In[1]:=
```
B = {{0, 1, 0}, {1/2 v^2 (-3 + γ), v (3 - γ), -1 + γ},
  {- cs^2 v/(-1 + γ) + v^3/2 (γ - 2), 1/2 v^2 (3 - 2 γ) + cs^2/(-1 + γ), γ v}}
```

Out[1]= $\left\{\{0,1,0\},\left\{\frac{1}{2}v^2(-3+\gamma),\ v(3-\gamma),\ -1+\gamma\right\},\left\{\frac{1}{2}v^3(-2+\gamma)-\frac{v\,c_s^2}{-1+\gamma},\ \frac{1}{2}v^2(3-2\gamma)+\frac{c_s^2}{-1+\gamma},\ v\,\gamma\right\}\right\}$

In[2]:=
```
Expand[CharacteristicPolynomial [B, λ]]
```

Out[2]= $v^3-3v^2\lambda+3v\lambda^2-\lambda^3+\frac{v\,c_s^2}{-1+\gamma}-\frac{v\,\gamma\,c_s^2}{-1+\gamma}-\frac{\lambda\,c_s^2}{-1+\gamma}+\frac{\gamma\,\lambda\,c_s^2}{-1+\gamma}$

In[3]:=

In[4]:=
```
Simplify[Eigenvalues[B]]
```

Out[4]= $\{v,\ v-c_s,\ v+c_s\}$

In[6]:=
```
Simplify[Eigenvectors[B]]
```

Out[6]= $\left\{\left\{\frac{2}{v^2},\ \frac{2}{v},\ 1\right\},\left\{\frac{2(-1+\gamma)}{v^2(-1+\gamma)-2v(-1+\gamma)c_s+2c_s^2},\ \frac{2(-1+\gamma)(v-c_s)}{v^2(-1+\gamma)-2v(-1+\gamma)c_s+2c_s^2},\ 1\right\},\right.$
$\left.\left\{\frac{2(-1+\gamma)}{v^2(-1+\gamma)+2v(-1+\gamma)c_s+2c_s^2},\ \frac{2(-1+\gamma)(v+c_s)}{v^2(-1+\gamma)+2v(-1+\gamma)c_s+2c_s^2},\ 1\right\}\right\}$