{\beta\cdot(p3+p4)}\right)+\hat{e}^{\beta\cdot(p2+p3+p4)}\right)}{1-a^{4}}, \quad x2st := \\ \dfrac{\alpha\cdot\hat{e}^{-\beta\cdot(p1+p2+p3+p4)}\cdot\left(\hat{e}^{\beta\cdot p1}\cdot\left(a^{2}\cdot\hat{e}^{\beta\cdot p2}\cdot\left(\hat{e}^{\beta\cdot p3}+a\cdot\hat{e}^{\beta\cdot p4}\right)+\hat{e}^{\beta\cdot(p3+p4)}\right)+a\cdot\hat{e}^{\beta\cdot(p2+p3+p4)}\right)}{1-a^{4}}, \quad x3st := \\ \dfrac{\alpha\cdot\hat{e}^{-\beta\cdot(p1+p2+p3+p4)}\cdot\left(\hat{e}^{\beta\cdot p1}\cdot\left(\hat{e}^{\beta\cdot p2}\cdot\left(a^{3}\cdot\hat{e}^{\beta\cdot p3}+\hat{e}^{\beta\cdot p4}\right)+a\cdot\hat{e}^{\beta\cdot(p3+p4)}\right)+a^{2}\cdot\hat{e}^{\beta\cdot(p2+p3+p4)}\right)}{1-a^{4}}, \quad x4st := \\ \dfrac{\alpha\cdot\hat{e}^{-\beta\cdot(p1+p2+p3+p4)}\cdot\left(\hat{e}^{\beta\cdot p1}\cdot\left(\hat{e}^{\beta\cdot p2}\cdot\left(\hat{e}^{\beta\cdot p3}+a\cdot\hat{e}^{\beta\cdot p4}\right)+a^{2}\cdot\hat{e}^{\beta\cdot(p3+p4)}\right)+a^{3}\cdot\hat{e}^{\beta\cdot(p2+p3+p4)}\right)}{1-a^{4}} \end{array}\right]$$

$$\#14:\ p1\cdot x1st + p2\cdot x2st + p3\cdot x3st + p4\cdot x4st$$ User

Simp(#14)

$$\#15:\ \frac{\alpha\cdot\hat{e}^{-\beta\cdot p1-\beta\cdot p2-\beta\cdot p3-\beta\cdot p4}\cdot\left(\hat{e}^{\beta\cdot p1}\cdot\left(\hat{e}^{\beta\cdot p2}\cdot\left(\hat{e}^{\beta\cdot p3}\cdot\left(a\cdot p1+a^{2}\cdot p2+a^{3}\cdot p3+p4\right)+\hat{e}^{\beta\cdot p4}\cdot\left(a^{2}\cdot p1+a^{3}\cdot p2+p3+a\cdot p4\right)\right)+\hat{e}^{\beta\cdot p3+\beta\cdot p4}\cdot\left(a^{3}\cdot p1+p2+a\cdot\left(p3+a\cdot p4\right)\right)\right)+\hat{e}^{\beta\cdot p2+\beta\cdot p3+\beta\cdot p4}\cdot\left(p1+a\cdot\left(p2+a\cdot\left(p3+a\cdot p4\right)\right)\right)\right)}{1-a^{4}}$$

Sub(#15)

$$\#16:\ \frac{\alpha\cdot\hat{e}^{-\beta\cdot p1-\beta\cdot p2-\beta\cdot p2-\beta\cdot p2}\cdot\left(\hat{e}^{\beta\cdot p1}\cdot\left(\hat{e}^{\beta\cdot p2}\cdot\left(\hat{e}^{\beta\cdot p2}\cdot\left(a\cdot p1+a^{2}\cdot p2+a^{3}\cdot p2+p2\right)+\hat{e}^{\beta\cdot p2}\cdot\left(a^{2}\cdot p1+a^{3}\cdot p2+p2+a\cdot p2\right)\right)+\hat{e}^{\beta\cdot p2+\beta\cdot p2}\cdot\left(a^{3}\cdot p1+p2+a\cdot\left(p2+a\cdot p2\right)\right)\right)+\hat{e}^{\beta\cdot p2+\beta\cdot p2+\beta\cdot p2}\cdot\left(p1+a\cdot\left(p2+a\cdot\left(p2+a\cdot p2\right)\right)\right)\right)}{1-a^{4}}$$

$$\#17:\ \frac{\alpha\cdot\hat{e}^{-\beta\cdot p1-\beta\cdot p2}\cdot\left(\hat{e}^{\beta\cdot p1}\cdot\left(a\cdot p1\cdot\left(a^{2}+a+1\right)+p2\cdot\left(2\cdot a^{3}+2\cdot a^{2}+2\cdot a+3\right)\right)+\hat{e}^{\beta\cdot p2}\cdot\left(p1+a\cdot p2\cdot\left(a^{2}+a+1\right)\right)\right)}{1-a^{4}}$$ Simp(#16)

$$\#18:\ rev := \frac{\alpha\cdot\hat{e}^{-\beta\cdot p1-\beta\cdot p2}\cdot\left(\hat{e}^{\beta\cdot p1}\cdot\left(a\cdot p1\cdot\left(a^{2}+a+1\right)+p2\cdot\left(2\cdot a^{3}+2\cdot a^{2}+2\cdot a+3\right)\right)+\hat{e}^{\beta\cdot p2}\cdot\left(p1+a\cdot p2\cdot\left(a^{2}+a+1\right)\right)\right)}{1-a^{4}}$$ User

$$\#19:\ \left[\frac{d}{d\ p1}\ rev,\ \frac{d}{d\ p2}\ rev\right]$$ User

Simp(#19)

#20: $$\left[\frac{\alpha\cdot\hat{e}^{-\beta\cdot p1}\cdot(\beta\cdot p1 + a\cdot\beta\cdot p2\cdot(a^2 + a + 1) - 1)}{a^4 - 1} + \frac{a\cdot\alpha\cdot\hat{e}^{-\beta\cdot p2}\cdot(a^2 + a + 1)}{1 - a^4}, \frac{a\cdot\alpha\cdot\hat{e}^{-\beta\cdot p1}\cdot(a^2 + a + 1)}{1 - a^4} + \frac{\alpha\cdot\hat{e}^{-\beta\cdot p2}\cdot(a\cdot\beta\cdot p1\cdot(a^2 + a + 1) + (2\cdot a^3 + 2\cdot a^2 + 2\cdot a + 3)\cdot(\beta\cdot p2 - 1))}{a^4 - 1}\right]$$

Sub(#20)

#21: $$\left[\frac{\alpha\cdot\hat{e}^{-\beta\cdot(1/\beta)\cdot\left[\beta\cdot\frac{1}{\beta} + a\cdot\beta\cdot\frac{1}{\beta}\cdot(a^2 + a + 1) - 1\right]}}{a^4 - 1} + \frac{a\cdot\alpha\cdot\hat{e}^{-\beta\cdot(1/\beta)\cdot(a^2 + a + 1)}}{1 - a^4}, \frac{a\cdot\alpha\cdot\hat{e}^{-\beta\cdot(1/\beta)\cdot(a^2 + a + 1)}}{1 - a^4} + \frac{\alpha\cdot\hat{e}^{-\beta\cdot(1/\beta)\cdot\left[a\cdot\beta\cdot\frac{1}{\beta}\cdot(a^2 + a + 1) + (2\cdot a^3 + 2\cdot a^2 + 2\cdot a + 3)\cdot\left[\beta\cdot\frac{1}{\beta} - 1\right]\right]}}{a^4 - 1}\right]$$

#22: [0, 0] Simp(#21)

#23: $$\begin{bmatrix}\left[\frac{d}{d\,p1}\right]^2\,\text{rev} & \frac{d}{d\,p2}\,\frac{d}{d\,p1}\,\text{rev}\\ \frac{d}{d\,p1}\,\frac{d}{d\,p2}\,\text{rev} & \left[\frac{d}{d\,p2}\right]^2\,\text{rev}\end{bmatrix}$$ User

#24: $$\begin{bmatrix}\frac{\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot p1}\cdot(\beta\cdot p1 + a\cdot\beta\cdot p2\cdot(a^2 + a + 1) - 2)}{1 - a^4} & \frac{a\cdot\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot p1}\cdot(a^2 + a + 1)}{a^4 - 1} + \frac{a\cdot\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot p2}\cdot(a^2 + a + 1)}{a^4 - 1}\\ \frac{a\cdot\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot p1}\cdot(a^2 + a + 1)}{a^4 - 1} + \frac{a\cdot\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot p2}\cdot(a^2 + a + 1)}{a^4 - 1} & \frac{\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot p2}\cdot(a\cdot\beta\cdot p1\cdot(a^2 + a + 1) + (2\cdot a^3 + 2\cdot a^2 + 2\cdot a + 3)\cdot(\beta\cdot p2 - 2))}{1 - a^4}\end{bmatrix}$$ Simp(#23)

Sub(#24)

#25: $$\begin{bmatrix}\frac{\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot(1/\beta)\cdot\left[\beta\cdot\frac{1}{\beta} + a\cdot\beta\cdot\frac{1}{\beta}\cdot(a^2 + a + 1) - 2\right]}}{1 - a^4} & \frac{a\cdot\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot(1/\beta)\cdot(a^2 + a + 1)}}{a^4 - 1} + \frac{a\cdot\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot(1/\beta)\cdot(a^2 + a + 1)}}{a^4 - 1}\\ \frac{a\cdot\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot(1/\beta)\cdot(a^2 + a + 1)}}{a^4 - 1} + \frac{a\cdot\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot(1/\beta)\cdot(a^2 + a + 1)}}{a^4 - 1} & \frac{\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot(1/\beta)\cdot\left[a\cdot\beta\cdot\frac{1}{\beta}\cdot(a^2 + a + 1) + (2\cdot a^3 + 2\cdot a^2 + 2\cdot a + 3)\cdot\left[\beta\cdot\frac{1}{\beta} - 2\right]\right]}}{1 - a^4}\end{bmatrix}$$

#26:
$$\begin{bmatrix} \frac{\alpha\cdot\beta\cdot\hat{e}^{-1}\cdot(a^3+a^2+a-1)}{1-a^4} & \frac{2\cdot a\cdot\alpha\cdot\beta\cdot\hat{e}^{-1}\cdot(a^2+a+1)}{a^4-1} \\ \frac{2\cdot a\cdot\alpha\cdot\beta\cdot\hat{e}^{-1}\cdot(a^2+a+1)}{a^4-1} & \frac{\alpha\cdot\beta\cdot\hat{e}^{-1}\cdot(a^3+a^2+a+3)}{a^4-1} \end{bmatrix}$$

Simp(#25)

User

#27: "We have just obtained the Hessian matrix of the profit fuction at the point p1 = p2 = p* =1/β. The Hessian is negative definite at a = 0, and remains so for small positive values of a. We now calculate the smllest value of a for which this will no longer be true"

#28: DET
$$\begin{bmatrix} \frac{\alpha\cdot\beta\cdot\hat{e}^{-1}\cdot(a^3+a^2+a-1)}{1-a^4} & \frac{2\cdot a\cdot\alpha\cdot\beta\cdot\hat{e}^{-1}\cdot(a^2+a+1)}{a^4-1} \\ \frac{2\cdot a\cdot\alpha\cdot\beta\cdot\hat{e}^{-1}\cdot(a^2+a+1)}{a^4-1} & \frac{\alpha\cdot\beta\cdot\hat{e}^{-1}\cdot(a^3+a^2+a+3)}{a^4-1} \end{bmatrix}$$

User

#29:
$$-\frac{\alpha^2\cdot\beta^2\cdot\hat{e}^{-2}\cdot(5\cdot a^3+5\cdot a^2+5\cdot a-3)}{(a-1)^2\cdot(a^3+a^2+a+1)}$$

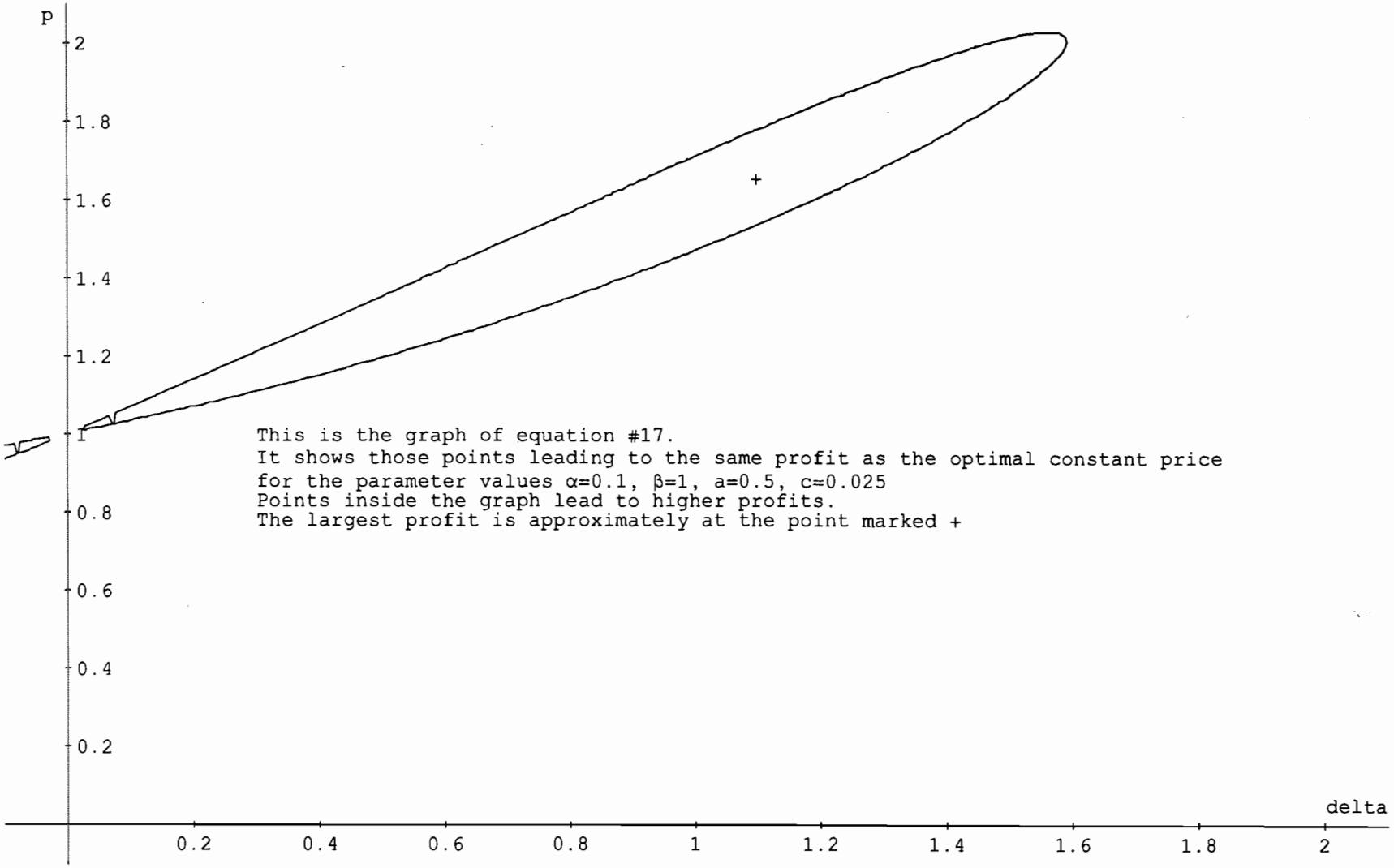
Simp(#28)

Solve(#29,a)

#30:
$$\left[a=-\left(\frac{2\cdot\sqrt{11}}{15}-\frac{58}{135}\right)^{1/3}+\left(\frac{2\cdot\sqrt{11}}{15}+\frac{58}{135}\right)^{1/3}-\frac{1}{3},\ a=\infty,\ a=-\infty,\ a=\left(\frac{\sqrt{11}}{60}-\frac{29}{540}\right)^{1/3}-\left(\frac{\sqrt{11}}{60}+\frac{29}{540}\right)^{1/3}-\frac{1}{3}+i\cdot\left(\left(\frac{\sqrt{33}}{20}-\frac{29\cdot\sqrt{3}}{180}\right)^{1/3}+\left(\frac{29\cdot\sqrt{3}}{180}+\frac{\sqrt{33}}{20}\right)^{1/3}\right),\ a=\left(\frac{\sqrt{11}}{60}-\frac{29}{540}\right)^{1/3}-\left(\frac{\sqrt{11}}{60}+\frac{29}{540}\right)^{1/3}-\frac{1}{3}-i\cdot\left(\left(\frac{\sqrt{33}}{20}-\frac{29\cdot\sqrt{3}}{180}\right)^{1/3}+\left(\frac{29\cdot\sqrt{3}}{180}+\frac{\sqrt{33}}{20}\right)^{1/3}\right)\right]$$

#31: [a = 0.389365, a = ∞, a = -∞, a = -0.694682 + 1.02877·i, a = -0.694682 - 1.02877·i]

0.1s Approx(#30)


p
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
delta
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
This is the graph of equation #17.
It shows those points leading to the same profit as the optimal constant price
for the parameter values α=0.1, β=1, a=0.5, c=0.025
Points inside the graph lead to higher profits.
The largest profit is approximately at the point marked +

#1: $[x1 :\varepsilon \text{ Real } [0, 1], x2 :\varepsilon \text{ Real } [0, 1]]$ User

#2: $\left[F(p) := \alpha \cdot \hat{e}^{-\beta \cdot p}, K(\delta) := c \cdot \delta^2\right]$ User

#3: $[\, x2 \;\; 1 - x2 \,] \cdot \begin{bmatrix} F(p) + a - K(\delta) & 1 - F(p) - a + K(\delta) \\ F(p) & 1 - F(p) \end{bmatrix} = [\, x1 \;\; 1 - x1 \,]$ User

#4: $[\, x1 \;\; 1 - x1 \,] \cdot \begin{bmatrix} F(p - \delta) + a & 1 - F(p - \delta) - a \\ F(p - \delta) & 1 - F(p - \delta) \end{bmatrix} = [\, x2 \;\; 1 - x2 \,]$ User

#5: $\left[\alpha \cdot \hat{e}^{-\beta \cdot p} + x2 \cdot (a - c \cdot \delta^2) = x1 - \alpha \cdot \hat{e}^{-\beta \cdot p} - a \cdot x2 + c \cdot \delta^2 \cdot x2 + 1 = 1 - x1\right]$ Simp(#3)

#6: $\left[\alpha \cdot \hat{e}^{\beta \cdot (\delta - p)} + a \cdot x1 = x2 - \alpha \cdot \hat{e}^{\beta \cdot (\delta - p)} - a \cdot x1 + 1 = 1 - x2\right]$ Simp(#4)

#7: $\text{SOLVE}(\left[\alpha \cdot \hat{e}^{-\beta \cdot p} + x2 \cdot (a - c \cdot \delta^2) = x1, \alpha \cdot \hat{e}^{\beta \cdot (\delta - p)} + a \cdot x1 = x2\right], [x1, x2])$ User

#8: $\left[x1 = -\frac{\alpha \cdot \hat{e}^{-\beta \cdot p} \cdot (\hat{e}^{\beta \cdot \delta} \cdot (a - c \cdot \delta^2) + 1)}{a^2 - a \cdot c \cdot \delta^2 - 1} \quad x2 = -\frac{\alpha \cdot \hat{e}^{-\beta \cdot p} \cdot (\hat{e}^{\beta \cdot \delta} + a)}{a^2 - a \cdot c \cdot \delta^2 - 1}\right]$ Simp(#7)

#9: $\left[x1st := -\frac{\alpha \cdot \hat{e}^{-\beta \cdot p} \cdot (\hat{e}^{\beta \cdot \delta} \cdot (a - c \cdot \delta^2) + 1)}{a^2 - a \cdot c \cdot \delta^2 - 1} \quad x2st := -\frac{\alpha \cdot \hat{e}^{-\beta \cdot p} \cdot (\hat{e}^{\beta \cdot \delta} + a)}{a^2 - a \cdot c \cdot \delta^2 - 1}\right]$ User

#10: $profit := p \cdot x1st + (p - \delta) \cdot x2st$ User

#11: $-\frac{\alpha \cdot \hat{e}^{-\beta \cdot p} \cdot (\hat{e}^{\beta \cdot \delta} \cdot (a \cdot p - c \cdot \delta^2 \cdot p - \delta + p) + a \cdot (p - \delta) + p)}{a^2 - a \cdot c \cdot \delta^2 - 1}$ 0.2s Simp(#10)

#12: "We set $\rho = 1/\beta$ and $\delta = 0$ to obtain the profit using the optimal constant price." User

#13: $-\frac{\alpha \cdot \hat{e}^{-\beta \cdot (1/\beta)} \cdot \left(\hat{e}^{\beta \cdot 0} \cdot \left(a \cdot \frac{1}{\beta} - c \cdot 0^2 \cdot \frac{1}{\beta} - 0 + \frac{1}{\beta}\right) + a \cdot \left(\frac{1}{\beta} - 0\right) + \frac{1}{\beta}\right)}{a^2 - a \cdot c \cdot 0^2 - 1}$ Sub(#11)

#14: $\frac{2 \cdot \alpha \cdot \hat{e}^{-1}}{\beta \cdot (1 - a)}$ 0.1s Simp(#13)

#15: $-\frac{\alpha \cdot \hat{e}^{-\beta \cdot p} \cdot (\hat{e}^{\beta \cdot \delta} \cdot (a \cdot p - c \cdot \delta^2 \cdot p - \delta + p) + a \cdot (p - \delta) + p)}{a^2 - a \cdot c \cdot \delta^2 - 1} = \frac{2 \cdot \alpha \cdot \hat{e}^{-1}}{\beta \cdot (1 - a)}$ User

User

#16: "We display the graph of this equation for $\alpha = 0.1$, $\beta = 1$, $a = 0.5$, $c = 0.025$ The graph shows that we can increase the profit by choosing p larger than $1/\beta$ and δ positive, i.e., by promoting. We can also numerically search the interior of the graph to find the optimal values of p and δ."

#17: $-\frac{0.1 \cdot \hat{e}^{-1 \cdot p} \cdot (\hat{e}^{1 \cdot \delta} \cdot (0.5 \cdot p - 0.025 \cdot \delta^2 \cdot p - \delta + p) + 0.5 \cdot (p - \delta) + p)}{0.5^2 - 0.5 \cdot 0.025 \cdot \delta^2 - 1} = \frac{2 \cdot 0.1 \cdot \hat{e}^{-1}}{1 \cdot (1 - 0.5)}$ Sub(#15)

User

#18: "To see what other values of the parameters lead to similar behavior of the profit function, we first verify that the first order conditions for optimality always hold if $p = 1/\beta$ and $\delta = 0$, and then calculate the determinant of the Hessian matrix at that point."

#19: $\left[\frac{d}{dp}\,\text{profit},\ \frac{d}{d\delta}\,\text{profit}\right]$ User

0.3s Simp(#19)

#20: $$\left[\frac{\alpha\cdot\hat{e}^{-\beta\cdot p}\cdot\left(\hat{e}^{\beta\cdot\delta}\cdot\left(a\cdot(\beta\cdot p-1)-\beta\cdot(c\cdot\delta^2\cdot p+\delta-p)+c\cdot\delta^2-1\right)-a\cdot(\beta\cdot(\delta-p)+1)+\beta\cdot p-1\right)}{a^2-a\cdot c\cdot\delta^2-1},\ \frac{a\cdot\alpha\cdot\hat{e}^{-\beta\cdot p}\cdot\left(a^2+a\cdot c\cdot\delta\cdot(\delta-2\cdot p)-2\cdot c\cdot\delta\cdot p-1\right)}{\left(a^2-a\cdot c\cdot\delta^2-1\right)^2}-\frac{\alpha\cdot\hat{e}^{\beta\cdot(\delta-p)}\cdot\left(a^3\cdot\beta\cdot p-a^2\cdot(\beta\cdot(2\cdot c\cdot\delta^2\cdot p+\delta-p)+1)+a\cdot(\beta\cdot(c^2\cdot\delta^4\cdot p+c\cdot\delta^2\cdot(\delta-p)-p)+c\cdot\delta\cdot(2\cdot p-\delta))+\beta\cdot(c\cdot\delta^2\cdot p+\delta-p)+2\cdot c\cdot\delta\cdot p+1\right)}{\left(a^2-a\cdot c\cdot\delta^2-1\right)^2}\right]$$

Sub(#20)

#21: $$\left[\frac{\alpha\cdot\hat{e}^{-\beta\cdot(1/\beta)}\cdot\left(\hat{e}^{\beta\cdot 0}\cdot\left(a\cdot\left(\beta\cdot\frac{1}{\beta}-1\right)-\beta\cdot\left(c\cdot 0^2\cdot\frac{1}{\beta}+0-\frac{1}{\beta}\right)+c\cdot 0^2-1\right)-a\cdot\left(\beta\cdot\left(0-\frac{1}{\beta}\right)+1\right)+\beta\cdot\frac{1}{\beta}-1\right)}{a^2-a\cdot c\cdot 0^2-1},\ \frac{a\cdot\alpha\cdot\hat{e}^{-\beta\cdot(1/\beta)}\cdot\left(a^2+a\cdot c\cdot 0\cdot\left(0-2\cdot\frac{1}{\beta}\right)-2\cdot c\cdot 0\cdot\frac{1}{\beta}-1\right)}{\left(a^2-a\cdot c\cdot 0^2-1\right)^2}-\frac{\alpha\cdot\hat{e}^{\beta\cdot(0-1/\beta)}\cdot\left(a^3\cdot\beta\cdot\frac{1}{\beta}-a^2\cdot\left(\beta\cdot\left(2\cdot c\cdot 0^2\cdot\frac{1}{\beta}+0-\frac{1}{\beta}\right)+1\right)+a\cdot\left(\beta\cdot\left(c^2\cdot 0^4\cdot\frac{1}{\beta}+c\cdot 0^2\cdot\left(0-\frac{1}{\beta}\right)-\frac{1}{\beta}\right)+c\cdot 0\cdot\left(2\cdot\frac{1}{\beta}-0\right)\right)+\beta\cdot\left(c\cdot 0^2\cdot\frac{1}{\beta}+0-\frac{1}{\beta}\right)+2\cdot c\cdot 0\cdot\frac{1}{\beta}+1\right)}{\left(a^2-a\cdot c\cdot 0^2-1\right)^2}\right]$$

#22: [0, 0] 0.1s Simp(#21)

#23: $$\begin{bmatrix}\left(\frac{d}{dp}\right)^2\,\text{profit} & \frac{d}{d\delta}\frac{d}{dp}\,\text{profit}\\ \frac{d}{dp}\frac{d}{d\delta}\,\text{profit} & \left(\frac{d}{d\delta}\right)^2\,\text{profit}\end{bmatrix}$$ User

2.6s Simp(#23)

#24:

$$-\frac{\alpha\cdot\beta\cdot\hat{e}^{-\beta\cdot p}\cdot\left(\hat{e}^{\beta\cdot\delta}\cdot\left(a\cdot(\beta\cdot p-2)-\beta\cdot(c\cdot\delta^{2}\cdot p+\delta-p)+2\cdot(c\cdot\delta^{2}-1)\right)-a\cdot(\beta\cdot(\delta-p)+2\right.}{a^{2}-a\cdot c\cdot\delta^{2}-1}$$

$$\frac{\alpha\cdot\hat{e}^{-\beta\cdot p}\cdot\left(\hat{e}^{\beta\cdot\delta}\cdot\left(a^{3}\cdot\beta\cdot(\beta\cdot p-1)+a^{2}\cdot\beta\cdot(2\cdot(c\cdot\delta^{2}-1)-\beta\cdot(2\cdot c\cdot\delta^{2}\cdot p+\delta-p))+a\cdot(\beta^{2}\cdot(c^{2}\cdot\delta^{4}\cdot p+c\cdot\delta^{2}\cdot(\delta-p)-p)-\beta\cdot(c^{2}\cdot\delta^{4}-2\cdot c\cdot\delta\cdot p-1)-2\cdot c\cdot\delta)+\beta^{2}\cdot(c\cdot\delta^{2}\cdot p+\delta-p)+\right.\right.}{\left(a^{2}-a\cdot c\cdot\delta^{2}-1\right)^{2}}$$

$$\left.\left.\right)+\beta\cdot p-2\right)$$

$$\frac{\beta\cdot(2-c\cdot\delta\cdot(\delta-2\cdot p))-2\cdot c\cdot\delta)-a\cdot(a^{2}\cdot\beta+a\cdot c\cdot\delta\cdot(\beta\cdot(\delta-2\cdot p)+2)-\beta\cdot(2\cdot c\cdot\delta\cdot p+1)+2\cdot c\cdot\delta))}{}$$

$$\frac{2\cdot a\cdot\alpha\cdot c\cdot\hat{e}^{-\beta\cdot p}\cdot\left(a^{3}\cdot(3\cdot\delta-p)+a^{2}\cdot(c\cdot\delta^{2}\cdot(\delta-3\cdot p)-p)-a\cdot(3\cdot c\cdot\delta^{2}\cdot p+3\cdot\delta-p)+p\right)}{\left(a^{2}-a\cdot c\cdot\delta^{2}-1\right)^{3}}-$$

$$\frac{\alpha\cdot\hat{e}^{\beta\cdot(\delta-p)}\cdot\left(a^{3}\cdot\beta\cdot(\beta\cdot p-1)+a^{2}\cdot\beta\cdot(2\cdot(c\cdot\delta^{2}-1)-\beta\cdot(2\cdot c\cdot\delta^{2}\cdot p+\delta-p))+a\cdot(\beta^{2}\cdot(c^{2}\cdot\delta^{4}\cdot p+c\cdot\delta^{2}\cdot(\delta-p)-p)-\beta\cdot(c^{2}\cdot\delta^{4}-2\cdot c\cdot\delta\cdot p-1)-2\cdot c\cdot\delta)+\beta^{2}\cdot(c\cdot\delta\right.}{\left(a^{2}-a\cdot c\cdot\delta^{2}-1\right)^{2}}$$

$$\frac{\alpha\cdot\hat{e}^{\beta\cdot(\delta-p)}\cdot\left(a^{5}\cdot\beta^{2}\cdot p-a^{4}\cdot\beta\cdot(\beta\cdot(3\cdot c\cdot\delta^{2}\cdot p+\delta-p)+2)+a^{3}\cdot(\beta^{2}\cdot(3\cdot c^{2}\cdot\delta^{4}\cdot p+2\cdot c\cdot\delta^{2}\cdot(\delta-p)-2\cdot p)+4\cdot\beta\cdot c\cdot\delta\cdot p+2\cdot c\cdot(p-3\cdot\delta))-a^{2}\cdot(\beta^{2}\cdot(c^{3}\cdot\delta^{6}\cdot p+c^{2}\cdot\delta^{4}\cdot(\delta-p)-4\cdot c\cdot\delta^{2}\right.}{}$$

$$\left.\cdot p+\delta-p)+\beta\cdot(2-c\cdot\delta\cdot(\delta-2\cdot p))-2\cdot c\cdot\delta)-\frac{a\cdot\alpha\cdot\hat{e}^{-\beta\cdot p}\cdot\left(a^{2}\cdot\beta+a\cdot c\cdot\delta\cdot(\beta\cdot(\delta-2\cdot p)+2)-\beta\cdot(2\cdot c\cdot\delta\cdot p+1)+2\cdot c\cdot\delta\right)}{\left(a^{2}-a\cdot c\cdot\delta^{2}-1\right)^{2}}\right.$$

$$\left.\cdot p-2\cdot(\delta-p))-2\cdot\beta\cdot(c^{2}\cdot\delta^{3}\cdot(\delta-2\cdot p)+2\cdot c\cdot\delta\cdot p+2)+2\cdot c\cdot(c\cdot\delta^{2}\cdot(\delta-3\cdot p)-p))-a\cdot(\beta^{2}\cdot(2\cdot c^{2}\cdot\delta^{4}\cdot p+2\cdot c\cdot\delta^{2}\cdot(\delta-p)-p)+4\cdot\beta\cdot c\cdot\delta\cdot p\cdot(c\cdot\delta^{2}+1)-2\cdot c\cdot(3\cdot c\cdot\delta^{2}\cdot p+3\cdot\delta-p)\right.$$

$$\left(a^{2}-a\cdot c\cdot\delta^{2}-1\right)^{3}$$

$$\left.\frac{)-\beta^{2}\cdot(c\cdot\delta^{2}\cdot p+\delta-p)-2\cdot(\beta\cdot(2\cdot c\cdot\delta\cdot p+1)+c\cdot p))}{}\right]$$

Sub(#24)

#25:

$$-\frac{\alpha\cdot\beta\cdot e^{-\beta\cdot(1/\beta)}\cdot\left(e^{\beta\cdot 0}\cdot\left(a\cdot\left(\beta\cdot\frac{1}{\beta}-2\right)-\beta\cdot\left(c\cdot 0^{2}\cdot\frac{1}{\beta}+0-\frac{1}{\beta}\right)+2\cdot(c\cdot 0^{2}-1)\right)-\right.}{a^{2}-a\cdot c\cdot 0^{2}-1}$$

$$\frac{\left.\alpha\cdot e^{-\beta\cdot(1/\beta)}\cdot\left(e^{\beta\cdot 0}\cdot\left(a^{3}\cdot\beta\cdot\left(\beta\cdot\frac{1}{\beta}-1\right)+a^{2}\cdot\beta\cdot\left(2\cdot(c\cdot 0^{2}-1)-\beta\cdot\left(2\cdot c\cdot 0\cdot\frac{1}{\beta}+0-\frac{1}{\beta}\right)\right)\right)+a\cdot\left(\beta^{2}\cdot\left(c^{2}\cdot 0^{4}\cdot\frac{1}{\beta}+c\cdot 0^{2}\cdot\left(0-\frac{1}{\beta}\right)-\frac{1}{\beta}\right)-\beta\cdot\left(c^{2}\cdot 0^{4}-2\cdot c\cdot 0\cdot\frac{1}{\beta}-1\right)-2\cdot c\cdot 0\right)+\beta^{2}\cdot\right.}{(a^{2}-a\cdot c\cdot 0^{2}-1)^{2}}$$

$$\frac{a\cdot\left(\beta\cdot\left(0-\frac{1}{\beta}\right)+2\right)+\beta\cdot\frac{1}{\beta}-2}{\left(c\cdot 0^{2}\cdot\frac{1}{\beta}+0-\frac{1}{\beta}\right)+\beta\cdot\left(2-c\cdot 0\cdot\left(0-2\cdot\frac{1}{\beta}\right)\right)-2\cdot c\cdot 0\right)-a\cdot\left(a^{2}\cdot\beta+a\cdot c\cdot 0\cdot\left(\beta\cdot\left(0-2\cdot\frac{1}{\beta}\right)+2\right)-\beta\cdot\left(2\cdot c\cdot 0\cdot\frac{1}{\beta}+1\right)+2\cdot c\cdot 0\right)\right)}$$

$$\frac{2\cdot a\cdot\alpha\cdot c\cdot e^{-\beta\cdot(1/\beta)}\cdot\left(a^{3}\cdot\left(3\cdot 0-\frac{1}{\beta}\right)+a^{2}\cdot\left(c\cdot 0^{2}\cdot\left(0-3\cdot\frac{1}{\beta}\right)-\frac{1}{\beta}\right)-a\cdot\left(3\cdot c\cdot 0^{2}\cdot\frac{1}{\beta}+3\cdot 0-\frac{1}{\beta}\right)+\frac{1}{\beta}\right)}{(a^{2}-a\cdot c\cdot 0^{2}-1)^{3}}-$$

$$\frac{\left.\alpha\cdot e^{\beta\cdot(0-1/\beta)}\cdot\left(a^{3}\cdot\beta\cdot\left(\beta\cdot\frac{1}{\beta}-1\right)+a^{2}\cdot\beta\cdot\left(2\cdot(c\cdot 0^{2}-1)-\beta\cdot\left(2\cdot c\cdot 0\cdot\frac{1}{\beta}+0-\frac{1}{\beta}\right)\right)+a\cdot\left(\beta^{2}\cdot\left(c^{2}\cdot 0^{4}\cdot\frac{1}{\beta}+c\cdot 0^{2}\cdot\left(0-\frac{1}{\beta}\right)-\frac{1}{\beta}\right)-\beta\cdot\left(c^{2}\cdot 0^{4}-2\cdot c\cdot 0\cdot\frac{1}{\beta}-1\right.\right.\right.}{(a^{2}-a\cdot c\cdot 0^{2}-1)^{2}}$$

$$\frac{\alpha\cdot e^{\beta\cdot(0-1/\beta)}\cdot\left(a^{5}\cdot\beta^{2}\cdot\frac{1}{\beta}-a^{4}\cdot\beta\cdot\left(\beta\cdot\left(3\cdot c\cdot 0^{2}\cdot\frac{1}{\beta}+0-\frac{1}{\beta}\right)+2\right)+a^{3}\cdot\left(\beta^{2}\cdot\left(3\cdot c^{2}\cdot 0^{4}\cdot\frac{1}{\beta}+2\cdot c\cdot 0^{2}\cdot\left(0-\frac{1}{\beta}\right)-2\cdot\frac{1}{\beta}\right)+4\cdot\beta\cdot c\cdot 0\cdot\frac{1}{\beta}+2\cdot c\cdot\left(\frac{1}{\beta}-3\cdot 0\right)\right)-a^{2}\cdot\left(\beta^{2}\cdot\left(c^{3}\cdot 0^{6}\cdot\frac{1}{\beta}+c^{2}\right.\right.\right.}$$

$$\left) - 2\cdot c\cdot 0\right) + \beta^{2}\cdot\left(c\cdot 0^{2}\cdot\frac{1}{\beta} + 0 - \frac{1}{\beta}\right) + \beta\cdot\left(2 - c\cdot 0\cdot\left(0 - 2\cdot\frac{1}{\beta}\right)\right) - 2\cdot c\cdot 0\right)}{\cdot 0^{4}\cdot\left(0 - \frac{1}{\beta}\right) - 4\cdot c\cdot 0^{2}\cdot\frac{1}{\beta} - 2\cdot\left(0 - \frac{1}{\beta}\right)\right) - 2\cdot\beta\cdot\left(c^{2}\cdot 0^{3}\cdot\left(0 - 2\cdot\frac{1}{\beta}\right) + 2\cdot c\cdot 0\cdot\frac{1}{\beta} + 2\right) + 2\cdot c\cdot\left(c\cdot 0^{2}\cdot\left(0 - 3\cdot\frac{1}{\beta}\right) - \frac{1}{\beta}\right)\right) - a\cdot\left(\beta^{2}\cdot\left(2\cdot c^{2}\cdot 0^{4}\cdot\frac{1}{\beta} + 2\cdot c\cdot 0^{2}\cdot\left(0 - \frac{1}{\beta}\right) - \frac{1}{\beta}\right) + 4\cdot\beta\cdot c\cdot 0\right.$$

$$\left. \cdot\frac{1}{\beta}\cdot\left(c\cdot 0^{2} + 1\right) - 2\cdot c\cdot\left(3\cdot c\cdot 0^{2}\cdot\frac{1}{\beta} + 3\cdot 0 - \frac{1}{\beta}\right)\right) - \beta^{2}\cdot\left(c\cdot 0^{2}\cdot\frac{1}{\beta} + 0 - \frac{1}{\beta}\right) - 2\cdot\left(\beta\cdot\left(2\cdot c\cdot 0\cdot\frac{1}{\beta} + 1\right) + c\cdot\frac{1}{\beta}\right)\right)$$

$$\#26:\ \begin{bmatrix} \frac{2\cdot\alpha\cdot\beta\cdot\hat{e}^{-1}}{a-1} & \frac{\alpha\cdot\beta\cdot\hat{e}^{-1}}{1-a} \\ \frac{\alpha\cdot\beta\cdot\hat{e}^{-1}}{1-a} & -\frac{\alpha\cdot\hat{e}^{-1}\cdot\left(a^{2}\cdot\beta^{2} + 2\cdot a\cdot\left(c-\beta^{2}\right) + \beta^{2} + 2\cdot c\right)}{\beta\cdot(a+1)\cdot(a-1)^{2}} \end{bmatrix}$$ 0.6s Simp(#25)

$$\#27:\ \mathrm{DET}\begin{bmatrix} \frac{2\cdot\alpha\cdot\beta\cdot\hat{e}^{-1}}{a-1} & \frac{\alpha\cdot\beta\cdot\hat{e}^{-1}}{1-a} \\ \frac{\alpha\cdot\beta\cdot\hat{e}^{-1}}{1-a} & -\frac{\alpha\cdot\hat{e}^{-1}\cdot\left(a^{2}\cdot\beta^{2} + 2\cdot a\cdot\left(c-\beta^{2}\right) + \beta^{2} + 2\cdot c\right)}{\beta\cdot(a+1)\cdot(a-1)^{2}} \end{bmatrix}$$ User

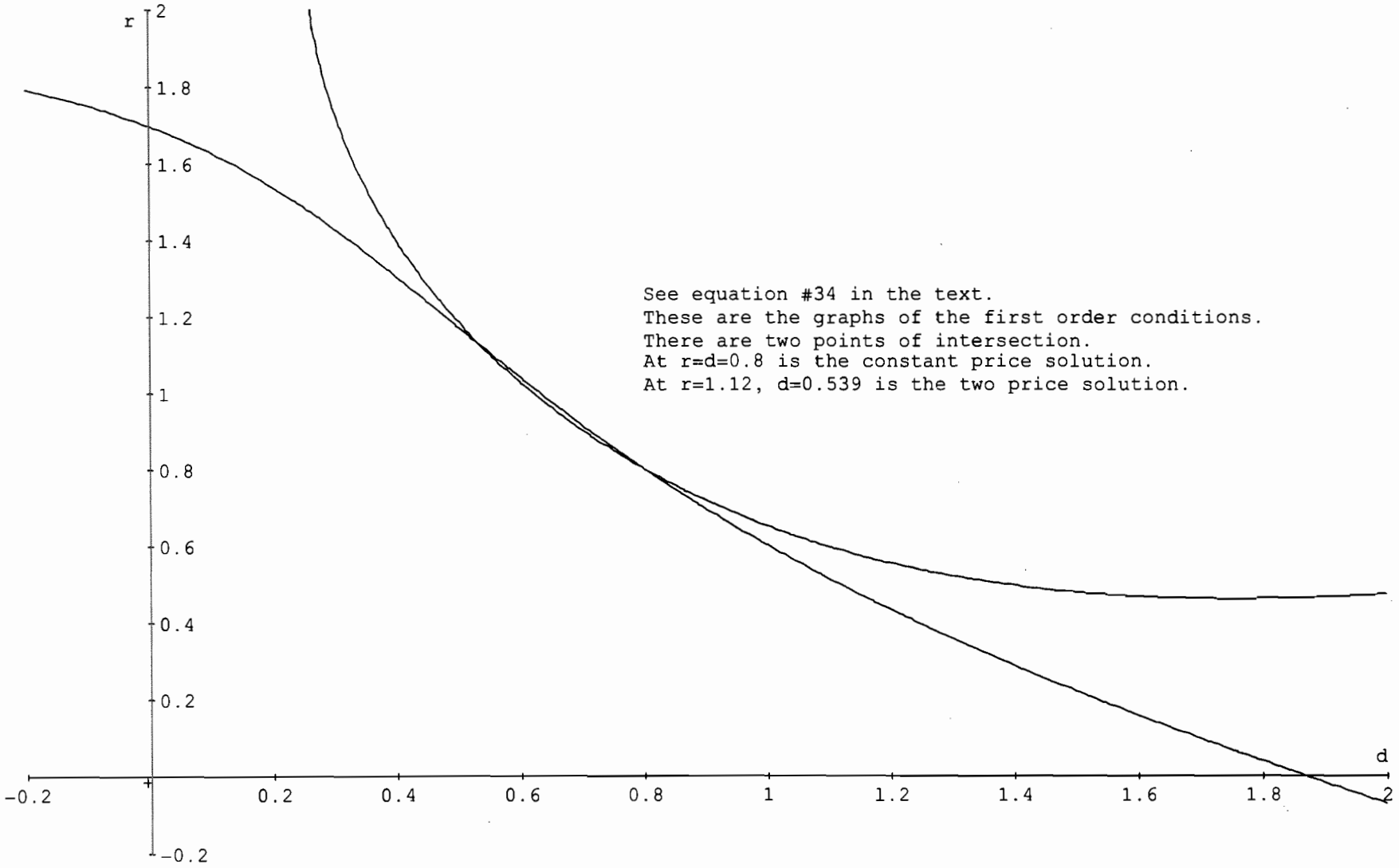
$$\#28:\ \frac{\alpha^{2}\cdot\hat{e}^{-2}\cdot\left(3\cdot a^{2}\cdot\beta^{2} + 4\cdot a\cdot\left(c-\beta^{2}\right) + \beta^{2} + 4\cdot c\right)}{(a+1)\cdot(1-a)^{3}}$$ 0.0s Simp(#27)

#29: "The sign of this determinant is the same as the sign of" User

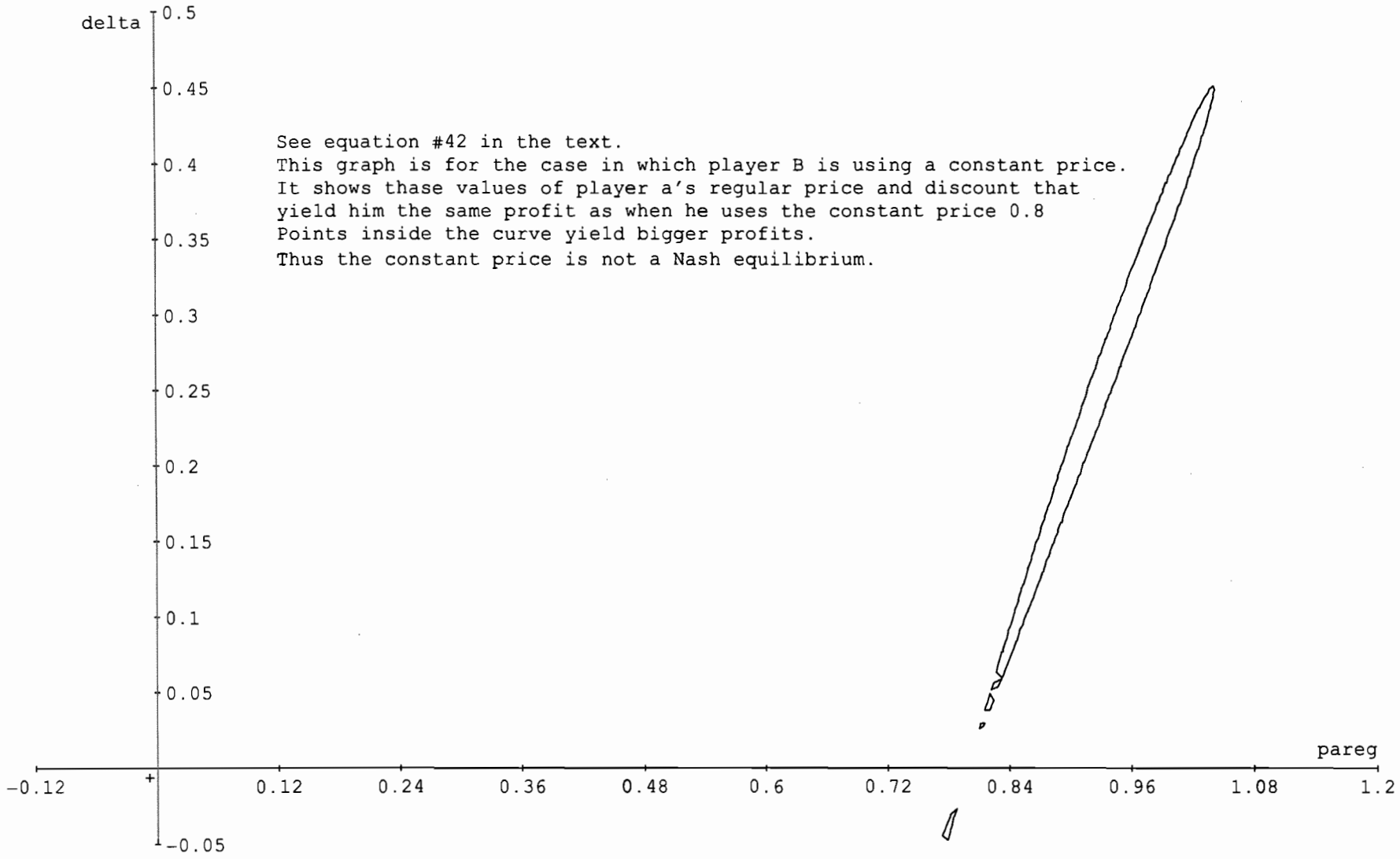
$$\#30:\ 3\cdot a^{2}\cdot\beta^{2} + 4\cdot a\cdot\left(c-\beta^{2}\right) + \beta^{2} + 4\cdot c$$ User

#31: "Whenever c is less than the following expression, the profit function will exhibit the behavior described above." User

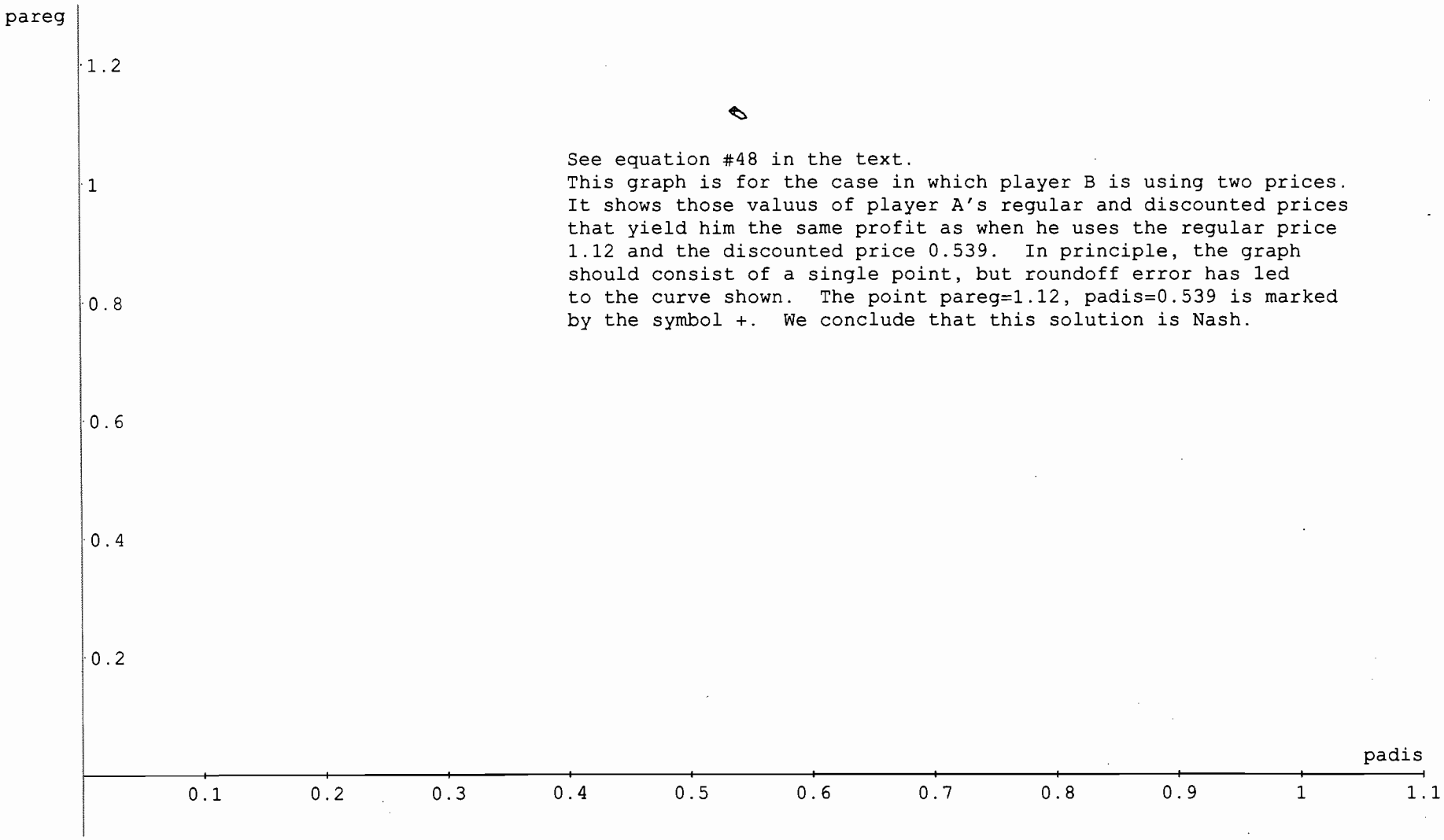
$$\#32:\ \left[c = -\frac{\beta^{2}\cdot\left(3\cdot a^{2} - 4\cdot a + 1\right)}{4\cdot(a+1)}\right]$$ 0.0s Solve(#30,c)



See equation #34 in the text.
These are the graphs of the first order conditions.
There are two points of intersection.
At r=d=0.8 is the constant price solution.
At r=1.12, d=0.539 is the two price solution.



See equation #42 in the text.
This graph is for the case in which player B is using a constant price.
It shows thase values of player a's regular price and discount that
yield him the same profit as when he uses the constant price 0.8
Points inside the curve yield bigger profits.
Thus the constant price is not a Nash equilibrium.



See equation #48 in the text.
This graph is for the case in which player B is using two prices. It shows those valuus of player A's regular and discounted prices that yield him the same profit as when he uses the regular price 1.12 and the discounted price 0.539. In principle, the graph should consist of a single point, but roundoff error has led to the curve shown. The point pareg=1.12, padis=0.539 is marked by the symbol +. We conclude that this solution is Nash.

#1: [FA(α, β, p) :=, FB(α, β, q) :=, H(δ) :=] User

#2: [aa :ε Real [0, ∞), ab :ε Real [0, ∞), ba :ε Real [0, ∞), bb :ε Real [0, ∞)] User

#3: [pareg :ε Real [0, ∞), padis :ε Real [0, ∞), pbreg :ε Real [0, ∞), pbdis :ε Real [0, ∞)] User

#4: [xa1 :ε Real [0, ∞), xa2 :ε Real [0, ∞), xb1 :ε Real [0, ∞), xb2 :ε Real [0, ∞)] User

#5: VariableOrder := [x, y, z, xa1, xa2, xb1, xb2, padis, pareg, pbdis, pbreg] User

User

$$\#6:\ \begin{bmatrix} xa1 & xb1 & 1 - xa1 - xb1 \end{bmatrix} = \begin{bmatrix} xa1 & xb1 & 1 - xa1 - xb1 \end{bmatrix} \cdot \begin{bmatrix} FA(\alpha, \beta, padis) + aa & FB(\alpha, \beta, pbreg) + bb & \\ FA(\alpha, \beta, padis) + ba & FB(\alpha, \beta, pbreg) + ab - H(pbreg - pbdis) & 1 - FA(\alpha, \\ FA(\alpha, \beta, padis) & FB(\alpha, \beta, pbreg) & \end{bmatrix}$$

$$\begin{bmatrix} 1 - FA(\alpha, \beta, padis) - FB(\alpha, \beta, pbreg) - aa - bb & \\ \beta, padis) - FB(\alpha, \beta, pbreg) - ba - ab + H(pbreg - pbdis) & \\ 1 - FA(\alpha, \beta, padis) - FB(\alpha, \beta, pbreg) & \\ \beta, pareg) - FB(\alpha, \beta, pbdis) - aa - bb + H(pareg - padis) & \\ 1 - FA(\alpha, \beta, pareg) - FB(\alpha, \beta, pbdis) - ba - ab & \\ 1 - FA(\alpha, \beta, pareg) - FB(\alpha, \beta, pbdis) & \end{bmatrix} \cdot \begin{bmatrix} FA(\alpha, \beta, pareg) + aa - H(pareg - padis) & FB(\alpha, \beta, pbdis) + bb & 1 - FA(\alpha, \\ FA(\alpha, \beta, pareg) + ba & FB(\alpha, \beta, pbdis) + ab & \\ FA(\alpha, \beta, pareg) & FB(\alpha, \beta, pbdis) & \end{bmatrix}$$

Expd(#6)

$$\#7:\ \begin{bmatrix} xa1 = -FA(\alpha, \beta, padis) \cdot H(pareg - padis) + aa \cdot FA(\alpha, \beta, padis) + FA(\alpha, \beta, pareg) + ba \cdot FB(\alpha, \beta, pbreg) - aa \cdot xa1 \cdot H(pareg - padis) - ba \cdot xb1 \cdot H(pareg - padis) - ba \cdot xb1 \cdot H(pbreg - \\ pbdis) + xa1 \cdot (aa^2 + ba \cdot bb) + xb1 \cdot (aa \cdot ba + ab \cdot ba) & xb1 = bb \cdot FA(\alpha, \beta, padis) + FB(\alpha, \beta, pbdis) + ab \cdot FB(\alpha, \beta, pbreg) - ab \cdot xb1 \cdot H(pbreg - pbdis) + xa1 \cdot (aa \cdot bb + ab \cdot bb) + xb1 \cdot (ab^2 \\ + ba \cdot bb) & -xa1 - xb1 + 1 = FA(\alpha, \beta, padis) \cdot H(pareg - padis) - (aa + bb) \cdot FA(\alpha, \beta, padis) - FA(\alpha, \beta, pareg) - FB(\alpha, \beta, pbdis) - (ab + ba) \cdot FB(\alpha, \beta, pbreg) + aa \cdot xa1 \cdot H(pareg - \\ padis) + ba \cdot xb1 \cdot H(pareg - padis) + xb1 \cdot (ab + ba) \cdot H(pbreg - pbdis) - xa1 \cdot (aa^2 + aa \cdot bb + bb \cdot (ab + ba)) - xb1 \cdot (aa \cdot ba + ab^2 + ab \cdot ba + ba \cdot bb) + 1 \end{bmatrix}$$

User

#8: SOLVE([xa1 = - FA(α, β, padis)·H(pareg - padis) + aa·FA(α, β, padis) + FA(α, β, pareg) + ba·FB(α, β, pbreg) - aa·xa1·H(pareg - padis) - ba·xb1·H(pareg - padis) - ba·xb1·H(pbreg - pbdis) + xa1·(aa^2 + ba·bb) + xb1·(aa·ba + ab·ba), xb1 = bb·FA(α, β, padis) + FB(α, β, pbdis) + ab·FB(α, β, pbreg) - ab·xb1·H(pbreg - pbdis) + xa1·(aa·bb + ab·bb) + xb1·(ab^2 + ba·bb)], [xa1, xb1])

0.7s Simp(#8)

#9:

$$\left[xa1 = -\frac{FA(\alpha,\ \beta,\ padis)\cdot(H(pareg - padis)\cdot(ab\cdot H(pbreg - pbdis) - ab^2 + 1) + (ba\cdot bb - aa\cdot ab)\cdot H(pbreg - pbdis) + aa\cdot(ab^2 - 1) - ab\cdot ba\cdot bb) - FA(\alpha,\ \beta,\ pareg)\cdot(ab\cdot H(pbreg - pbdis) - ab^2 - ba\cdot bb + 1) + ba\cdot(FB(\alpha,\ \beta,\ pbdis)\cdot(H(pareg - padis) + H(pbreg - pbdis) - aa - ab) + FB(\alpha,\ \beta,\ pbreg)\cdot(ab\cdot H(pareg - padis) - aa\cdot ab + ba\cdot bb - 1))}{H(pareg - padis)\cdot(aa\cdot ab\cdot H(pbreg - pbdis) + aa\cdot(1 - ab^2) + ab\cdot ba\cdot bb) - (aa^2\cdot ab - aa\cdot ba\cdot bb - ab)\cdot H(pbreg - pbdis) + aa^2\cdot(ab^2 - 1) - 2\cdot aa\cdot ab\cdot ba\cdot bb - ab^2 + (ba\cdot bb - 1)^2} \right.$$

$$\left. xb1 = -\frac{bb\cdot FA(\alpha,\ \beta,\ padis)\cdot(ab\cdot H(pareg - padis) - aa\cdot ab + ba\cdot bb - 1) - bb\cdot(aa + ab)\cdot FA(\alpha,\ \beta,\ pareg) - FB(\alpha,\ \beta,\ pbdis)\cdot(aa\cdot H(pareg - padis) - aa^2 - ba\cdot bb + 1) - FB(\alpha,\ \beta,\ pbreg)\cdot(aa\cdot ab\cdot H(pareg - padis) - aa^2\cdot ab + aa\cdot ba\cdot bb + ab)}{H(pareg - padis)\cdot(aa\cdot ab\cdot H(pbreg - pbdis) + aa\cdot(1 - ab^2) + ab\cdot ba\cdot bb) - (aa^2\cdot ab - aa\cdot ba\cdot bb - ab)\cdot H(pbreg - pbdis) + aa^2\cdot(ab^2 - 1) - 2\cdot aa\cdot ab\cdot ba\cdot bb - ab^2 + (ba\cdot bb - 1)^2} \right]$$

User

#10:

$$\begin{bmatrix} xa2 & xb2 & 1 - xa2 - xb2 \end{bmatrix} = \begin{bmatrix} xa2 & xb2 & 1 - xa2 - xb2 \end{bmatrix}\cdot \begin{bmatrix} FA(\alpha,\ \beta,\ pareg) + aa - H(pareg - padis) & FB(\alpha,\ \beta,\ pbdis) + bb & 1 - FA(\alpha,\ \beta,\ pareg) - FB(\alpha,\ \beta,\ pbdis) - aa - bb + H(pareg - padis) \\ FA(\alpha,\ \beta,\ pareg) + ba & FB(\alpha,\ \beta,\ pbdis) + ab & 1 - FA(\alpha,\ \beta,\ pareg) - FB(\alpha,\ \beta,\ pbdis) - ba - ab \\ FA(\alpha,\ \beta,\ pareg) & FB(\alpha,\ \beta,\ pbdis) & 1 - FA(\alpha,\ \beta,\ pareg) - FB(\alpha,\ \beta,\ pbdis) \end{bmatrix} \cdot \begin{bmatrix} FA(\alpha,\ \beta,\ padis) + aa & FB(\alpha,\ \beta,\ pbreg) + bb & 1 - FA(\alpha,\ \beta,\ padis) - FB(\alpha,\ \beta,\ pbreg) - aa - bb \\ FA(\alpha,\ \beta,\ padis) + ba & FB(\alpha,\ \beta,\ pbreg) + ab - H(pbreg - pbdis) & \beta,\ padis) - FB(\alpha,\ \beta,\ pbreg) - ba - ab + H(pbreg - pbdis) \\ FA(\alpha,\ \beta,\ padis) & FB(\alpha,\ \beta,\ pbreg) & 1 - FA(\alpha,\ \beta,\ padis) - FB(\alpha,\ \beta,\ pbreg) \end{bmatrix}$$

Expd(#10)

#11:

$$\begin{bmatrix} xa2 = FA(\alpha,\ \beta,\ padis) + aa\cdot FA(\alpha,\ \beta,\ pareg) + ba\cdot FB(\alpha,\ \beta,\ pbdis) - aa\cdot xa2\cdot H(pareg - padis) + xa2\cdot(aa^2 + ba\cdot bb) + xb2\cdot(aa\cdot ba + ab\cdot ba) & xb2 = bb\cdot FA(\alpha,\ \beta,\ pareg) - FB(\alpha,\ \beta,\ pbdis)\cdot H(pbreg - pbdis) + ab\cdot FB(\alpha,\ \beta,\ pbdis) + FB(\alpha,\ \beta,\ pbreg) - bb\cdot xa2\cdot H(pareg - padis) - bb\cdot xa2\cdot H(pbreg - pbdis) - ab\cdot xb2\cdot H(pbreg - pbdis) + xa2\cdot(aa\cdot bb + ab\cdot bb) + xb2\cdot(ab^2 + ba\cdot bb) & -xa2 - xb2 + 1 = -FA(\alpha,\ \beta,\ padis) - (aa + bb)\cdot FA(\alpha,\ \beta,\ pareg) + FB(\alpha,\ \beta,\ pbdis)\cdot H(pbreg - pbdis) - (ab + ba)\cdot FB(\alpha,\ \beta,\ pbdis) - FB(\alpha,\ \beta,\ pbreg) + xa2\cdot(aa + bb)\cdot H(pareg - padis) + bb\cdot xa2\cdot H(pbreg - pbdis) + ab\cdot xb2\cdot H(pbreg - pbdis) - xa2\cdot(aa^2 + aa\cdot bb + bb\cdot(ab + ba)) - xb2\cdot(aa\cdot ba + ab^2 + ab\cdot ba + ba\cdot bb) + 1 \end{bmatrix}$$

#12: "For some unknown reason the software command SOLVE would not solve these equations. To get around this difficulty required a number of steps" User

#13:

$$\left[xa2 = \frac{FA(\alpha,\ \beta,\ padis) + aa\cdot FA(\alpha,\ \beta,\ pareg) + ba\cdot(FB(\alpha,\ \beta,\ pbdis) + xb2\cdot(aa + ab))}{aa\cdot H(pareg - padis) - aa^2 - ba\cdot bb + 1} \right]$$

Solve(#11',xa2)

#14:

$$\left[xa2 = \frac{bb\cdot FA(\alpha,\ \beta,\ pareg) + FB(\alpha,\ \beta,\ pbdis)\cdot(ab - H(pbreg - pbdis)) + FB(\alpha,\ \beta,\ pbreg) - xb2\cdot(ab\cdot H(pbreg - pbdis) - ab^2 - ba\cdot bb + 1)}{bb\cdot(H(pareg - padis) + H(pbreg - pbdis) - aa - ab)} \right]$$

Solve(#11',xa2)

User

#15:
$$\frac{FA(\alpha,\ \beta,\ padis) + aa\cdot FA(\alpha,\ \beta,\ pareg) + ba\cdot(FB(\alpha,\ \beta,\ pbdis) + xb2\cdot(aa + ab))}{aa\cdot H(pareg - padis) - aa^2 - ba\cdot bb + 1} -$$

$$\frac{bb\cdot FA(\alpha,\ \beta,\ pareg) + FB(\alpha,\ \beta,\ pbdis)\cdot(ab - H(pbreg - pbdis)) + FB(\alpha,\ \beta,\ pbreg) - xb2\cdot(ab\cdot H(pbreg - pbdis) - ab^2 - ba\cdot bb + 1)}{bb\cdot(H(pareg - padis) + H(pbreg - pbdis) - aa - ab)}$$

0.3s Solve(#15,xb2)

#16:
$$\left\{xb2 = -\frac{bb\cdot FA(\alpha,\ \beta,\ padis)\cdot(H(pareg - padis) + H(pbreg - pbdis) - aa - ab) + bb\cdot FA(\alpha,\ \beta,\ pareg)\cdot(aa\cdot H(pbreg - pbdis) - aa\cdot ab + ba\cdot bb - 1) + FB(\alpha,\ \beta,\ pbdis)\cdot(H(pareg - padis)\cdot(aa\cdot H(pbreg - pbdis) + aa\cdot(1 - ab^2) + ab\cdot ba\cdot bb) - (aa^2\cdot ab - aa\cdot ba\cdot bb - ab)\cdot(pbreg - pbdis) - aa\cdot ab + ba\cdot bb) + (1 - aa^2)\cdot H(pbreg - pbdis) + aa^2\cdot ab - aa\cdot ba\cdot bb - ab) - FB(\alpha,\ \beta,\ pbreg)\cdot(aa\cdot H(pareg - padis) - aa^2 - ba\cdot bb + 1)}{H(pbreg - pbdis) + aa^2\cdot(ab^2 - 1) - 2\cdot aa\cdot ab\cdot ba\cdot bb - ab^2 + (ba\cdot bb - 1)^2}\right\}$$

#17:
$$\left\{xb2 = -\frac{FA(\alpha,\ \beta,\ padis) + aa\cdot FA(\alpha,\ \beta,\ pareg) + ba\cdot FB(\alpha,\ \beta,\ pbdis) - xa2\cdot(aa\cdot H(pareg - padis) - aa^2 - ba\cdot bb + 1)}{ba\cdot(aa + ab)}\right\}$$ Solve(#11',xb2)

#18:
$$\left\{xb2 = \frac{bb\cdot FA(\alpha,\ \beta,\ pareg) + FB(\alpha,\ \beta,\ pbdis)\cdot(ab - H(pbreg - pbdis)) + FB(\alpha,\ \beta,\ pbreg) - bb\cdot xa2\cdot(H(pareg - padis) + H(pbreg - pbdis) - aa - ab)}{ab\cdot H(pbreg - pbdis) - ab^2 - ba\cdot bb + 1}\right\}$$ Solve(#11',xb2)

User

#19:
$$-\frac{FA(\alpha,\ \beta,\ padis) + aa\cdot FA(\alpha,\ \beta,\ pareg) + ba\cdot FB(\alpha,\ \beta,\ pbdis) - xa2\cdot(aa\cdot H(pareg - padis) - aa^2 - ba\cdot bb + 1)}{ba\cdot(aa + ab)} -$$

$$\frac{bb\cdot FA(\alpha,\ \beta,\ pareg) + FB(\alpha,\ \beta,\ pbdis)\cdot(ab - H(pbreg - pbdis)) + FB(\alpha,\ \beta,\ pbreg) - bb\cdot xa2\cdot(H(pareg - padis) + H(pbreg - pbdis) - aa - ab)}{ab\cdot H(pbreg - pbdis) - ab^2 - ba\cdot bb + 1}$$

0.7s Solve(#19,xa2)

#20:
$$\left\{xa2 = \frac{FA(\alpha,\ \beta,\ padis)\cdot(ab\cdot H(pbreg - pbdis) - ab^2 - ba\cdot bb + 1) + FA(\alpha,\ \beta,\ pareg)\cdot(aa\cdot ab\cdot H(pbreg - pbdis) + aa\cdot(1 - ab^2) + ab\cdot ba\cdot bb) - ba\cdot(FB(\alpha,\ \beta,\ pbdis)\cdot(aa\cdot H(pbreg - pbdis) - a\cdot ab + ba\cdot bb - 1) - (aa + ab)\cdot FB(\alpha,\ \beta,\ pbreg))}{H(pareg - padis)\cdot(aa\cdot ab\cdot H(pbreg - pbdis) + aa\cdot(1 - ab^2) + ab\cdot ba\cdot bb) - (aa^2\cdot ab - aa\cdot ba\cdot bb - ab)\cdot H(pbreg - pbdis) + aa^2\cdot(ab^2 - 1) - 2\cdot aa\cdot ab\cdot ba\cdot bb - ab^2 + (ba\cdot bb - 1)^2}\right\}$$

User

#21:

xa1st := −

$$\frac{FA(\alpha,\ \beta,\ padis)\cdot(H(pareg - padis)\cdot(ab\cdot H(pbreg - pbdis) - ab^2 + 1) + (ba\cdot bb - aa\cdot ab)\cdot H(pbreg - pbdis) + aa\cdot(ab^2 - 1) - ab\cdot ba\cdot bb) - FA(\alpha,\ \beta,\ pareg)\cdot(ab\cdot H(pbreg - pbdis) - ab}{H(pareg - padis)\cdot(aa\cdot ab\cdot H(pbreg - pbdis) + aa\cdot(1 - ab^2) + ab\cdot ba\cdot bb) - (aa^2\cdot ab - aa\cdot ba\cdot bb - ab)\cdot}$$

xb1st := −

$$\frac{bb\cdot FA(\alpha,\ \beta,\ padis)\cdot(ab\cdot H(pareg - padis) - aa\cdot ab + ba\cdot bb - 1) - bb\cdot(aa + ab)\cdot FA(\alpha,\ \beta,\ pareg) - FB(\alpha,\ \beta,\ pbdis)\cdot(aa\cdot H(pareg}{H(pareg - padis)\cdot(aa\cdot ab\cdot H(pbreg - pbdis) + aa\cdot(1 - ab^2) + ab\cdot ba\cdot bb) - (aa^2\cdot ab - aa\cdot ba\cdot bb - ab)\cdot}$$

xa2st :=

$$\frac{FA(\alpha,\ \beta,\ padis)\cdot(ab\cdot H(pbreg - pbdis) - ab^2 - ba\cdot bb + 1) + FA(\alpha,\ \beta,\ pareg)\cdot(aa\cdot ab\cdot H(pbreg - pbdis) + aa\cdot(1 - ab^2) + ab\cdot ba\cdot bb}{H(pareg - padis)\cdot(aa\cdot ab\cdot H(pbreg - pbdis) + aa\cdot(1 - ab^2) + ab\cdot ba\cdot bb) - (aa^2\cdot ab - aa\cdot ba\cdot bb - ab)\cdot H}$$

$$\frac{bb\cdot FA(\alpha,\ \beta,\ padis)\cdot(H(pareg - padis) + H(pbreg - pbdis) - aa - ab) + bb\cdot FA(\alpha,\ \beta,\ pareg)\cdot(aa\cdot H(pbreg - pbdis) - aa\cdot ab + ba\cdot bb - 1) + FB(\alpha,\ \beta,\ pbdis)\cdot(H(pareg - padis)\cdot(aa\cdot H}{H(pareg - padis)\cdot(aa\cdot ab\cdot H(pbreg - pbdis) + aa\cdot(1 - ab^2) + ab\cdot ba\cdot bb) - (aa^2\cdot ab - aa\cdot ba\cdot bb - ab)\cdot}$$

xb2st := −

$$\frac{{}^{2} - ba\cdot bb + 1) + ba\cdot(FB(\alpha,\ \beta,\ pbdis)\cdot(H(pareg - padis) + H(pbreg - pbdis) - aa - ab) + FB(\alpha,\ \beta,\ pbreg)\cdot(ab\cdot H(pareg - padis) - aa\cdot ab + ba\cdot bb - 1))}{H(pbreg - pbdis) + aa^2\cdot(ab^2 - 1) - 2\cdot aa\cdot ab\cdot ba\cdot bb - ab^2 + (ba\cdot bb - 1)^2}$$

$$\frac{- padis) - aa^2 - ba\cdot bb + 1) - FB(\alpha,\ \beta,\ pbreg)\cdot(aa\cdot ab\cdot H(pareg - padis) - aa^2\cdot ab + aa\cdot ba\cdot bb + ab)}{H(pbreg - pbdis) + aa^2\cdot(ab^2 - 1) - 2\cdot aa\cdot ab\cdot ba\cdot bb - ab^2 + (ba\cdot bb - 1)^2}$$

$$\frac{) - ba\cdot(FB(\alpha,\ \beta,\ pbdis)\cdot(aa\cdot H(pbreg - pbdis) - aa\cdot ab + ba\cdot bb - 1) - (aa + ab)\cdot FB(\alpha,\ \beta,\ pbreg))}{(pbreg - pbdis) + aa^2\cdot(ab^2 - 1) - 2\cdot aa\cdot ab\cdot ba\cdot bb - ab^2 + (ba\cdot bb - 1)^2}$$

$$\frac{(pbreg - pbdis) - aa\cdot ab + ba\cdot bb) + (1 - aa^2)\cdot H(pbreg - pbdis) + aa^2\cdot ab - aa\cdot ba\cdot bb - ab) - FB(\alpha,\ \beta,\ pbreg)\cdot(aa\cdot H(pareg - padis) - aa^2 - ba\cdot bb + 1)}{H(pbreg - pbdis) + aa^2\cdot(ab^2 - 1) - 2\cdot aa\cdot ab\cdot ba\cdot bb - ab^2 + (ba\cdot bb - 1)^2}$$

#22: pareg·xa1st + padis·xa2st

User

User
#23: "This is player A's profit with general functions. Even after we substitute specific functions and specific parameter values α=0.1, β=1, aa=ab=0.5, ba=bb=-0.1, and c=0.025, the resulting function of the four prices is analytically intractable."

#24: $\left[FA(\alpha, \beta, p) := \alpha \cdot e^{-\beta \cdot p},\ FB(\alpha, \beta, q) := \alpha \cdot e^{-\beta \cdot q},\ H(\delta) := c \cdot \delta^2\right]$ User

Simp(#22)

#25:
$$\frac{\alpha \cdot e^{-\beta \cdot (padis + pareg + pbdis + pbreg)} \cdot (e^{\beta \cdot padis} \cdot (ba \cdot e^{\beta \cdot pareg} \cdot (e^{\beta \cdot pbdis} \cdot (aa \cdot (ab \cdot pareg + padis) + ab \cdot (padis - c \cdot pareg \cdot (padis - pareg)^2) - pareg \cdot (ba \cdot bb - 1)) + e^{\beta \cdot pbreg} \cdot (aa \cdot (a}{}$$

$$\frac{b \cdot padis - c \cdot padis \cdot (pbdis - pbreg)^2 + pareg) + ab \cdot pareg - ba \cdot bb \cdot padis - c \cdot pareg \cdot (padis^2 - 2 \cdot padis \cdot pareg + pareg^2 + (pbdis - pbreg)^2) + padis)) - e^{\beta \cdot (pbdis + pbreg)} \cdot (aa \cdot padis}{}$$

$$\frac{aa^2 \cdot (ab^2 - ab \cdot c \cdot (pbdis - pbreg)^2 - 1) - aa \cdot (ab^2 \cdot c \cdot (padis - pareg)^2 + ab \cdot (2 \cdot ba \cdot bb - c^2 \cdot (padis - pareg)}{}$$

$$\frac{\cdot (ab^2 - ab \cdot c \cdot (pbdis - pbreg)^2 - 1) + ab^2 \cdot pareg - ab \cdot (ba \cdot bb \cdot padis + c \cdot pareg \cdot (pbdis - pbreg)^2) + pareg \cdot (ba \cdot bb - 1))) - e^{\beta \cdot (pareg + pbdis + pbreg)} \cdot (aa \cdot pareg \cdot (ab^2 - ab \cdot c \cdot (pbdis}{}$$

$$\frac{^2 \cdot (pbdis - pbreg)^2) - c \cdot (ba \cdot bb \cdot (pbdis - pbreg)^2 + (padis - pareg)^2)) - ab^2 + ab \cdot c \cdot (ba \cdot bb \cdot (padis - pareg)^2 + (pbdis - pbreg)^2) + (ba \cdot bb - 1)^2}{}$$

$$\frac{- pbreg)^2 - 1) + ab^2 \cdot (padis - c \cdot pareg \cdot (padis - pareg)^2) + ab \cdot (c \cdot (pbdis - pbreg)^2 \cdot (c \cdot pareg \cdot (padis - pareg)^2 - padis) - ba \cdot bb \cdot pareg) + ba \cdot bb \cdot (c \cdot pareg \cdot (pbdis - pbreg)^2 + padi}{}$$

$$\frac{s) + c \cdot pareg \cdot (padis - pareg)^2 - padis))}{}$$

Sub(#25)

#26:
$$\frac{0.1 \cdot e^{-1 \cdot (padis + pareg + pbdis + pbreg)} \cdot (e^{1 \cdot padis} \cdot ((-0.1) \cdot e^{1 \cdot pareg} \cdot (e^{1 \cdot pbdis} \cdot (0.5 \cdot (0.5 \cdot pareg + padis) + 0.5 \cdot (padis - 0.025 \cdot pareg \cdot (padis - pareg)^2) - pareg \cdot ((-0.1) \cdot (-0.1) - }{}$$

$$\frac{1)) + e^{1 \cdot pbreg} \cdot (0.5 \cdot (0.5 \cdot padis - 0.025 \cdot padis \cdot (pbdis - pbreg)^2 + pareg) + 0.5 \cdot pareg - (-0.1) \cdot (-0.1) \cdot padis - 0.025 \cdot pareg \cdot (padis^2 - 2 \cdot padis \cdot pareg + pareg^2 + (pbdis - pbreg)^2)}{}$$

$$\frac{0.5^2 \cdot (0.5^2 - 0.5 \cdot 0.025 \cdot (pbdis - pbreg)^2 - 1) - 0.5 \cdot (0.5^2 \cdot 0.025 \cdot (padis - pa}{}$$

$$\frac{+ padis)) - e^{1 \cdot (pbdis + pbreg)} \cdot (0.5 \cdot padis \cdot (0.5^2 - 0.5 \cdot 0.025 \cdot (pbdis - pbreg)^2 - 1) + 0.5^2 \cdot pareg - 0.5 \cdot ((-0.1) \cdot (-0.1) \cdot padis + 0.025 \cdot pareg \cdot (pbdis - pbreg)^2) + pareg \cdot ((-0.1) \cdot (-}{}$$

$$\frac{reg)^2 + 0.5 \cdot (2 \cdot (-0.1) \cdot (-0.1) - 0.025^2 \cdot (padis - pareg)^2 \cdot (pbdis - pbreg)^2) - 0.025 \cdot ((-0.1) \cdot (-0.1) \cdot (pbdis - pbreg)^2 + (padis - pareg)^2)) - 0.5^2 + 0.5 \cdot 0.025 \cdot ((-0.1) \cdot (-0.1) \cdot (pad}{}$$

$$\frac{0.1) - 1))) - e^{1 \cdot (pareg + pbdis + pbreg)} \cdot (0.5 \cdot pareg \cdot (0.5^2 - 0.5 \cdot 0.025 \cdot (pbdis - pbreg)^2 - 1) + 0.5^2 \cdot (padis - 0.025 \cdot pareg \cdot (padis - pareg)^2) + 0.5 \cdot (0.025 \cdot (pbdis - pbreg)^2 \cdot (0.0}{}$$

$$\frac{is - pareg)^2 + (pbdis - pbreg)^2) + ((-0.1) \cdot (-0.1) - 1)^2}{}$$

$$25 \cdot pareg \cdot (padis - pareg)^2 - padis) - (-0.1) \cdot (-0.1) \cdot pareg) + (-0.1) \cdot (-0.1) \cdot (0.025 \cdot pareg \cdot (pbdis - pbreg)^2 + padis) + 0.025 \cdot pareg \cdot (padis - pareg)^2 - padis))$$

0.7s Fctr(#26)

#27:
$$\frac{e^{-padis - pareg - pbdis - pbreg}\cdot(e^{padis}\cdot(e^{pareg}\cdot(e^{pbdis}\cdot(4\cdot e^{2}\cdot(5\cdot padis\cdot pareg - 10\cdot padis\cdot(pareg^{2} + 40) + pareg\cdot(5\cdot pareg^{2} - 496)) + 4\cdot e^{pbreg}\cdot(10\cdot padis^{2}\cdot pareg - padis\cdot(20\cdot pareg^{2} - 5\cdot pbdis^{2} + 10\cdot pbdis\cdot pbreg - 5\cdot pbreg^{2} + 496) + 10\cdot pareg\cdot(pareg^{2} + pbdis^{2} - 2\cdot pbdis\cdot pbreg + pbreg^{2} - 40))) + 20\cdot e^{pbdis + pbreg}\cdot(padis\cdot(5\cdot pbdis^{2} - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^{2} + 304) - 10\cdot padis\cdot pareg\cdot(5\cdot pbdis^{2} - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^{2} + 296))) - e^{pareg + pbdis + pbreg}\cdot(5\cdot padis^{2}\cdot pareg\cdot(pbdis^{2} - 2\cdot pbdis\cdot pbreg + pbreg^{2} + 60) - 10\cdot padis^{2}\cdot(pareg^{2}\cdot(pbdis^{2} - 2\cdot pbdis\cdot pbreg + pbreg^{2} + 60) + 4\cdot(5\cdot pbdis^{2} - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^{2} + 296)) + pareg\cdot(5\cdot pareg^{2}\cdot(pbdis^{2} - 2\cdot pbdis\cdot pbreg + pbreg^{2} + 60) - 32\cdot(3\cdot pbdis^{2} - 6\cdot pbdis\cdot pbreg + 3\cdot pbreg^{2} + 190))))}{5\cdot padis^{2}\cdot(5\cdot pbdis^{2} - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^{2} + 304) - 10\cdot padis\cdot pareg\cdot(5\cdot pbdis^{2} - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^{2} + 304) + 5\cdot pareg^{2}\cdot(5\cdot pbdis^{2} - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^{2} + 304) + 16\cdot(95\cdot pbdis^{2} - 190\cdot pbdis\cdot pbreg + 95\cdot pbreg^{2} + 5376)}$$

User

#28: profita :=

$$\frac{e^{-padis - pareg - pbdis - pbreg}\cdot(e^{padis}\cdot(e^{pareg}\cdot(e^{pbdis}\cdot(4\cdot e^{2}\cdot(5\cdot padis\cdot pareg - 10\cdot padis\cdot(pareg^{2} + 40) + pareg\cdot(5\cdot pareg^{2} - 496)) + 4\cdot e^{pbreg}\cdot(10\cdot padis^{2}\cdot pareg - padis\cdot(20\cdot pareg^{2} - 5\cdot pbdis^{2} + 10\cdot pbdis\cdot pbreg - 5\cdot pbreg^{2} + 496) + 10\cdot pareg\cdot(pareg^{2} + pbdis^{2} - 2\cdot pbdis\cdot pbreg + pbreg^{2} - 40))) + 20\cdot e^{pbdis + pbreg}\cdot(padis\cdot(5\cdot pbdis^{2} - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^{2} + 304) - 10\cdot padis\cdot pareg\cdot(5\cdot pbdis^{2} - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^{2} + 296))) - e^{pareg + pbdis + pbreg}\cdot(5\cdot padis^{2}\cdot pareg\cdot(pbdis^{2} - 2\cdot pbdis\cdot pbreg + pbreg^{2} + 60) - 10\cdot padis^{2}\cdot(pareg^{2}\cdot(pbdis^{2} - 2\cdot pbdis\cdot pbreg + pbreg^{2} + 60) + 4\cdot(5\cdot pbdis^{2} - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^{2} + 296)) + pareg\cdot(5\cdot pareg^{2}\cdot(pbdis^{2} - 2\cdot pbdis\cdot pbreg + pbreg^{2} + 60) - 32\cdot(3\cdot pbdis^{2} - 6\cdot pbdis\cdot pbreg + 3\cdot pbreg^{2} + 190))))}{5\cdot padis^{2}\cdot(5\cdot pbdis^{2} - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^{2} + 304) - 10\cdot padis\cdot pareg\cdot(5\cdot pbdis^{2} - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^{2} + 304) + 5\cdot pareg^{2}\cdot(5\cdot pbdis^{2} - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^{2} + 304) + 16\cdot(95\cdot pbdis^{2} - 190\cdot pbdis\cdot pbreg + 95\cdot pbreg^{2} + 5376)}$$

#29: $\left[\frac{d}{d\,pareg}\,profita,\ \frac{d}{d\,padis}\,profita\right]$

User

57.6s Simp(#29)

#30:

$$
\begin{aligned}
&\frac{-padis^4\cdot(25\cdot padis^2\cdot(pbdis^2-2\cdot pbdis\cdot pbreg+pbreg^2+60)\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)-100\cdot padis^3\cdot pareg\cdot(pbdis^2-2\cdot pbdis\cdot pbreg+pbreg^2+60)\cdot(5\cdot pbdis^2}{e^{padis}}\\
&-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)+10\cdot padis^2\cdot(pbdis^2-2\cdot pbdis\cdot pbreg+pbreg^2+60)\cdot(15\cdot pareg^2\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)-32\cdot(15\cdot pbdis^2-30\cdot pbdis\cdot pbr\\
&eg+15\cdot pbreg^2+1012))-20\cdot padis\cdot pareg\cdot(5\cdot pareg^2\cdot(pbdis^2-2\cdot pbdis\cdot pbreg+pbreg^2+60)\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)+4\cdot(255\cdot pbdis^4-1020\cdot pbdis^3\cdot pbreg+\\
&(5\cdot padis^2\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)-10\cdot padis\cdot pareg\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)+5\cdot pareg^2\cdot(5\cdot pbdis^2-10\cdot pb\\
&18\cdot pbdis^2\cdot(85\cdot pbreg^2+1628)-12\cdot pbdis\cdot pbreg\cdot(85\cdot pbreg^2+4884)+255\cdot pbreg^4+29304\cdot pbreg^2+840320))+25\cdot pareg^4\cdot(pbdis^2-2\cdot pbdis\cdot pbreg+pbreg^2+60)\cdot(5\cdot pbdis^2-10\cdot p\\
&dis\cdot pbreg+5\cdot pbreg^2+304)+16\cdot(95\cdot pbdis^2-190\cdot pbdis\cdot pbreg+95\cdot pbreg^2+5376))^2\\
&bdis\cdot pbreg+5\cdot pbreg^2+304)+80\cdot pareg^2\cdot(315\cdot pbdis^4-1260\cdot pbdis^3\cdot pbreg+2\cdot pbdis^2\cdot(945\cdot pbreg^2+18476)-4\cdot pbdis\cdot pbreg\cdot(315\cdot pbreg^2+18476)+315\cdot pbreg^4+36952\cdot pbreg^2+\\
&1083200)-512\cdot(3\cdot pbdis^2-6\cdot pbdis\cdot pbreg+3\cdot pbreg^2+190)\cdot(95\cdot pbdis^2-190\cdot pbdis\cdot pbreg+95\cdot pbreg^2+5376))}\\
&-\frac{-pareg^3\cdot(5\cdot padis^2\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)^2-20\cdot padis^2\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)\cdot(4\cdot pareg+5\cdot(pbdis^2-2\cdot pbdis\cdot pbreg+pbreg^2+}{20\cdot e^{pareg}}\\
&60))-padis\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)\cdot(25\cdot pareg^2\cdot(3\cdot pbdis^2-6\cdot pbdis\cdot pbreg+3\cdot pbreg^2+176)-10\cdot pareg\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)-\\
&(5\cdot padis^2\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)-10\cdot padis\cdot pareg\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)+5\cdot\\
&16\cdot(95\cdot pbdis^2-190\cdot pbdis\cdot pbreg+95\cdot pbreg^2+5376))+2\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+296)\cdot(5\cdot pareg^3\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)+5\cdot pareg^2\cdot(5\cdot p\\
&pareg^2\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)+16\cdot(95\cdot pbdis^2-190\cdot pbdis\cdot pbreg+95\cdot pbreg^2+5376))^2\\
&bdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)+16\cdot pareg\cdot(95\cdot pbdis^2-190\cdot pbdis\cdot pbreg+95\cdot pbreg^2+5376)-16\cdot(95\cdot pbdis^2-190\cdot pbdis\cdot pbreg+95\cdot pbreg^2+5376)))\\
&+\frac{-pbdis^4\cdot(5\cdot padis^2\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)-20\cdot padis^3\cdot pareg\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)+2\cdot padis^2\cdot(15\cdot pareg^2\cdot(5\cdot pbdis^2-10\cdot pbdis}{40\cdot e^{pbdis}}
\end{aligned}
$$

$$\cdot pbreg + 5\cdot pbreg^2 + 304) + 25\cdot pbdis^4 - 100\cdot pbdis^3\cdot pbreg + 30\cdot pbdis^2\cdot(5\cdot pbreg^2 + 18) - 20\cdot pbdis\cdot pbreg\cdot(5\cdot pbreg^2 + 54) + 25\cdot pbreg^4 + 540\cdot pbreg^2 - 62784) - 5\cdot padis\cdot pareg\cdot(4\cdot pa$$

$$(5\cdot padis^2\cdot(5\cdot pbdis^2 - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^2 + 304)$$

$$reg^2\cdot(5\cdot pbdis^2 - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^2 + 304) + 5\cdot pbdis^4 - 20\cdot pbdis^3\cdot pbreg + 2\cdot pbdis^2\cdot(15\cdot pbreg^2 + 512) - 4\cdot pbdis\cdot pbreg\cdot(5\cdot pbreg^2 + 512) + 5\cdot pbreg^4 + 1024\cdot pbreg^2 + 3865$$

$$- 10\cdot padis\cdot pareg\cdot(5\cdot pbdis^2 - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^2 + 304) + 5\cdot pareg^2\cdot(5\cdot pbdis^2 - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^2 + 304) + 16\cdot(95\cdot pbdis^2 - 190\cdot pbdis\cdot pbreg + 95\cdot pbreg^2 + 5376)$$

$$6) + 5\cdot pareg^4\cdot(5\cdot pbdis^2 - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^2 + 304) - pareg^2\cdot(25\cdot pbdis^4 - 100\cdot pbdis^3\cdot pbreg + 10\cdot pbdis^2\cdot(15\cdot pbreg^2 - 404) + 20\cdot pbdis\cdot pbreg\cdot(404 - 5\cdot pbreg^2) + 25\cdot pbreg$$

$$)^2$$

$$^4 - 4040\cdot pbreg^2 - 318848) + 16\cdot(pbdis^2 - 2\cdot pbdis\cdot pbreg + pbreg^2 - 40)\cdot(95\cdot pbdis^2 - 190\cdot pbdis\cdot pbreg + 95\cdot pbreg^2 + 5376))$$

$$+$$

$$4\cdot\hat{e}^{-pbreg}\cdot(25\cdot padis^4\cdot(5\cdot pbdis^2 - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^2 + 304) - 100\cdot padis^3\cdot pareg\cdot(5\cdot pbdis^2 - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^2 + 304) + 10\cdot padis^2\cdot(15\cdot pareg^2\cdot(5\cdot pbdis^2 - 10\cdot pbd$$

$$(5\cdot padi$$

$$is\cdot pbreg + 5\cdot pbreg^2 + 304) - 16\cdot(155\cdot pbdis^2 - 310\cdot pbdis\cdot pbreg + 155\cdot pbreg^2 + 9624)) - 20\cdot padis\cdot pareg\cdot(5\cdot pareg^2\cdot(5\cdot pbdis^2 - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^2 + 304) + 8\cdot(65\cdot pbdis^2 -$$

$$s^2\cdot(5\cdot pbdis^2 - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^2 + 304) - 10\cdot padis\cdot pareg\cdot(5\cdot pbdis^2 - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^2 + 304) + 5\cdot pareg^2\cdot(5\cdot pbdis^2 - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^2 + 304) + 16\cdot($$

$$130\cdot pbdis\cdot pbreg + 65\cdot pbreg^2 + 3152)) + 25\cdot pareg^4\cdot(5\cdot pbdis^2 - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^2 + 304) + 640\cdot pareg^2\cdot(55\cdot pbdis^2 - 110\cdot pbdis\cdot pbreg + 55\cdot pbreg^2 + 3194) - 7936\cdot(95\cdot pbdi$$

$$95\cdot pbdis^2 - 190\cdot pbdis\cdot pbreg + 95\cdot pbreg^2 + 5376))^2$$

$$s^2 - 190\cdot pbdis\cdot pbreg + 95\cdot pbreg^2 + 5376))$$

,

$$\hat{e}^{-padis}\cdot(25\cdot padis^4\cdot pareg\cdot(pbdis^2 - 2\cdot pbdis\cdot pbreg + pbreg^2 + 60)\cdot(5\cdot pbdis^2 - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^2 + 304) - 100\cdot padis^3\cdot(5\cdot pbdis^2 - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^2 + 304)\cdot(par$$

$$eg^2\cdot(pbdis^2 - 2\cdot pbdis\cdot pbreg + pbreg^2 + 60) + 2\cdot(5\cdot pbdis^2 - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^2 + 296)) + 10\cdot padis^2\cdot(15\cdot pareg^2\cdot(pbdis^2 - 2\cdot pbdis\cdot pbreg + pbreg^2 + 60)\cdot(5\cdot pbdis^2 - 10\cdot pb$$

$$dis\cdot pbreg + 5\cdot pbreg^2 + 304) + 16\cdot pareg\cdot(95\cdot pbdis^4 - 380\cdot pbdis^3\cdot pbreg + 2\cdot pbdis^2\cdot(285\cdot pbreg^2 + 5588) - 4\cdot pbdis\cdot pbreg\cdot(95\cdot pbreg^2 + 5588) + 95\cdot pbreg^4 + 11176\cdot pbreg^2 + 328480)$$

$$- 20\cdot(5\cdot pbdis^2 - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^2 + 296)\cdot(5\cdot pbdis^2 - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^2 + 304)) - 20\cdot padis\cdot(5\cdot pareg^4\cdot(pbdis^2 - 2\cdot pbdis\cdot pbreg + pbreg^2 + 60)\cdot(5\cdot pbdis^2 - 10\cdot p$$

$$bdis\cdot pbreg + 5\cdot pbreg^2 + 304) + 2\cdot pareg^2\cdot(385\cdot pbdis^4 - 1540\cdot pbdis^3\cdot pbreg + 14\cdot pbdis^2\cdot(165\cdot pbreg^2 + 3172) - 28\cdot pbdis\cdot pbreg\cdot(55\cdot pbreg^2 + 3172) + 385\cdot pbreg^4 + 44408\cdot pbreg^2 + 12$$

$$(5\cdot padis^2\cdot(5\cdot pbdis^2 - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^2 + 304) - 10\cdot padis\cdot pareg\cdot(5\cdot pbdis^2 - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^2 + 304) + 5\cdot pareg^2\cdot(5\cdot pbdis^2 - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg$$

$$\frac{78080) + 40\cdot pareg\cdot(5\cdot pbdis^{2} - 10\cdot pbdis\cdot pbreg + 5\cdot pbreg^{2} + 296)^{2} + 32\cdot(5\cdot pbdis^{2} - 10\cdot pbdi}{2 + 304) + 16\cdot(95\cdot pbdis^{2} - 190\cdot pbdis\cdot pbreg + 95\cdot pbreg^{2} + 5376))^{2}}$$

#31: "Because the coefficients are symmetric, we seek symmetric solutions pareg=pbreg=p, and padis=pbdis=d, of these first order conditions" User

Sub(#30)

#32:

$$\frac{-d^4\cdot(25\cdot d^2\cdot(d^2-2\cdot d\cdot r+r^2+60)\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)-100\cdot d^3\cdot r\cdot(d^2-2\cdot d\cdot r+r^2+60)\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+10\cdot d^2\cdot(d^2-2\cdot d\cdot r+r^2+60)\cdot(15\cdot r^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)-32\cdot(15\cdot d^2-30\cdot d\cdot r+15\cdot r^2+1012))-20\cdot d\cdot r\cdot(5\cdot r^2\cdot(d^2-2\cdot d\cdot r+r^2+60)\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+4\cdot(255\cdot d^4-1020\cdot d^3\cdot r+18\cdot d^2\cdot(85\cdot r^2+1628)\cdot(5\cdot d^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)-10\cdot d\cdot r\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+5\cdot r^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)-12\cdot d\cdot r\cdot(85\cdot r^2+4884)+255\cdot r^4+29304\cdot r^2+840320))+25\cdot r^4\cdot(d^2-2\cdot d\cdot r+r^2+60)\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+80\cdot r^2\cdot(315\cdot d^4-1260\cdot d^3\cdot r+2\cdot d^2\cdot(945\cdot r^2+18476)-4\cdot d\cdot r\cdot(315\cdot r^2+18476)+315\cdot r^4+36952\cdot r^2+1083200)-512\cdot(3\cdot d^2-6\cdot d\cdot r+3\cdot r^2+190)\cdot(95\cdot d^2-190\cdot d\cdot r+95\cdot r^2+5376))}{(r^2+304)+16\cdot(95\cdot d^2-190\cdot d\cdot r+95\cdot r^2+5376))^2}$$

$$-\frac{-r^3\cdot(5\cdot d^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)^2-20\cdot d^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)\cdot(4\cdot r+5\cdot(d^2-2\cdot d\cdot r+r^2+60))-d\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)\cdot(25\cdot r^2\cdot(3\cdot d^2-6\cdot d\cdot r+3\cdot r^2+176)-10\cdot r\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)-16\cdot(95\cdot d^2-190\cdot d\cdot r+95\cdot r^2+5376))+2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+296)\cdot(5\cdot r^3\cdot(5\cdot d^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+5\cdot r^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)-10\cdot d\cdot r\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+5\cdot r^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+16\cdot(95\cdot d^2-190\cdot d\cdot r+95\cdot r^2+5376))^2\cdot r+5\cdot r^2+304)+16\cdot r\cdot(95\cdot d^2-190\cdot d\cdot r+95\cdot r^2+5376)-16\cdot(95\cdot d^2-190\cdot d\cdot r+95\cdot r^2+5376)))}{}+$$

$$\frac{-d^4\cdot(5\cdot d^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)-20\cdot d^3\cdot r\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+2\cdot d^2\cdot(15\cdot r^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+25\cdot d^4-100\cdot d^3\cdot r+30\cdot d^2\cdot(5\cdot r^2+18)-20\cdot d\cdot r\cdot(5\cdot r^2+54)+25\cdot r^4+540\cdot r^2-62784)-5\cdot d\cdot r\cdot(4\cdot r\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+5\cdot d^4-20\cdot d^3\cdot r+2\cdot d^2\cdot(15\cdot r^2+512)-4\cdot d\cdot r\cdot(5\cdot r^2+512)+5\cdot r^4+1024\cdot r^2+38656)+5\cdot r^4\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)-r^2\cdot(25\cdot d^4-100\cdot d^3\cdot r+10\cdot d^2\cdot(15\cdot r^2-404)+20\cdot d\cdot r\cdot(404-5\cdot r^2)+25\cdot r^4-4040\cdot r^2-318848)+16\cdot(d^2-2\cdot d\cdot r+r^2-40)\cdot(95\cdot d^2-190\cdot d\cdot r+95\cdot r^2+5376))}{(5\cdot d^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)-10\cdot d\cdot r\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+5\cdot r^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+16\cdot(95\cdot d^2-190\cdot d\cdot r+95\cdot r^2+5376))^2}+$$

$$\frac{4\cdot e^{-r}\cdot(25\cdot d^4\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)-100\cdot d^3\cdot r\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+10\cdot d^2\cdot(15\cdot r^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)-16\cdot(155\cdot d^2-310\cdot d\cdot r+155\cdot r^2+9624))-20\cdot d\cdot r\cdot(5\cdot r^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+8\cdot(65\cdot d^2-130\cdot d\cdot r+65\cdot r^2+3152))+25\cdot r^4\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+640\cdot r^2\cdot(55\cdot d^2-110\cdot d\cdot r+55\cdot r^2+3194)-7936\cdot(95\cdot d^2-190\cdot d\cdot r+95\cdot r^2+5376))}{(5\cdot d^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)-10\cdot d\cdot r\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+5\cdot r^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+16\cdot(95\cdot d^2-190\cdot d\cdot r+95\cdot r^2+5376))^2},$$

$$\frac{e^{-d}\cdot(25\cdot d^4\cdot r\cdot(d^2-2\cdot d\cdot r+r^2+60)\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)-100\cdot d^3\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)\cdot(r^2\cdot(d^2-2\cdot d\cdot r+r^2+60)+2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+296))+10\cdot d^2\cdot(15\cdot r^3\cdot(d^2-2\cdot d\cdot r+r^2+60)\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+16\cdot r\cdot(95\cdot d^4-380\cdot d^3\cdot r+2\cdot d^2\cdot(285\cdot r^2+5588)-4\cdot d\cdot r\cdot(95\cdot r^2+5588)+95\cdot r^4+11176\cdot r^2+328480)-20\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+296)\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304))-20\cdot d\cdot(5\cdot r\cdot(d^2-2\cdot d\cdot r+r^2+60)\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+2\cdot r^2\cdot(385\cdot d^4-1540\cdot d^3\cdot r+14\cdot d^2\cdot(165\cdot r^2+3172)-28\cdot d\cdot r\cdot(55\cdot r^2+3172)+385\cdot r^4+44408\cdot r^2+1278080)+40\cdot r\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+296)^2+32\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+296)\cdot(95\cdot d^2-190\cdot d\cdot r+95\cdot r^2+5376))+25\cdot r^2\cdot(d^2-2\cdot d\cdot r+r^2+60)\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+80\cdot r^3\cdot(65\cdot d^4-260\cdot d^3\cdot r+2\cdot d^2\cdot(195\cdot r^2+3676)-4\cdot d\cdot r\cdot(65\cdot r^2+3676)+65\cdot r^4+7352\cdot r^2+207040)+200\cdot r^2\cdot(125\cdot d^4-500\cdot d^3\cdot r+10\cdot d^2\cdot(75\cdot r^2+1484)-20\cdot d\cdot r\cdot(25\cdot r^2+1484)+125\cdot r^4+14840\cdot r^2+440448)-512\cdot r\cdot(3\cdot d^2-6\cdot d\cdot r+3\cdot r^2+190)\cdot(95\cdot d^2-190\cdot d\cdot r+95\cdot r^2+5376)+640\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+296)\cdot(95\cdot d^2-190\cdot d\cdot r+95\cdot r^2+5376))}{(5\cdot d^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)-10\cdot d\cdot r\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+5\cdot r^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+16\cdot(95\cdot d^2-190\cdot d\cdot r+95\cdot r^2+5376))^2}-$$

$$\frac{20\cdot e^{-r}\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)\cdot(5\cdot d^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+20\cdot d\cdot r\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+296)-5\cdot r^2\cdot(25\cdot d^2-50\cdot d\cdot r+25\cdot r^2+1488)-16\cdot(95\cdot d^2-190\cdot d\cdot r+95\cdot r^2+5376))}{(5\cdot d^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)-10\cdot d\cdot r\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+5\cdot r^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+16\cdot(95\cdot d^2-190\cdot d\cdot r+95\cdot r^2+5376))^2}-$$

$$\frac{4\cdot e^{-d}\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2-496)\cdot(5\cdot d^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+20\cdot d\cdot r\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+296)-5\cdot r^2\cdot(25\cdot d^2-50\cdot d\cdot r+25\cdot r^2+1488)-16\cdot(95\cdot d^2-190\cdot d\cdot r+95\cdot r^2+5376))}{(5\cdot d^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)-10\cdot d\cdot r\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+5\cdot r^2\cdot(5\cdot d^2-10\cdot d\cdot r+5\cdot r^2+304)+16\cdot(95\cdot d^2-190\cdot d\cdot r+95\cdot r^2+5376))^2}$$

$$\frac{95\cdot r^2 + 5376))}{} +$$

$$\frac{1600\cdot \hat{e}^{-r}\cdot(5\cdot d^2\cdot(5\cdot d^2 - 10\cdot d\cdot r + 5\cdot r^2 + 304) + 20\cdot d\cdot r\cdot(5\cdot d^2 - 10\cdot d\cdot r + 5\cdot r^2 + 296) - 5\cdot r^2\cdot(25\cdot d^2 - 50\cdot d\cdot r + 25\cdot r^2 + 1488) - 16\cdot(95\cdot d^2 - 190\cdot d\cdot r + 95\cdot r^2 + 5376))}{(5\cdot d^2\cdot(5\cdot d^2 - 10\cdot d\cdot r + 5\cdot r^2 + 304) - 10\cdot d\cdot r\cdot(5\cdot d^2 - 10\cdot d\cdot r + 5\cdot r^2 + 304) + 5\cdot r^2\cdot(5\cdot d^2 - 10\cdot d\cdot r + 5\cdot r^2 + 304) + 16\cdot(95\cdot d^2 - 190\cdot d\cdot r + 95\cdot r^2 + 5376))^2}$$

6.1s Simp(#32)

#33:

$$\frac{\hat{e}^{-d}\cdot(25\cdot d^6 - 150\cdot d^5\cdot r + 5\cdot d^4\cdot(75\cdot r^2 + 68) - 20\cdot d^3\cdot r\cdot(25\cdot r^2 + 398) + d^2\cdot(375\cdot r^4 + 21840\cdot r^2 - 108544) - 2\cdot d\cdot r\cdot(75\cdot r^4 + 10580\cdot r^2 + 88576) + 25\cdot r^6 + 6940\cdot r^4 + 285696\cdot r^2 - 1720}{(5\cdot d^2 - 10\cdot d\cdot r + 5\cdot r^2 + 224)\cdot(5\cdot d^2 - 10\cdot d\cdot r + 5\cdot r^2 + 384)^2}$$

$$\frac{320)}{} -$$

$$\frac{4\cdot \hat{e}^{-r}\cdot(125\cdot d^5 - 25\cdot d^4\cdot(10\cdot r + 21) - 50\cdot d^3\cdot(5\cdot r^2 - 27\cdot r - 344) + 20\cdot d^2\cdot(50\cdot r^3 - 45\cdot r^2 - 20\cdot r - 2432) - 5\cdot d\cdot(175\cdot r^4 + 30\cdot r^3 + 10160\cdot r^2 - 10496\cdot r - 116736) + 250\cdot r^5 + 225\cdot r^4}{(5\cdot d^2 - 10\cdot d\cdot r + 5\cdot r^2 + 224)\cdot(5\cdot d^2 - 10\cdot d\cdot r + 5\cdot r^2 + 384)^2}$$

$$\frac{+ 34000\cdot r^3 - 3840\cdot r^2 + 1136640\cdot r - 946176)}{},$$

$$\frac{\hat{e}^{-d}\cdot(25\cdot d^6\cdot r - 50\cdot d^5\cdot(3\cdot r^2 + 20) + 5\cdot d^4\cdot(75\cdot r^3 + 1388\cdot r - 220) - 20\cdot d^3\cdot(25\cdot r^4 + 888\cdot r^2 + 110\cdot r + 6800) + d^2\cdot r\cdot(375\cdot r^4 + 21640\cdot r^2 + 13200\cdot r + 319936) - 2\cdot d\cdot(75\cdot r^6 + 6380\cdot r^4}{(5\cdot d^2 - 10\cdot d\cdot r + 5\cdot r^2 + 224)\cdot(5\cdot d^2 - 10\cdot d\cdot r + 5\cdot r^2 + 38}$$

$$\frac{+ 7700\cdot r^3 + 115936\cdot r^2 + 197120\cdot r + 2273280) + 25\cdot r^7 + 2940\cdot r^5 + 5500\cdot r^4 + 47936\cdot r^3 + 394240\cdot r^2 - 2334720\cdot r + 3784704)}{4)^2} -$$

$$\frac{20\cdot \hat{e}^{-r}\cdot(25\cdot d^4 + 50\cdot d^3\cdot r - 300\cdot d^2\cdot r^2 + 70\cdot d\cdot r\cdot(5\cdot r^2 + 128) - 125\cdot r^4 - 1792\cdot(5\cdot r^2 + 48))}{(5\cdot d^2 - 10\cdot d\cdot r + 5\cdot r^2 + 224)\cdot(5\cdot d^2 - 10\cdot d\cdot r + 5\cdot r^2 + 384)^2}$$

User

#34:

$$\frac{-d}{\hat{e}}\cdot(25\cdot d^6 - 150\cdot d^5\cdot r + 5\cdot d^4\cdot(75\cdot r^2 + 68) - 20\cdot d^3\cdot r\cdot(25\cdot r^2 + 398) + d^2\cdot(375\cdot r^4 + 21840\cdot r^2 - 108544) - 2\cdot d\cdot r\cdot(75\cdot r^4 + 10580\cdot r^2 + 88576) + 25\cdot r^6 + 6940\cdot r^4 + 285696\cdot r^2 - 172032)$$

$$\frac{}{(5\cdot d^2 - 10\cdot d\cdot r + 5\cdot r^2 + 224)\cdot(5\cdot d^2 - 10\cdot d\cdot r + 5\cdot r^2 + 384)^2} -$$

$$\frac{-r}{4\cdot\hat{e}}\cdot(125\cdot d^5 - 25\cdot d^4\cdot(10\cdot r + 21) - 50\cdot d^3\cdot(5\cdot r^2 - 27\cdot r - 344) + 20\cdot d^2\cdot(50\cdot r^3 - 45\cdot r^2 - 20\cdot r - 2432) - 5\cdot d\cdot(175\cdot r^4 + 30\cdot r^3 + 10160\cdot r^2 - 10496\cdot r - 116736) + 250\cdot r^5 + 225\cdot r^4$$

$$+ 34000\cdot r^3 - 3840\cdot r^2 + 1136640\cdot r - 946176)$$

$$\frac{}{(5\cdot d^2 - 10\cdot d\cdot r + 5\cdot r^2 + 224)\cdot(5\cdot d^2 - 10\cdot d\cdot r + 5\cdot r^2 + 384)^2} = 0,$$

$$\frac{-d}{\hat{e}}\cdot(25\cdot d^6\cdot r - 50\cdot d^5\cdot(3\cdot r^2 + 20) + 5\cdot d^4\cdot(75\cdot r^3 + 1388\cdot r - 220) - 20\cdot d^3\cdot(25\cdot r^4 + 888\cdot r^2 + 110\cdot r + 6800) + d^2\cdot r\cdot(375\cdot r^4 + 21640\cdot r^2 + 13200\cdot r + 319936) - 2\cdot d\cdot(75\cdot r^6 + 6380\cdot r^4$$

$$+ 7700\cdot r^3 + 115936\cdot r^2 + 197120\cdot r + 2273280) + 25\cdot r^7 + 2940\cdot r^5 + 5500\cdot r^4 + 47936\cdot r^3 + 394240\cdot r^2 - 2334720\cdot r + 3784704)$$

$$\frac{}{(5\cdot d^2 - 10\cdot d\cdot r + 5\cdot r^2 + 224)\cdot(5\cdot d^2 - 10\cdot d\cdot r + 5\cdot r^2 + 384)^2} -$$

$$\frac{-r}{20\cdot\hat{e}}\cdot(25\cdot d^4 + 50\cdot d^3\cdot r - 300\cdot d^2\cdot r^2 + 70\cdot d\cdot r\cdot(5\cdot r^2 + 128) - 125\cdot r^4 - 1792\cdot(5\cdot r^2 + 48))$$

$$\frac{}{(5\cdot d^2 - 10\cdot d\cdot r + 5\cdot r^2 + 224)\cdot(5\cdot d^2 - 10\cdot d\cdot r + 5\cdot r^2 + 384)^2} = 0$$

User

#35: "When we solve these equations numerically we find two solutions:a constant price solution at r=d=0.8 and a two price solution at r=1.12, d=0.539. We first investigate the constant price solution d=r analytically, and verify thatit occurs at d=r=4/5=0.8"

Sub(#34)

#36:

$$\left[-\frac{e^{-r}\cdot(25\cdot r^6-150\cdot r^5\cdot r+5\cdot r^4\cdot(75\cdot r^2+68)-20\cdot r^3\cdot r\cdot(25\cdot r^2+398)+r^2\cdot(375\cdot r^4+21840\cdot r^2-108544)-2\cdot r\cdot r\cdot(75\cdot r^4+10580\cdot r^2+88576)+25\cdot r^6+6940\cdot r^4+285696\cdot r^2-172032)}{(5\cdot r^2-10\cdot r\cdot r+5\cdot r^2+224)\cdot(5\cdot r^2-10\cdot r\cdot r+5\cdot r^2+384)^2}-\frac{4\cdot e^{-r}\cdot(125\cdot r^5-25\cdot r^4\cdot(10\cdot r+21)-50\cdot r^3\cdot(5\cdot r^2-27\cdot r-344)+20\cdot r^2\cdot(50\cdot r^3-45\cdot r^2-20\cdot r-2432)-5\cdot r\cdot(175\cdot r^4+30\cdot r^3+10160\cdot r^2-10496\cdot r-116736)+250\cdot r^5+225\cdot r^4+34000\cdot r^3-3840\cdot r^2+1136640\cdot r-946176)}{(5\cdot r^2-10\cdot r\cdot r+5\cdot r^2+224)\cdot(5\cdot r^2-10\cdot r\cdot r+5\cdot r^2+384)^2}=0,\ \frac{e^{-r}\cdot(25\cdot r^6\cdot r-50\cdot r^5\cdot(3\cdot r^2+20)+5\cdot r^4\cdot(75\cdot r^3+1388\cdot r-220)-20\cdot r^3\cdot(25\cdot r^4+888\cdot r^2+110\cdot r+6800)+r^2\cdot r\cdot(375\cdot r^4+21640\cdot r^2+13200\cdot r+319936)-2\cdot r\cdot(75\cdot r^6+6380\cdot r^4+7700\cdot r^3+115936\cdot r^2+197120\cdot r+2273280)+25\cdot r^7+2940\cdot r^5+5500\cdot r^4+47936\cdot r^3+394240\cdot r^2-2334720\cdot r+3784704)}{(5\cdot r^2-10\cdot r\cdot r+5\cdot r^2+224)\cdot(5\cdot r^2-10\cdot r\cdot r+5\cdot r^2+384)^2}-\frac{20\cdot e^{-r}\cdot(25\cdot r^4+50\cdot r^3\cdot r-300\cdot r^2\cdot r^2+70\cdot r\cdot r\cdot(5\cdot r^2+128)-125\cdot r^4-1792\cdot(5\cdot r^2+48))}{(5\cdot r^2-10\cdot r\cdot r+5\cdot r^2+224)\cdot(5\cdot r^2-10\cdot r\cdot r+5\cdot r^2+384)^2}=0\right]$$

#37:

$$\left[\frac{e^{-r}\cdot(4-5\cdot r)}{24}=0,\ \frac{e^{-r}\cdot(4-5\cdot r)}{24}=0\right]$$

0.2s Simp(#36)

Sub(#27)

#38:
$$\frac{\hat{e}^{-0.8-0.8-0.8-0.8\cdot 0.8-0.8\cdot 0.8-0.8\cdot 0.8}\cdot(\hat{e}^{0.8\cdot 0.8}\cdot(\hat{e}^{0.8\cdot 0.8}\cdot(4\cdot\hat{e}^{0.8\cdot 0.8}\cdot(5\cdot 0.8^2\cdot 0.8-10\cdot 0.8\cdot(0.8^2+40)+0.8\cdot(5\cdot 0.8^2-496))+4\cdot\hat{e}^{0.8\cdot 0.8}\cdot(10\cdot 0.8^2\cdot 0.8-0.8\cdot(20\cdot 0.8^2-5\cdot 0.8^2+10\cdot 0.8\cdot 0.8-5\cdot 0.8^2+496)+10\cdot 0.8\cdot(0.8^2+0.8^2-2\cdot 0.8\cdot 0.8+0.8^2-40)))+20\cdot\hat{e}^{0.8+0.8}\cdot(0.8\cdot(5\cdot 0.8^2-10\cdot 0.8\cdot 0.8+5\cdot 0.8^2+304)+2\cdot 0.8\cdot(5\cdot 0.8^2-10\cdot 0.8\cdot 0.8+5\cdot 0.8^2+296)))-\hat{e}^{0.8+0.8+0.8+0.8}\cdot(5\cdot 0.8^2\cdot(5\cdot 0.8^2-10\cdot 0.8\cdot 0.8+5\cdot 0.8^2+304)-10\cdot 0.8\cdot 0.8\cdot(5\cdot 0.8^2-10\cdot 0.8\cdot 0.8+5\cdot 0.8^2+304)+5\cdot 0.8^2\cdot(5\cdot 0.8^2-10\cdot 0.8\cdot 0.8+5\cdot 0.8^2+304)+16\cdot(95\cdot 0.8^8\cdot(5\cdot 0.8^2\cdot 0.8\cdot(0.8^2-2\cdot 0.8\cdot 0.8+0.8^2+60)-10\cdot 0.8\cdot(0.8^2\cdot(0.8^2-2\cdot 0.8\cdot 0.8+0.8^2+60)+4\cdot(5\cdot 0.8^2-10\cdot 0.8\cdot 0.8+5\cdot 0.8^2+296))+0.8\cdot(5\cdot 0.8^2\cdot(0.8^2-2\cdot 0.8\cdot 0.8+0.8^2+60)-32\cdot(3\cdot 0.8^2-6\cdot 0.8\cdot 0.8+3\cdot 0.8^2+190))))}{-190\cdot 0.8\cdot 0.8+95\cdot 0.8^2+5376)}$$

#39:
$$\frac{4\cdot\hat{e}^{-4/5}}{15}$$

0.1s Simp(#38)

User

#40:
$$\frac{\hat{e}^{-padis-pareg-pbdis-pbreg}\cdot(\hat{e}^{padis\cdot pareg}\cdot(\hat{e}^{pbdis^2\cdot pareg-10\cdot padis\cdot(pareg^2+40)+pareg\cdot(5\cdot pareg^2-496)}\cdot(4\cdot\hat{e}^{pbreg^2\cdot(10\cdot padis\cdot pareg-padis\cdot(20\cdot pareg^2-5\cdot pbdis^2+10\cdot pbdis\cdot pbreg-5\cdot pbreg^2+496)+10\cdot pareg\cdot(pareg^2+pbdis^2-2\cdot pbdis\cdot pbreg+pbreg^2-40)))+20\cdot\hat{e}^{pbdis+pbreg}\cdot(padis\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)-10\cdot padis\cdot pareg\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)+2\cdot pareg\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+296)))-\hat{e}^{pareg+pbdis+pbreg}\cdot(5\cdot padis^2\cdot pareg\cdot(pbdis^2-2\cdot pbdis\cdot pbreg+pbreg^2+60)-10\cdot padis\cdot(pareg^2\cdot(pbdis^2-2\cdot pbdis\cdot pbreg+pbreg^2+60)+4\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+296))+pareg\cdot(5\cdot pareg^2\cdot(pbdis^2-2\cdot pbdis\cdot pbreg+pbreg^2+60)-32\cdot(3\cdot pbdis^2-6\cdot pbdis\cdot pbreg+3\cdot pbreg^2+190))))}{5\cdot pbdis^2+10\cdot pbdis\cdot pbreg-5\cdot pbreg^2+496)+10\cdot pareg\cdot(pareg^2+pbdis^2-2\cdot pbdis\cdot pbreg+pbreg^2-40)))+20\cdot\hat{e}^{pbdis+pbreg}\cdot(padis\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)-10\cdot padis\cdot pareg\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)+2\cdot pareg\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+296)))-\hat{e}^{pareg+pbdis+pbreg}\cdot(5\cdot padis^2\cdot pareg\cdot(pbdis^2-2\cdot pbdis\cdot pbreg+pbreg^2+60)-10\cdot padis\cdot(pareg^2\cdot(pbdis^2-2\cdot pbdis\cdot pbreg+pbreg^2+60)+4\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+296))+pareg\cdot(5\cdot pareg^2\cdot(pbdis^2-2\cdot pbdis\cdot pbreg+pbreg^2+60)-32\cdot(3\cdot pbdis^2-6\cdot pbdis\cdot pbreg+3\cdot pbreg^2+190))))}{5\cdot pbdis^2+10\cdot pbdis\cdot pbreg-5\cdot pbreg^2+496)+10\cdot pareg\cdot(pareg^2+pbdis^2-2\cdot pbdis\cdot pbreg+pbreg^2-40)))+20\cdot\hat{e}^{pbdis+pbreg}\cdot(padis\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)-10\cdot padis\cdot pareg\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+304)+2\cdot pareg\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+296)))-\hat{e}^{pareg+pbdis+pbreg}\cdot(5\cdot padis^2\cdot pareg\cdot(pbdis^2-2\cdot pbdis\cdot pbreg+pbreg^2+60)-10\cdot padis\cdot(pareg^2\cdot(pbdis^2-2\cdot pbdis\cdot pbreg+pbreg^2+60)+4\cdot(5\cdot pbdis^2-10\cdot pbdis\cdot pbreg+5\cdot pbreg^2+296))+pareg\cdot(5\cdot pareg^2\cdot(pbdis^2-2\cdot pbdis\cdot pbreg+pbreg^2+60)-32\cdot(3\cdot pbdis^2-6\cdot pbdis\cdot pbreg+3\cdot pbreg^2+190))))} = \frac{4\cdot\hat{e}^{-4/5}}{15}$$

User

#41: "This is the equation satisfied by those prices that lead to the same value of A's profit as does the constant price solution found above. We next investigate what happens when player B uses these constant prices but player A deviates from them."

Sub(#40)

#42:
$$\frac{\hat{e}^{-(\text{pareg}-\delta)-\text{pareg}-0.8-0.8}\cdot(\hat{e}^{\text{pareg}-\delta}\cdot(\hat{e}^{\text{pareg}}\cdot(4\cdot\hat{e}^{0.8}\cdot(5\cdot(\text{pareg}-\delta)^2\cdot\text{pareg}-10\cdot(\text{pareg}-\delta)\cdot(\text{pareg}^2+40)+\text{pareg}\cdot(5\cdot\text{pareg}^2-496))+4\cdot\hat{e}^{0.8}\cdot(10\cdot(\text{pareg}-\delta)^2\cdot\text{pareg}-(\text{pareg}-\delta)\cdot(20\cdot\text{pareg}^2-5\cdot0.8^2+10\cdot0.8\cdot0.8-5\cdot0.8^2+496)+10\cdot\text{pareg}\cdot(\text{pareg}^2+0.8^2-2\cdot0.8\cdot0.8+0.8^2-40)))+20\cdot\hat{e}^{0.8+0.8}\cdot((\text{pareg}-\delta)\cdot(5\cdot0.8^2-10\cdot0.8\cdot0.8+5\cdot0.8^2+304)-10\cdot(\text{pareg}-\delta)\cdot\text{pareg}\cdot(5\cdot0.8^2-10\cdot0.8\cdot0.8+5\cdot0.8^2+304)+5\cdot(\text{pareg}-\delta)^2\cdot(5\cdot0.8^2-10\cdot0.8\cdot0.8+5\cdot0.8^2+304)-10\cdot(\text{pareg}-\delta)\cdot\text{pareg}\cdot(5\cdot0.8^2-10\cdot0.8\cdot0.8+5\cdot0.8^2+304)+2\cdot\text{pareg}\cdot(5\cdot0.8^2-10\cdot0.8\cdot0.8+5\cdot0.8^2+296)))-\hat{e}^{\text{pareg}+0.8+0.8}\cdot(5\cdot(\text{pareg}-\delta)^2\cdot\text{pareg}\cdot(0.8^2-2\cdot0.8\cdot0.8+0.8^2+60)-10\cdot(\text{pareg}-\delta)\cdot(\text{pareg}^2\cdot(0.8^2-2\cdot0.8\cdot0.8+0.8^2+60)+4\cdot(5\cdot0.8^2-10\cdot0.8\cdot0.8+5\cdot0.8^2+296))+\text{pareg}\cdot(5\cdot\text{pareg}^2\cdot(0.8^2-2\cdot0.8\cdot0.8+0.8^2+60)-32\cdot(3\cdot0.8^2-6\cdot0.8\cdot0.8+3\cdot0.8^2+190))))}{5\cdot\text{pareg}^2\cdot(5\cdot0.8^2-10\cdot0.8\cdot0.8+5\cdot0.8^2+304)+16\cdot(95\cdot0.8^2-190\cdot0.8\cdot0.8+95\cdot0.8^2+5376)} = \frac{4\cdot\hat{e}^{-4/5}}{15}$$

User

#43: "When we graph this expression we see that there are points, with pareg larger than 0.8 and δ positive, which increase player A's profit. Thus the constant price solution found above is not a Nash equilibrium."

#44: "Finally. we investigate the two price solution r=1.12, d=0.539"

User

Sub(#27)

#45:
$$\frac{\hat{e}^{-\text{padis}-\text{pareg}-0.539-1.12}\cdot(\hat{e}^{\text{padis}}\cdot(\hat{e}^{\text{pareg}}\cdot(4\cdot\hat{e}^{0.539}\cdot(5\cdot\text{padis}^2\cdot\text{pareg}-10\cdot\text{padis}\cdot(\text{pareg}^2+40)+\text{pareg}\cdot(5\cdot\text{pareg}^2-496))+4\cdot\hat{e}^{1.12}\cdot(10\cdot\text{padis}^2\cdot\text{pareg}-\text{padis}\cdot(20\cdot\text{pareg}^2-5\cdot0.539^2+10\cdot0.539\cdot1.12-5\cdot1.12^2+496)+10\cdot\text{pareg}\cdot(\text{pareg}^2+0.539^2-2\cdot0.539\cdot1.12+1.12^2-40)))+20\cdot\hat{e}^{0.539+1.12}\cdot(\text{padis}\cdot(5\cdot0.539^2-10\cdot0.539\cdot1.12+5\cdot1.12^2+304)+5\cdot\text{padis}^2\cdot(5\cdot0.539^2-10\cdot0.539\cdot1.12+5\cdot1.12^2+304)-10\cdot\text{padis}\cdot\text{pareg}\cdot(5\cdot0.539^2-10\cdot0.539\cdot1.12+5\cdot1.12^2+304)+\text{pareg}\cdot(5\cdot0.539^2-10\cdot0.539\cdot1.12+5\cdot1.12^2+296)))-\hat{e}^{\text{pareg}+0.539+1.12}\cdot(5\cdot\text{padis}^2\cdot\text{pareg}\cdot(0.539^2-2\cdot0.539\cdot1.12+1.12^2+60)-10\cdot\text{padis}\cdot(\text{pareg}^2\cdot(0.539^2-2\cdot0.539\cdot1.12+1.12^2+60)+4\cdot(5\cdot0.539^2-10\cdot0.539\cdot1.12+5\cdot1.12^2+296))+\text{pareg}\cdot(5\cdot\text{pareg}^2\cdot(0.539^2-2\cdot0.539\cdot1.12+1.12^2+60)-32\cdot(3\cdot0.539^2-6\cdot0.539\cdot1.12+3\cdot1.12^2+190))))}{5\cdot\text{padis}^2\cdot(5\cdot0.539^2-10\cdot0.539\cdot1.12+5\cdot1.12^2+304)-10\cdot\text{padis}\cdot\text{pareg}\cdot(5\cdot0.539^2-10\cdot0.539\cdot1.12+5\cdot1.12^2+304)+\text{pareg}\cdot(5\cdot0.539^2-10\cdot0.539\cdot1.12+5\cdot1.12^2+296)))-\hat{e}^{\text{pareg}+0.539+1.12}\cdot(5\cdot\text{padis}^2\cdot\text{pareg}\cdot(0.539^2-2\cdot0.539\cdot1.12+1.12^2+60)-10\cdot\text{padis}\cdot(\text{pareg}^2\cdot(0.539^2-2\cdot0.539\cdot1.12+1.12^2+60)+4\cdot(5\cdot0.539^2-10\cdot0.539\cdot1.12+5\cdot1.12^2+296))+\text{pareg}\cdot(5\cdot\text{pareg}^2\cdot(0.539^2-2\cdot0.539\cdot1.12+1.12^2+60)-32\cdot(3\cdot0.539^2-6\cdot0.539\cdot1.12+3\cdot1.12^2+190))))}$$

Sub(#44)

#46:
$$\frac{e^{-0.539-1.12-0.539-1.12}\cdot\left(e^{0.539}\cdot\left(e^{1.12}\cdot\left(4\cdot e^{0.539}\cdot\left(5\cdot 0.539^2\cdot 1.12-10\cdot 0.539\cdot(1.12^2+40)+1.12\cdot(5\cdot 1.12^2-496)\right)+4\cdot e^{1.12}\cdot\left(10\cdot 0.539^2\cdot 1.12-0.539\cdot(20\cdot 1.12^2-5\cdot 0.539^2+10\cdot 0.539\cdot 1.12-5\cdot 1.12^2+496)+10\cdot 1.12\cdot(1.12^2+0.539^2-2\cdot 0.539\cdot 1.12+1.12^2-40)\right)\right)+20\cdot e^{0.539+1.12}\cdot\left(0.539\cdot\left(5\cdot 0.539^2-10\cdot 0.539\cdot 1.12+5\cdot 1.12^2+304\right)+2\cdot 1.12\cdot(5\cdot 0.539^2\cdot(5\cdot 0.539^2-10\cdot 0.539\cdot 1.12+5\cdot 1.12^2+304)-10\cdot 0.539\cdot 1.12\cdot(5\cdot 0.539^2-10\cdot 0.539\cdot 1.12+5\cdot 1.12^2+304)+5\cdot 1.12^2\cdot(5\cdot 0.539^2-10\cdot 0.539\cdot 1.12+5\cdot 1.12^2+296))-e^{1.12+0.539+1.12}\cdot(5\cdot 0.539^2\cdot 1.12\cdot(0.539^2-2\cdot 0.539\cdot 1.12+1.12^2+60)-10\cdot 0.539\cdot(1.12^2\cdot(0.539^2-2\cdot 0.539\cdot 1.12+1.12^2+60)+4\cdot(5\cdot 0.539^2-10\cdot 0.539\cdot 1.12+5\cdot 1.12^2+296))+1.12\cdot(5\cdot 1.12^2\cdot(0.539^2-2\cdot 0.539\cdot 1.12+1.12^2+60)-32\cdot(3\cdot 0.539^2-6\cdot 0.539\cdot 1.12+3\cdot 1.12^2+190))))}{(5\cdot 0.539^2-10\cdot 0.539\cdot 1.12+5\cdot 1.12^2+304)^2+16\cdot(95\cdot 0.539^2-190\cdot 0.539\cdot 1.12+95\cdot 1.12^2+5376)}$$

#47: 0.119984 0.1s Approx(#46)

User

#48:
$$\frac{e^{-padis-pareg-0.539-1.12}\cdot\left(e^{padis}\cdot\left(e^{pareg}\cdot\left(4\cdot e^{0.539}\cdot\left(5\cdot padis\cdot pareg^2-10\cdot padis\cdot(pareg^2+40)+pareg\cdot(5\cdot pareg^2-496)\right)+4\cdot e^{1.12}\cdot\left(10\cdot padis^2\cdot pareg^2-padis\cdot(20\cdot pareg^2-5\cdot 0.539^2+10\cdot 0.539\cdot 1.12-5\cdot 1.12^2+496)+10\cdot pareg\cdot(pareg^2+0.539^2-2\cdot 0.539\cdot 1.12+1.12^2-40)\right)\right)+20\cdot e^{0.539+1.12}\cdot\left(padis\cdot\left(5\cdot 0.539^2-10\cdot 0.539\cdot 1.12+5\cdot 1.12^2+304\right)+2\cdot 5\cdot padis^2\cdot(5\cdot 0.539^2-10\cdot 0.539\cdot 1.12+5\cdot 1.12^2+304)-10\cdot padis\cdot pareg\cdot(5\cdot 0.539^2-10\cdot 0.539\cdot 1.12+5\cdot 1.12^2+304)\cdot pareg\cdot(5\cdot 0.539^2-10\cdot 0.539\cdot 1.12+5\cdot 1.12^2+296))-e^{pareg+0.539+1.12}\cdot(5\cdot padis^2\cdot pareg\cdot(0.539^2-2\cdot 0.539\cdot 1.12+1.12^2+60)-10\cdot padis\cdot(pareg^2\cdot(0.539^2-2\cdot 0.539\cdot 1.12+1.12^2+60)+5\cdot pareg^2\cdot(5\cdot 0.539^2-10\cdot 0.539\cdot 1.12+5\cdot 1.12^2+304)+16\cdot(95\cdot 0.539^2-190\cdot 0.539\cdot 1.12+95\cdot 1.12^2+5376)+4\cdot(5\cdot 0.539^2-10\cdot 0.539\cdot 1.12+5\cdot 1.12^2+296))+pareg\cdot(5\cdot pareg^2\cdot(0.539^2-2\cdot 0.539\cdot 1.12+1.12^2+60)-32\cdot(3\cdot 0.539^2-6\cdot 0.539\cdot 1.12+3\cdot 1.12^2+190))))}{(5\cdot 0.539^2-10\cdot 0.539\cdot 1.12+5\cdot 1.12^2+304)^2+16\cdot(95\cdot 0.539^2-190\cdot 0.539\cdot 1.12+95\cdot 1.12^2+5376)}=$$

0.119984

User

#49: "This equation fixes pbreg=1.12 and pbdis=0.539 When we graph it to see if player A can do better, we find that he can not. Since the situation is symmetric, the same would also hold for player B. Thus this solution is a Nash equilibrium."