First Equation
Original:

$$q = \frac{-1 + (1 + 4D_d[1 - Vu^{0.5} - (1-V)u])^{0.5}}{2D_d} * q_{max}$$

$$\frac{dq}{du} = (q_{max}(1 + 4D_d(1 - Vu^{0.5} - (1-V)u))^{-0.5}) * (-0.5Vu^{-0.5} + V - 1)$$

Utility:

```
q: ((-1+(1+4*D*(1-V*u^0.5-(1-V)*u))^0.5)/(2*D))*qmax

diff(q,u): 1.0*qmax*(4*D*(-V*u^0.5 - u*(-V + 1) + 1) + 1)^0.5*(-0.5*V*u^0.5/u + V
- 1)/(4*D*(-V*u^0.5 - u*(-V + 1) + 1) + 1)
```

Latex equivalent:

$$\frac{dq}{du} = 1.0\frac{q_{max}\left(4D_d(-Vu^{0.5} - u(-V+1) + 1) + 1)\right)^{0.5}\left(-0.5\frac{Vu^{0.5}}{u} + V - 1\right)}{(4D_d(-Vu^{0.5} - u(-V+1) + 1) + 1)}$$

Equivalent

Second Equation

Original:

$$q = [1 - Vu^{0.5} - (1-V)u] \cdot q_{max}$$

$$\frac{dq}{du} = q_{max} \cdot (-0.5Vu^{-0.5} + V - 1)$$

Utility:

```
q: (1-V*u^0.5-(1-V)*u)*qmax

diff(q,u): qmax*(-0.5*V*u^0.5/u + V - 1)
```

Latex equivalent:

$$\frac{dq}{du} = q_{max}\left(-0.5\frac{Vu^{0.5}}{u} + V - 1\right)$$

Equivalent

Third Equation

Original:

$$q = q_{max} \cdot \frac{-1 + \left(1 + 4D_d \cdot [1 - 2vx\left(\frac{p_R}{p_x}\right)u^{0.5} - v(1-x)(\frac{p_R}{p_x})^2u])^{0.5}\right)}{2D_d}$$

$$\frac{dq}{du} = q_{max} \cdot \left(1 + 4D_d \cdot \left[1 - 2vx\frac{p_R}{p_x}u^{0.5} - v(1-x)\left(\frac{p_R}{p_x}\right)^2 u\right]\right)^{-0.5} \cdot \left(-v\frac{p_R}{p_x}\left[xu^{-0.5} + \frac{p_R}{p_x}(1-x)\right]\right)$$

Utility:

```
q: qmax*(-1+(1+4*D*(1-2*v*x*(pr/px)*u^0.5-v*(1-x)*(pr/px)^2*u))^0.5)/(2*D)

diff(q,u): 1.0*qmax*(4*D*(-V*pr^2*u*(-x + 1)/px^2 - 2*V*pr*u^0.5*x/px + 1) + 1)^0.5
*(-V*pr^2*(-x + 1)/px^2 - 1.0*V*pr*u^0.5*x/(px*u))/(4*D*(-V*pr^2*u*(-x + 1)/px^2 -
2*V*pr*u^0.5*x/px + 1) + 1)
```

Latex Equivalent:

$$\frac{dq}{du} = 1.0\frac{q_{max}\left(4D_d\left(-\frac{Vp_r^2u(-x+1)}{p_x^2} - 2\frac{Vp_ru^{0.5}x}{p_x} + 1\right) + 1\right)^{0.5}\left(-\frac{Vp_r^2u(-x+1)}{p_x^2} - 1.0\frac{Vp_ru^{0.5}x}{p_xu}\right)}{\left(4D_d\left(-\frac{Vp_r^2u(-x+1)}{p_x^2} - 2\frac{Vp_ru^{0.5}x}{p_x} + 1\right) + 1\right)}$$

Equivalent

Fourth Equation

Original:

$$q = q_{max} \cdot \left[1 - 2vx\frac{p_R}{p_x}u^{0.5} - v(1-x)\left(\frac{p_R}{p_x}\right)^2 u\right]$$

$$\frac{dq}{du} = q_{max} \cdot \left(-v\frac{p_R}{p_x}\left[xu^{-0.5} + \frac{p_R}{p_x}(1-x)\right]\right)$$

Utility:

```
q: qmax*(1-2*V*x*(pr/px)*u^0.5-V*(1-x)*(pr/px)^2*u)

diff(q,u): qmax*(-V*pr^2*(-x + 1)/px^2 - 1.0*V*pr*u^0.5*x/(px*u))
```

Latex equivalent:

$$\frac{dq}{du} = q_{max}\left(-\frac{Vp_r^2(-x+1)}{p_x^2} - 1.0\frac{Vp_ru^{0.5}x}{p_xu}\right)$$

Equivalent

All the original derivatives are equivalent to the ones differentiated by SymPy.