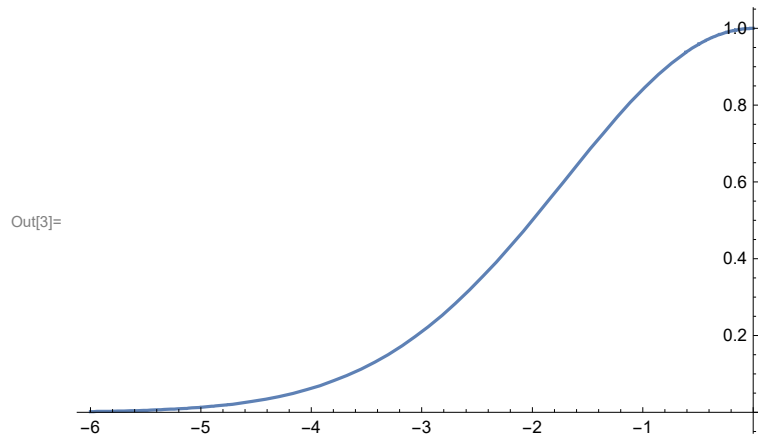In[1]:= `P[p_, p50_, b_] = (1 / 2) ^ ((p / p50) ^b)`

Out[1]= $2^{-\left(\frac{p}{p50}\right)^b}$

In[2]:= $2^{-\left(\frac{p}{p50}\right)^b}$

Out[2]= $2^{-\left(\frac{p}{p50}\right)^b}$

In[3]:= `Plot[P[p, -2, 2], {p, -6, 0}]`

Out[3]=

In[4]:= `Pp := Derivative[1, 0, 0][P]`

In[5]:= `Pp[p, p50, b]`

Out[5]= $-\dfrac{2^{-\left(\frac{p}{p50}\right)^b} b \left(\frac{p}{p50}\right)^{-1+b} \text{Log}[2]}{p50}$

In[6]:= `Ajm[gs1_, x1_] := gs1 ca (1 - x1) (x1 ca + 2 gstar) / (x1 ca (1 - br) - (gstar + br Km))`

In[7]:= `Ajm[gs, x]`

Out[7]= $\dfrac{\text{ca gs } (1 - x) \ (2 \text{ gstar} + \text{ca x})}{-\text{gstar} - \text{br Km} + (1 - \text{br}) \text{ ca x}}$

In[8]:= `Jmax[jm_] := 4 phi0 Iabs / Sqrt[(phi0 Iabs / jm)^2 - 1]`

In[9]:= `Jmax[Ajm]`

Out[9]= $\dfrac{4 \text{ Iabs phi0}}{\sqrt{-1 + \frac{\text{Iabs}^2 \text{ phi0}^2}{\text{Ajm}^2}}}$

In[10]:= `A[gs1_, x1_] := gs1 ca (1 - x1)`

In[11]:=

In[12]:= `A[gs, x]`

Out[12]= `ca gs (1 - x)`

In[13]:=

In[14]:= `(* K here is K/eta*)`
`gs[dpsi_] = K * (Pox - Ppox * dpsi / 2) * dpsi`

Out[14]= $\mathtt{dpsi\ K\ \left(Pox - \dfrac{dpsi\ Ppox}{2}\right)}$

In[15]:= `gs[dpsi] /. Pox → P[psoil, p50, b] /. Ppox → Pp[psoil, p50, b]`

Out[15]= $\mathtt{dpsi\ K\ \left(2^{-\left(\frac{psoil}{p50}\right)^{b}} + \dfrac{2^{-1-\left(\frac{psoil}{p50}\right)^{b}}\ b\ dpsi\ \left(\frac{psoil}{p50}\right)^{-1+b}\ Log[2]}{p50}\right)}$

In[16]:= `F[x_, dpsi_] := A[gs, x] - a Jmax[mj] - y dpsi^2`

In[17]:= `F[x, dpsi]`

Out[17]= $\mathtt{-\dfrac{4\ a\ Iabs\ phi0}{\sqrt{-1 + \frac{Iabs^{2}\ phi0^{2}}{mj^{2}}}} + ca\ gs\ (1 - x) - dpsi^{2}\ y}$

In[18]:= `F[x, dpsi] /. gs → gs[dpsi]`

Out[18]= $\mathtt{-\dfrac{4\ a\ Iabs\ phi0}{\sqrt{-1 + \frac{Iabs^{2}\ phi0^{2}}{mj^{2}}}} + ca\ dpsi\ K\ \left(Pox - \dfrac{dpsi\ Ppox}{2}\right)\ (1 - x) - dpsi^{2}\ y}$

In[19]:= `Fsubs[x_, dpsi_] := F[x, dpsi] /. gs → gs[dpsi] /. mj → Ajm[gs[dpsi], x]`

In[20]:=

`Fsubs[x, dpsi]`

Out[20]= $\mathtt{ca\ dpsi\ K\ \left(Pox - \dfrac{dpsi\ Ppox}{2}\right)\ (1 - x) - \dfrac{4\ a\ Iabs\ phi0}{\sqrt{-1 + \frac{Iabs^{2}\ phi0^{2}\ (-gstar-br\ Km+(1-br)\ ca\ x)^{2}}{ca^{2}\ dpsi^{2}\ K^{2}\ \left(Pox-\frac{dpsi\ Ppox}{2}\right)^{2}\ (1-x)^{2}\ (2\ gstar+ca\ x)^{2}}}} - dpsi^{2}\ y}$

In[21]:=

`(*F1=FullSimplify[Derivative[1,0][Fsubs][x,dpsi]]*)`

In[22]:=

`(*F2=FullSimplify[Derivative[0,1][Fsubs][x,dpsi]]*)`

In[23]:= `dAdx = Derivative[0, 1][A][gs, x]`

Out[23]= `- ca gs`

In[24]:= **dgsddpsi = Simplify[D[gs[dpsi], dpsi]]**

Out[24]= K (Pox − dpsi Ppox)

In[25]:= **dAddpsi = D[A[Gs[dpsi], x], dpsi]**

Out[25]= ca (1 − x) Gs′[dpsi]

In[26]:= **dAddpsi /. Gs'[dpsi] → dgsddpsi**

Out[26]= ca K (Pox − dpsi Ppox) (1 − x)

In[27]:= **dJmaxdAjm = Derivative[1][Jmax]**

Out[27]= $\dfrac{4\,\text{Iabs}^3\,\text{phi0}^3}{\left(-1 + \dfrac{\text{Iabs}^2\,\text{phi0}^2}{\#1^2}\right)^{3/2}\#1^3}$ &

In[28]:= **dAjmdx = Simplify[D[Ajm[gs, x], x]]**

Out[28]= $\dfrac{\text{ca gs}\left(2\,\text{gstar}\,(\text{gstar} + \text{br Km}) + (-1 + \text{br})\,\text{ca}^2\,x^2 + \text{br ca Km}\,(-1 + 2\,x) + \text{ca gstar}\,(-3 + 2\,\text{br} + 2\,x)\right)}{(\text{gstar} − \text{ca}\,x + \text{br}\,(\text{Km} + \text{ca}\,x))^2}$

In[29]:= **Collect[Numerator[dAjmdx], {gs ca, br, gstar}] / Denominator[dAjmdx]**

Out[29]= $\dfrac{\text{ca gs}\left(2\,\text{gstar}^2 − \text{ca}^2\,x^2 + \text{gstar}\,(-3\,\text{ca} + 2\,\text{ca}\,x) + \text{br}\left(\text{gstar}\,(2\,\text{ca} + 2\,\text{Km}) + \text{ca}^2\,x^2 + \text{ca Km}\,(-1 + 2\,x)\right)\right)}{(\text{gstar} − \text{ca}\,x + \text{br}\,(\text{Km} + \text{ca}\,x))^2}$

In[30]:= **dAjmddpsi = D[Ajm[Gs[dpsi], x], dpsi]**

Out[30]= $\dfrac{\text{ca}\,(1 − x)\,(2\,\text{gstar} + \text{ca}\,x)\,\text{Gs}′[\text{dpsi}]}{-\text{gstar} − \text{br Km} + (1 − \text{br})\,\text{ca}\,x}$

In[31]:= **dFdx = dAdx − a DJmaxdAjm dAjmdx**

Out[31]= $-\text{ca gs} − \big(a\,\text{ca DJmaxdAjm gs}$
  $\left(2\,\text{gstar}\,(\text{gstar} + \text{br Km}) + (-1 + \text{br})\,\text{ca}^2\,x^2 + \text{br ca Km}\,(-1 + 2\,x) + \text{ca gstar}\,(-3 + 2\,\text{br} + 2\,x)\right)\big)\,/$
  $(\text{gstar} − \text{ca}\,x + \text{br}\,(\text{Km} + \text{ca}\,x))^2$

In[32]:= **X1 = Solve[dFdx == 0, DJmaxdAjm][[All, 1, 2]][[1]]**

Out[32]= $-\big((\text{gstar} + \text{br Km} − \text{ca}\,x + \text{br ca}\,x)^2 \big/$
  $\big(a\,(-3\,\text{ca gstar} + 2\,\text{br ca gstar} + 2\,\text{gstar}^2 − \text{br ca Km} + 2\,\text{br gstar Km} +$
  $2\,\text{ca gstar}\,x + 2\,\text{br ca Km}\,x − \text{ca}^2\,x^2 + \text{br ca}^2\,x^2)\big)\big)$

In[33]:= **dFddpsi = dAddpsi − a DJmaxdAjm dAjmddpsi − 2 y dpsi**

Out[33]= $-2\,\text{dpsi}\,y + \text{ca}\,(1 − x)\,\text{Gs}′[\text{dpsi}] − \dfrac{a\,\text{ca DJmaxdAjm}\,(1 − x)\,(2\,\text{gstar} + \text{ca}\,x)\,\text{Gs}′[\text{dpsi}]}{-\text{gstar} − \text{br Km} + (1 − \text{br})\,\text{ca}\,x}$

In[34]:= `X2 = Solve[dFddpsi == 0, DJmaxdAjm][[All, 1, 2]][[1]]`

Out[34]= $-\dfrac{(\text{gstar} + \text{br Km} - \text{ca x} + \text{br ca x})\,(2\,\text{dpsi y} - \text{ca Gs}'[\text{dpsi}] + \text{ca x Gs}'[\text{dpsi}])}{\text{a ca}\,(-1 + x)\,(2\,\text{gstar} + \text{ca x})\,\text{Gs}'[\text{dpsi}]}$

In[35]:= `Collect[Numerator[Simplify[1 / X1 - 1 / X2]], x, Simplify]`

Out[35]= $\text{a ca}^2\,x^2\,(-2\,(-1 + \text{br})\,\text{dpsi y} + ((-3 + 2\,\text{br})\,\text{gstar} - \text{br Km})\,\text{Gs}'[\text{dpsi}]) +$
$\quad \text{a}\,\big(2\,\text{dpsi}\,((3 - 2\,\text{br})\,\text{ca gstar} + \text{br ca Km} - 2\,\text{gstar}\,(\text{gstar} + \text{br Km}))\,\text{y} +$
$\qquad \text{ca}^2\,((-3 + 2\,\text{br})\,\text{gstar} - \text{br Km})\,\text{Gs}'[\text{dpsi}]\big) +$
$\quad 2\,\text{a ca x}\,(-2\,\text{dpsi}\,(\text{gstar} + \text{br Km})\,\text{y} + \text{ca}\,((3 - 2\,\text{br})\,\text{gstar} + \text{br Km})\,\text{Gs}'[\text{dpsi}])$

In[36]:= `Simplify[Solve[X1 == X2, x]]`

Out[36]= $\Big\{\Big\{x \to \dfrac{\text{gstar} + \text{br Km}}{\text{ca} - \text{br ca}}\Big\},$

$\quad \Big\{x \to \big(-2\,\text{ca dpsi}\,(\text{gstar} + \text{br Km})\,\text{y} + \text{ca}^2\,((3 - 2\,\text{br})\,\text{gstar} + \text{br Km})\,\text{Gs}'[\text{dpsi}] - \sqrt{2}$
$\qquad \sqrt{\big(\text{ca}^2\,\text{dpsi}\,((-3 + 2\,\text{br})\,\text{gstar} - \text{br Km})\,((-1 + \text{br})\,\text{ca} + \text{gstar} + \text{br Km})}$
$\qquad\quad \overline{\text{y}\,(-2\,\text{dpsi y} + (\text{ca} + 2\,\text{gstar})\,\text{Gs}'[\text{dpsi}])\big)}\big) \Big/$
$\qquad \big(\text{ca}^2\,(2\,(-1 + \text{br})\,\text{dpsi y} + ((3 - 2\,\text{br})\,\text{gstar} + \text{br Km})\,\text{Gs}'[\text{dpsi}])\big)\Big\},$

$\quad \Big\{x \to \big(-2\,\text{ca dpsi}\,(\text{gstar} + \text{br Km})\,\text{y} + \text{ca}^2\,((3 - 2\,\text{br})\,\text{gstar} + \text{br Km})\,\text{Gs}'[\text{dpsi}] +$
$\qquad \sqrt{2}\,\sqrt{\big(\text{ca}^2\,\text{dpsi}\,((-3 + 2\,\text{br})\,\text{gstar} - \text{br Km})\,((-1 + \text{br})\,\text{ca} + \text{gstar} + \text{br Km})}$
$\qquad\quad \overline{\text{y}\,(-2\,\text{dpsi y} + (\text{ca} + 2\,\text{gstar})\,\text{Gs}'[\text{dpsi}])\big)}\big) \Big/$
$\qquad \big(\text{ca}^2\,(2\,(-1 + \text{br})\,\text{dpsi y} + ((3 - 2\,\text{br})\,\text{gstar} + \text{br Km})\,\text{Gs}'[\text{dpsi}])\big)\Big\}\Big\}$

In[37]:= `(*Expand X2 by approximate formula for Gs*)`
`X2approx = X2 /. Gs'[dpsi] → dgsddpsi`

Out[37]= $-\dfrac{(\text{gstar} + \text{br Km} - \text{ca x} + \text{br ca x})\,(-\text{ca K}\,(\text{Pox} - \text{dpsi Ppox}) + \text{ca K}\,(\text{Pox} - \text{dpsi Ppox})\,\text{x} + 2\,\text{dpsi y})}{\text{a ca K}\,(\text{Pox} - \text{dpsi Ppox})\,(-1 + x)\,(2\,\text{gstar} + \text{ca x})}$

In[38]:= `(* Express dpsi in terms of x -->`
`  Final eqn to solve for x. Approximation of Gs required*)`
`dpsiasfx = Simplify[Solve[X1 == X2approx, dpsi]][[All, 1, 2]][[1]]`

Out[38]= $\big(\text{ca}^2\,K\,((-3 + 2\,\text{br})\,\text{gstar} - \text{br Km})\,\text{Pox}\,(-1 + x)^2\big) \Big/$
$\quad \big(4\,\text{gstar}\,(\text{gstar} + \text{br Km})\,\text{y} + 2\,\text{ca}\,(\text{br Km}\,(-1 + 2\,x) + \text{gstar}\,(-3 + 2\,\text{br} + 2\,x))\,\text{y} +$
$\qquad \text{ca}^2\,\big((-3 + 2\,\text{br})\,\text{gstar K Ppox}\,(-1 + x)^2 - 2\,x^2\,y - \text{br}\,(K\,\text{Km Ppox}\,(-1 + x)^2 - 2\,x^2\,y)\big)\big)$

In[39]:= `Collect[Numerator[dpsiasfx], {br, Pox, PPox, ca, K, x}] /`
`  Collect[Denominator[dpsiasfx], {br, Pox, Ppox, ca, K, x}]`

Out[39]= $\left(ca^2\, K\, Pox\, \left(-3\, gstar + 6\, gstar\, x - 3\, gstar\, x^2\right) + \right.$
$\quad br\, ca^2\, K\, Pox\, \left(2\, gstar - Km + (-4\, gstar + 2\, Km)\, x + (2\, gstar - Km)\, x^2\right)\Big) \Big/$
$\quad \left(ca^2\, K\, Ppox\, \left(-3\, gstar + 6\, gstar\, x - 3\, gstar\, x^2\right) + 4\, gstar^2\, y - \right.$
$\quad 2\, ca^2\, x^2\, y + ca\, (-6\, gstar\, y + 4\, gstar\, x\, y) +$
$\quad br\, \Big(ca^2\, K\, Ppox\, \left(2\, gstar - Km + (-4\, gstar + 2\, Km)\, x + (2\, gstar - Km)\, x^2\right) +$
$\qquad 4\, gstar\, Km\, y + 2\, ca^2\, x^2\, y + ca\, (4\, gstar\, y - 2\, Km\, y + 4\, Km\, x\, y)\Big)\Big)$

In[40]:= `(*Express x in terms of dpsi -->`
` Final eqn to solve for dpsi. No approximation required,`
`but dpsi bound needs to be calc*)`
`xasfdpsiAll = Simplify[Solve[X1 == X2, x][[All, 1, 2]]]`

Out[40]= $\Big\{ \dfrac{gstar + br\, Km}{ca - br\, ca},\ \Big(-2\, ca\, dpsi\, (gstar + br\, Km)\, y +$
$\quad ca^2\, \big((3 - 2\, br)\, gstar + br\, Km\big)\, Gs'[dpsi] - \sqrt{2}\, \sqrt{\big(ca^2\, dpsi\, ((-3 + 2\, br)\, gstar - br\, Km)}$
$\qquad \overline{\big((-1 + br)\, ca + gstar + br\, Km\big)\, y\, (-2\, dpsi\, y + (ca + 2\, gstar)\, Gs'[dpsi])\big)}\Big) \Big/$
$\quad \left(ca^2\, (2\, (-1 + br)\, dpsi\, y + ((3 - 2\, br)\, gstar + br\, Km)\, Gs'[dpsi])\right),$
$\quad \Big(-2\, ca\, dpsi\, (gstar + br\, Km)\, y + ca^2\, \big((3 - 2\, br)\, gstar + br\, Km\big)\, Gs'[dpsi] +$
$\qquad \sqrt{2}\, \sqrt{\big(ca^2\, dpsi\, ((-3 + 2\, br)\, gstar - br\, Km)}$
$\qquad\quad \overline{\big((-1 + br)\, ca + gstar + br\, Km\big)\, y\, (-2\, dpsi\, y + (ca + 2\, gstar)\, Gs'[dpsi])\big)}\Big) \Big/$
$\quad \left(ca^2\, (2\, (-1 + br)\, dpsi\, y + ((3 - 2\, br)\, gstar + br\, Km)\, Gs'[dpsi])\right)\Big\}$

In[41]:= `Qdelta =`
`  ca^2 * dpsi * ((-3 + 2 * br) * gstar - br * Km) * ((-1 + br) * ca + gstar + br * Km) * y *`
`    (-2 * dpsi * y + (ca + 2 * gstar) * Derivative[1][Gs][dpsi])`

Out[41]= $ca^2\, dpsi\, ((-3 + 2\, br)\, gstar - br\, Km)$
$\quad ((-1 + br)\, ca + gstar + br\, Km)\, y\, (-2\, dpsi\, y + (ca + 2\, gstar)\, Gs'[dpsi])$

In[42]:= `Factor[Qdelta]`

Out[42]= $ca^2\, dpsi\, (-3\, gstar + 2\, br\, gstar - br\, Km)$
$\quad (-ca + br\, ca + gstar + br\, Km)\, y\, (-2\, dpsi\, y + ca\, Gs'[dpsi] + 2\, gstar\, Gs'[dpsi])$

In[43]:= `(* When is determinant > 0? When dpsi < some value. Lets calculate that value*)`
`Collect[(-2 dpsi y + (ca + 2 gstar) Gs'[dpsi]) /. Gs'[dpsi] → dgsddpsi, dpsi]`

Out[43]= $(ca + 2\, gstar)\, K\, Pox + dpsi\, ((-ca - 2\, gstar)\, K\, Ppox - 2\, y)$

In[44]:= **Solve[(Simplify[Qdelta] /. Gs'[dpsi] → dgsddpsi) == 0, dpsi]**

Out[44]= $\left\{ \{dpsi \to 0\}, \left\{ dpsi \to \dfrac{ca\ K\ Pox + 2\ gstar\ K\ Pox}{ca\ K\ Ppox + 2\ gstar\ K\ Ppox + 2\ y} \right\} \right\}$

In[45]:= **xasfdpsi = xasfdpsiAll[[3]]**

Out[45]= $\Big(-2\ ca\ dpsi\ (gstar + br\ Km)\ y +$
$\quad ca^2\ ((3 - 2\ br)\ gstar + br\ Km)\ Gs'[dpsi] + \sqrt{2}\ \sqrt{\big(ca^2\ dpsi\ ((-3 + 2\ br)\ gstar - br\ Km)}$
$\qquad ((-1 + br)\ ca + gstar + br\ Km)\ y\ (-2\ dpsi\ y + (ca + 2\ gstar)\ Gs'[dpsi]) \big) \Big) \Big/$
$\Big(ca^2\ (2\ (-1 + br)\ dpsi\ y + ((3 - 2\ br)\ gstar + br\ Km)\ Gs'[dpsi]) \Big)$

In[46]:= **Collect[Numerator[xasfdpsi], {br, ca, dpsi}] /**
   Collect[Denominator[xasfdpsi], {br, ca, dpsi}]

Out[46]= $\Big(-2\ ca\ dpsi\ gstar\ y + 3\ ca^2\ gstar\ Gs'[dpsi] +$
$\quad \sqrt{2}\ \sqrt{\big(ca^2\ dpsi\ ((-3 + 2\ br)\ gstar - br\ Km)\ ((-1 + br)\ ca + gstar + br\ Km)}$
$\qquad y\ (-2\ dpsi\ y + (ca + 2\ gstar)\ Gs'[dpsi]) \big) +$
$\quad br\ \big(-2\ ca\ dpsi\ Km\ y + ca^2\ (-2\ gstar\ Gs'[dpsi] + Km\ Gs'[dpsi]) \big) \Big) \Big/$
$\Big(ca^2\ (-2\ dpsi\ y + 3\ gstar\ Gs'[dpsi]) + br\ ca^2\ (2\ dpsi\ y - 2\ gstar\ Gs'[dpsi] + Km\ Gs'[dpsi]) \Big)$

In[47]:= `Rx = dFdx /. DJmaxdAjm → dJmaxdAjm[Ajm[gs, x]] /. gs → gs[dpsi] /. dpsi → dpsiasfx`

Out[47]= $-\Bigg(\Bigg(ca^3 K^2 \left((-3+2\,br)\,gstar - br\,Km\right) Pox$

$(-1+x)^2 \left(Pox - \left(ca^2 K \left((-3+2\,br)\,gstar - br\,Km\right) Pox\,Ppox\,(-1+x)^2\right)\Big/$

$\left(2\left(4\,gstar\,(gstar+br\,Km)\,y + 2\,ca\,(br\,Km\,(-1+2\,x)+gstar\,(-3+2\,br+2\,x))\,y+ca^2\right.\right.$

$\left.\left.\left(\,(-3+2\,br)\,gstar\,K\,Ppox\,(-1+x)^2 - 2\,x^2\,y - br\left(K\,Km\,Ppox\,(-1+x)^2 - 2\,x^2\,y\right)\right)\right)\right)\Bigg)\Bigg)\Bigg)\Big/$

$\left(4\,gstar\,(gstar+br\,Km)\,y + 2\,ca\,(br\,Km\,(-1+2\,x)+gstar\,(-3+2\,br+2\,x))\,y +\right.$

$\left. ca^2\left((-3+2\,br)\,gstar\,K\,Ppox\,(-1+x)^2 - 2\,x^2\,y - br\left(K\,Km\,Ppox\,(-1+x)^2 - 2\,x^2\,y\right)\right)\right)\Bigg) -$

$\left(4\,a\,Iabs^3\,phi0^3\,\left(-gstar - br\,Km + (1-br)\,ca\,x\right)^3\right.$

$\left(2\,gstar\,(gstar+br\,Km) + (-1+br)\,ca^2\,x^2 + br\,ca\,Km\,(-1+2\,x) + ca\,gstar\,(-3+2\,br+2\,x)\right)$

$\left(4\,gstar\,(gstar+br\,Km)\,y + 2\,ca\,(br\,Km\,(-1+2\,x)+gstar\,(-3+2\,br+2\,x))\,y +\right.$

$\left.\left. ca^2\left((-3+2\,br)\,gstar\,K\,Ppox\,(-1+x)^2 - 2\,x^2\,y - br\left(K\,Km\,Ppox\,(-1+x)^2 - 2\,x^2\,y\right)\right)\right)^2\right)\Big/$

$\left(ca^6 K^4 \left((-3+2\,br)\,gstar - br\,Km\right)^2 Pox^2\,(1-x)^3\,(-1+x)^4\,(2\,gstar+ca\,x)^3\right.$

$(gstar - ca\,x + br\,(Km+ca\,x))^2$

$\left(Pox - \left(ca^2 K \left((-3+2\,br)\,gstar - br\,Km\right) Pox\,Ppox\,(-1+x)^2\right)\Big/\right.$

$\left(2\left(4\,gstar\,(gstar+br\,Km)\,y + 2\,ca\,(br\,Km\,(-1+2\,x)+gstar\,(-3+2\,br+2\,x))\,y+ca^2\right.\right.$

$\left.\left.\left.\left(\,(-3+2\,br)\,gstar\,K\,Ppox\,(-1+x)^2 - 2\,x^2\,y - br\left(K\,Km\,Ppox\,(-1+x)^2 - 2\,x^2\,y\right)\right)\right)\right)\right)^2$

$\left(-1 + \left(Iabs^2\,phi0^2\,\left(-gstar - br\,Km + (1-br)\,ca\,x\right)^2\left(4\,gstar\,(gstar+br\,Km)\,y + 2\right.\right.\right.$

$ca\,(br\,Km\,(-1+2\,x)+gstar\,(-3+2\,br+2\,x))\,y + ca^2\left((-3+2\,br)\,gstar\right.$

$\left.\left.\left. K\,Ppox\,(-1+x)^2 - 2\,x^2\,y - br\left(K\,Km\,Ppox\,(-1+x)^2 - 2\,x^2\,y\right)\right)\right)^2\right)\Big/$

$\left(ca^6 K^4 \left((-3+2\,br)\,gstar - br\,Km\right)^2 Pox^2\,(1-x)^2\,(-1+x)^4\,(2\,gstar+ca\,x)^2\right.$

$\left(Pox - \left(ca^2 K \left((-3+2\,br)\,gstar - br\,Km\right) Pox\,Ppox\,(-1+x)^2\right)\Big/\right.$

$\left(2\left(4\,gstar\,(gstar+br\,Km)\,y + 2\,ca\,(br\,Km\,(-1+2\,x)+gstar\,(-3+2\,br+2\,x))\,y +\right.\right.$

$ca^2\left((-3+2\,br)\,gstar\,K\,Ppox\,(-1+x)^2 - 2\,x^2\,y -\right.$

$\left.\left.\left.\left.\left.\left. br\left(K\,Km\,Ppox\,(-1+x)^2 - 2\,x^2\,y\right)\right)\right)\right)^2\right)\right)^{3/2}\right)$

In[48]:= **Rx /. br → 0**

Out[48]= $\dfrac{3\,ca^3\,gstar\,K^2\,Pox\,(-1+x)^2\,\left(Pox+\dfrac{3\,ca^2\,gstar\,K\,Pox\,Ppox\,(-1+x)^2}{2\,\left(4\,gstar^2\,y+2\,ca\,gstar\,(-3+2\,x)\,y+ca^2\,\left(-3\,gstar\,K\,Ppox\,(-1+x)^2-2\,x^2\,y\right)\right)}\right)}{4\,gstar^2\,y+2\,ca\,gstar\,(-3+2\,x)\,y+ca^2\,\left(-3\,gstar\,K\,Ppox\,(-1+x)^2-2\,x^2\,y\right)}\ -$

$\left(4\,a\,Iabs^3\,phi0^3\,(-gstar+ca\,x)^3\,\left(2\,gstar^2-ca^2\,x^2+ca\,gstar\,(-3+2\,x)\right)\right.$

$\left.\left(4\,gstar^2\,y+2\,ca\,gstar\,(-3+2\,x)\,y+ca^2\,\left(-3\,gstar\,K\,Ppox\,(-1+x)^2-2\,x^2\,y\right)\right)^2\right)\Big/$

$\left(9\,ca^6\,gstar^2\,K^4\,Pox^2\,(1-x)^3\,(-1+x)^4\,(gstar-ca\,x)^2\,(2\,gstar+ca\,x)^3\right.$

$\left(Pox+\dfrac{3\,ca^2\,gstar\,K\,Pox\,Ppox\,(-1+x)^2}{2\,\left(4\,gstar^2\,y+2\,ca\,gstar\,(-3+2\,x)\,y+ca^2\,\left(-3\,gstar\,K\,Ppox\,(-1+x)^2-2\,x^2\,y\right)\right)}\right)^2$

$\left(-1+\left(Iabs^2\,phi0^2\,(-gstar+ca\,x)^2\right.\right.$

$\left.\left.\left(4\,gstar^2\,y+2\,ca\,gstar\,(-3+2\,x)\,y+ca^2\,\left(-3\,gstar\,K\,Ppox\,(-1+x)^2-2\,x^2\,y\right)\right)^2\right)\right/$

$\left.\left(9\,ca^6\,gstar^2\,K^4\,Pox^2\,(1-x)^2\,(-1+x)^4\,(2\,gstar+ca\,x)^2\,\left(Pox+\dfrac{3\,ca^2\,g}{2\,\left(4\,gstar^2\,y+2\,ca\,gstar\,(-3\right.}\right.\right.$

In[49]:= **Rdpsi = dFdx(*/.DJmaxdAjm → dJmaxdAjm[Ajm[gs,x]]*)**

Out[49]= $-ca\,gs-\Big(a\,ca\,DJmaxdAjm\,gs$

$\left(2\,gstar\,(gstar+br\,Km)+(-1+br)\,ca^2\,x^2+br\,ca\,Km\,(-1+2\,x)+ca\,gstar\,(-3+2\,br+2\,x)\right)\Big)\Big/$

$(gstar-ca\,x+br\,(Km+ca\,x))^2$

In[50]:=