left parabolic --- dc<x<=0

In[1]:=
```
w[x_] = vc + sc * x + pc * x^2
```

Out[•]= $vc + sc\,x + pc\,x^2$

In[2]:=
```
g[x_] = (1 - x * w'[x] / (2 * w[x]))^2 - w'[x]^2 / 4 * (1 / w[x] + 1/4) + w''[x] / 2
```

Out[•]= $pc - \frac{1}{4}(sc + 2\,pc\,x)^2\left(\frac{1}{4} + \frac{1}{vc + sc\,x + pc\,x^2}\right) + \left(1 - \frac{x(sc + 2\,pc\,x)}{2(vc + sc\,x + pc\,x^2)}\right)^2$

In[3]:=
```
Simplify[pc - 1/4 (sc + 2 pc x)^2 (1/4 + 1/(vc + sc x + pc x^2)) + (1 - x (sc + 2 pc x)/(2 (vc + sc x + pc x^2)))^2]
```
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Out[•]= $pc + \frac{(2\,vc + sc\,x)^2}{4(vc + x(sc + pc\,x))^2} - \frac{1}{4}(sc + 2\,pc\,x)^2\left(\frac{1}{4} + \frac{1}{vc + x(sc + pc\,x)}\right)$

right parabolic --- 0<x<=uc

In[•]:=
```
w[x_] = vc + sc * x + cc * x^2
```

Out[•]= $vc + sc\,x + cc\,x^2$

In[•]:=
```
g[x_] = (1 - x * w'[x] / (2 * w[x]))^2 - w'[x]^2 / 4 * (1 / w[x] + 1/4) + w''[x] / 2
```

Out[•]= $cc - \frac{1}{4}(sc + 2\,cc\,x)^2\left(\frac{1}{4} + \frac{1}{vc + sc\,x + cc\,x^2}\right) + \left(1 - \frac{x(sc + 2\,cc\,x)}{2(vc + sc\,x + cc\,x^2)}\right)^2$

In[•]:=
```
Simplify[cc - 1/4 (sc + 2 cc x)^2 (1/4 + 1/(vc + sc x + cc x^2)) + (1 - x (sc + 2 cc x)/(2 (vc + sc x + cc x^2)))^2]
```
化简

Out[•]= $cc + \frac{(2\,vc + sc\,x)^2}{4(vc + x(sc + cc\,x))^2} - \frac{1}{4}(sc + 2\,cc\,x)^2\left(\frac{1}{4} + \frac{1}{vc + x(sc + cc\,x)}\right)$

left smoothing range --- dc(1+dsm)<x<=dc

In[•]:=
```
w[x_] = vc - (1 + 1/dsm) * pc * dc^2 - sc * dc / (2 * dsm) +
    (1 + 1/dsm) * (2 * pc * dc + sc) * x - (pc/dsm + sc/(2 * dc * dsm)) * x^2
```

Out[•]= $-dc^2\left(1 + \frac{1}{dsm}\right)pc - \frac{dc\,sc}{2\,dsm} + vc + \left(1 + \frac{1}{dsm}\right)(2\,dc\,pc + sc)\,x - \left(\frac{pc}{dsm} + \frac{sc}{2\,dc\,dsm}\right)x^2$

```
In[•]:= g[x_] = (1 - x*w'[x]/(2*w[x]))^2 - w'[x]^2/4 * (1/w[x] + 1/4) + w''[x]/2
```

$$\text{Out[•]}= -\frac{pc}{dsm} - \frac{sc}{2\,dc\,dsm} - \frac{1}{4}\left(\left(1+\frac{1}{dsm}\right)(2\,dc\,pc+sc) - 2\left(\frac{pc}{dsm}+\frac{sc}{2\,dc\,dsm}\right)x\right)^2 \left(\frac{1}{4} + \frac{1}{-dc^2\left(1+\frac{1}{dsm}\right)pc - \frac{dc\,sc}{2\,dsm} + vc + \left(1+\frac{1}{dsm}\right)(2\,dc\,pc+sc)\,x - \left(\frac{pc}{dsm}+\frac{sc}{2\,dc\,dsm}\right)x^2}\right) + \left(1 - \frac{x\left(\left(1+\frac{1}{dsm}\right)(2\,dc\,pc+sc) - 2\left(\frac{pc}{dsm}+\frac{sc}{2\,dc\,dsm}\right)x\right)}{2\left(-dc^2\left(1+\frac{1}{dsm}\right)pc - \frac{dc\,sc}{2\,dsm} + vc + \left(1+\frac{1}{dsm}\right)(2\,dc\,pc+sc)\,x - \left(\frac{pc}{dsm}+\frac{sc}{2\,dc\,dsm}\right)x^2\right)}\right)^2$$

```
In[•]:= Simplify[%2]
```
化简

$$\text{Out[•]}= -\frac{pc}{dsm} - \frac{sc}{2\,dc\,dsm} + \left(dc^2\left(-2\,dc^2(1+dsm)\,pc - dc\,sc + 2\,dsm\,vc + 2\,dc(1+dsm)\,pc\,x + sc\,x + dsm\,sc\,x\right)^2\right) \Big/ \left(2\,dc^3(1+dsm)\,pc + sc\,x^2 + dc^2(sc - 4(1+dsm)\,pc\,x) - 2\,dc\left(x(sc - pc\,x) + dsm(vc + sc\,x)\right)\right)^2 - \frac{1}{4\,dc^2\,dsm^2}(2\,dc\,pc+sc)^2(dc + dc\,dsm - x)^2\left(\frac{1}{4} - (2\,dc\,dsm) \Big/ \left(2\,dc^3(1+dsm)\,pc + sc\,x^2 + dc^2(sc - 4(1+dsm)\,pc\,x) - 2\,dc\left(x(sc - pc\,x) + dsm(vc + sc\,x)\right)\right)\right)$$

---

right smoothing range --- uc<x<=uc(1+usm)

```
In[•]:= w[x_] = vc - (1 + 1/usm) * cc * uc^2 - sc*uc/(2*usm) +
          (1 + 1/usm) * (2*cc*uc + sc) * x - (cc/usm + sc/(2*uc*usm)) * x^2
```

$$\text{Out[•]}= -cc\,uc^2\left(1+\frac{1}{usm}\right) - \frac{sc\,uc}{2\,usm} + vc + (sc + 2\,cc\,uc)\left(1+\frac{1}{usm}\right)x - \left(\frac{cc}{usm}+\frac{sc}{2\,uc\,usm}\right)x^2$$

```
In[•]:= g[x_] = (1 - x*w'[x]/(2*w[x]))^2 - w'[x]^2/4 * (1/w[x] + 1/4) + w''[x]/2
```

$$\text{Out[•]}= -\frac{cc}{usm} - \frac{sc}{2\,uc\,usm} - \frac{1}{4}\left((sc + 2\,cc\,uc)\left(1+\frac{1}{usm}\right) - 2\left(\frac{cc}{usm}+\frac{sc}{2\,uc\,usm}\right)x\right)^2 \left(\frac{1}{4} + \frac{1}{-cc\,uc^2\left(1+\frac{1}{usm}\right) - \frac{sc\,uc}{2\,usm} + vc + (sc + 2\,cc\,uc)\left(1+\frac{1}{usm}\right)x - \left(\frac{cc}{usm}+\frac{sc}{2\,uc\,usm}\right)x^2}\right) + \left(1 - \frac{x\left((sc + 2\,cc\,uc)\left(1+\frac{1}{usm}\right) - 2\left(\frac{cc}{usm}+\frac{sc}{2\,uc\,usm}\right)x\right)}{2\left(-cc\,uc^2\left(1+\frac{1}{usm}\right) - \frac{sc\,uc}{2\,usm} + vc + (sc + 2\,cc\,uc)\left(1+\frac{1}{usm}\right)x - \left(\frac{cc}{usm}+\frac{sc}{2\,uc\,usm}\right)x^2\right)}\right)^2$$

In[]:= Simplify[%2]
化简

Out[]= $$-\frac{cc}{usm}-\frac{sc}{2\,uc\,usm}+\left(uc^2\left(2\,usm\,vc-2\,cc\,uc\,(1+usm)\,(uc-x)+sc\,(-uc+x+usm\,x)\right)^2\right)\Big/\left(sc\left(uc^2-2\,uc\,(1+usm)\,x+x^2\right)+2\,uc\left(-usm\,vc+cc\left(uc^2\,(1+usm)-2\,uc\,(1+usm)\,x+x^2\right)\right)\right)^2-\frac{1}{4\,uc^2\,usm^2}$$
$$(sc+2\,cc\,uc)^2\,(uc+uc\,usm-x)^2\left(\frac{1}{4}-(2\,uc\,usm)\Big/\left(sc\left(uc^2-2\,uc\,(1+usm)\,x+x^2\right)+2\,uc\left(-usm\,vc+cc\left(uc^2\,(1+usm)-2\,uc\,(1+usm)\,x+x^2\right)\right)\right)\right)$$

left constant level --- x<dc(1+dsm)

In[]:= w[x_] = vc + dc * (2 + dsm) * (sc / 2) + (1 + dsm) * pc * dc ^ 2

Out[]= $$dc^2\,(1+dsm)\,pc+\frac{1}{2}\,dc\,(2+dsm)\,sc+vc$$

In[]:= g[x_] = $\left(1-\frac{x*w'[x]}{2*w[x]}\right)^2-\frac{w'[x]\,^2}{4}*\left(\frac{1}{w[x]}+\frac{1}{4}\right)+\frac{w''[x]}{2}$

Out[]= 1

right constant level --- uc(1+usm)<x

In[]:= w[x_] = vc + uc * (2 + usm) * (sc / 2) + (1 + usm) * cc * uc ^ 2

Out[]= $$cc\,uc^2\,(1+usm)+\frac{1}{2}\,sc\,uc\,(2+usm)+vc$$

In[]:= g[x_] = $\left(1-\frac{x*w'[x]}{2*w[x]}\right)^2-\frac{w'[x]\,^2}{4}*\left(\frac{1}{w[x]}+\frac{1}{4}\right)+\frac{w''[x]}{2}$

Out[]= 1