In[175]:= (*Ordinary Ideal gas*)

$$A = \left\{\{0, 1, 0\}, \left\{-\frac{1}{2}(3-\gamma)\left(\frac{u_2}{u_1}\right)^2, (3-\gamma)\left(\frac{u_2}{u_1}\right), \gamma - 1\right\}, \left\{-\frac{\gamma\, u_2\, u_3}{u_1^2} + (\gamma-1)\left(\frac{u_2}{u_1}\right)^3, \frac{\gamma\, u_3}{u_1} - \frac{3}{2}(\gamma-1)\left(\frac{u_2}{u_1}\right)^2, \frac{\gamma\, u_2}{u_1}\right\}\right\};$$

MatrixForm[A]

Out[176]//MatrixForm=

$$\begin{pmatrix} 0 & 1 & 0 \\ -\frac{(3-\gamma)\, u_2^2}{2\, u_1^2} & \frac{(3-\gamma)\, u_2}{u_1} & -1+\gamma \\ \frac{(-1+\gamma)\, u_2^3}{u_1^3} - \frac{\gamma\, u_2\, u_3}{u_1^2} & -\frac{3\,(-1+\gamma)\, u_2^2}{2\, u_1^2} + \frac{\gamma\, u_3}{u_1} & \frac{\gamma\, u_2}{u_1} \end{pmatrix}$$

In[177]:= $\text{FullSimplify}\left[\text{MatrixForm}[A] \text{ /. } \{u_1 \to \rho\} \text{ /. } \{u_2 \to \rho\, u\} \text{ /. } \left\{u_3 \to \frac{1}{2}\rho\, u^2 + \frac{P}{\gamma - 1}\right\}\right]$

Out[177]//MatrixForm=

$$\begin{pmatrix} 0 & 1 & 0 \\ \frac{1}{2}u^2\,(-3+\gamma) & -u\,(-3+\gamma) & -1+\gamma \\ \frac{1}{2}u^3\,(-2+\gamma) + \frac{P\, u\, \gamma}{\rho - \gamma\, \rho} & u^2\left(\frac{3}{2}-\gamma\right) + \frac{P\, \gamma}{(-1+\gamma)\, \rho} & u\, \gamma \end{pmatrix}$$

In[178]:= $\text{eigenvals} = \text{Eigenvalues}[A] \text{ /. } \{u_1 \to \rho\} \text{ /. } \{u_2 \to \rho\, u\} \text{ /. } \left\{u_3 \to \frac{1}{2}\rho\, u^2 + \frac{P}{\gamma - 1}\right\};$

$\text{FullSimplify}\left[\text{eigenvals} \text{ /. } \left\{P \to \frac{\rho\, c_s^2}{\gamma}\right\} \text{ /. } \left\{\rho \to \frac{\gamma\, P}{c_s^2}\right\}, \{c_s > 0, \gamma > 0, P > 0, \rho > 0\}\right]$

$\text{eigenvectors} = \text{Eigenvectors}[A] \text{ /. } \{u_1 \to \rho\} \text{ /. } \{u_2 \to \rho\, u\} \text{ /. } \left\{u_3 \to \frac{1}{2}\rho\, u^2 + \frac{P}{\gamma - 1}\right\};$

$\text{MatrixForm}\left[\text{Transpose}\left[\text{FullSimplify}\left[\text{eigenvectors} \text{ /. } \left\{P \to \frac{\rho\, c_s^2}{\gamma}\right\} \text{ /. } \left\{\rho \to \frac{\gamma\, P}{c_s^2}\right\}, \{c_s > 0, \gamma > 0, P > 0, \rho > 0\}\right]\right]\right]$

Out[179]= $\{u, u - c_s, u + c_s\}$

Out[181]//MatrixForm=

$$\begin{pmatrix} \frac{2}{u^2} & \frac{2\,(-1+\gamma)}{u^2\,(-1+\gamma) + 2\, c_s\,(u - u\,\gamma + c_s)} & \frac{2\,(-1+\gamma)}{u^2\,(-1+\gamma) + 2\, c_s\,(u\,(-1+\gamma) + c_s)} \\ \frac{2}{u} & \frac{2\,(-1+\gamma)\,(u - c_s)}{u^2\,(-1+\gamma) + 2\, c_s\,(u - u\,\gamma + c_s)} & \frac{2\,(-1+\gamma)\,(u + c_s)}{u^2\,(-1+\gamma) + 2\, c_s\,(u\,(-1+\gamma) + c_s)} \\ 1 & 1 & 1 \end{pmatrix}$$

In[182]:=

(*2 fluid Magnetic field*)

$$\text{Fluxp} = \left\{\{\rho\, u\},\ \{\rho\, u^2 + P\},\ \left\{u\left(\frac{\rho\, u^2}{2} + \frac{\gamma\,(P - C\,\rho^{\gamma_m})}{\gamma - 1} + \frac{\gamma_m\, C\,\rho^{\gamma_m}}{\gamma_m - 1}\right)\right\}\right\};$$

MatrixForm[Fluxp]

$$\text{Flux} = \text{FullSimplify}\left[\text{MatrixForm[Fluxp] /. }\left\{\rho \to u_1,\ u \to \frac{u_2}{u_1},\ P \to -\frac{\gamma - 1}{2}\frac{{u_2}^2}{u_1} + C\,{u_1}^{\gamma_m}\left(1 - \frac{\gamma - 1}{\gamma_m - 1}\right) + (\gamma - 1)\, u_3\right\},\ \{\gamma > 0,\ \gamma_m > 0,\ C > 0,\ P > 0,\ \rho > 0\}\right];$$

MatrixForm[Flux]

Out[183]//MatrixForm=

$$\begin{pmatrix} u\,\rho \\ P + u^2\,\rho \\ u\left(\frac{u^2\,\rho}{2} + \frac{\gamma\,(P - C\,\rho^{\gamma_m})}{-1+\gamma} + \frac{C\,\rho^{\gamma_m}\,\gamma_m}{-1+\gamma_m}\right) \end{pmatrix}$$

Out[185]//MatrixForm=

$$\begin{pmatrix} u_2 \\ -\frac{(-3+\gamma)\,u_2^2}{2\,u_1} + (-1+\gamma)\,u_3 + \frac{C\,u_1^{\gamma_m}\,(-\gamma+\gamma_m)}{-1+\gamma_m} \\ \frac{u_2\left(-(-1+\gamma)\,u_2^2 + 2\,u_1\left(\gamma\,u_3 + \frac{C\,u_1^{\gamma_m}\,(-\gamma+\gamma_m)}{-1+\gamma_m}\right)\right)}{2\,u_1^2} \end{pmatrix}$$

In[186]:= (* Some checks with manually done algebra ... Phew! That was tiring!*)

$$\text{Fluxc} = \left\{\{u_2\},\ \left\{\frac{3-\gamma}{2}\left(\frac{{u_2}^2}{u_1}\right) + \left(1 - \frac{\gamma - 1}{\gamma_m - 1}\right) C\,{u_1}^{\gamma_m} + (\gamma - 1)\, u_3\right\},\ \left\{-\frac{\gamma - 1}{2}\left(\frac{{u_2}^3}{{u_1}^2}\right) + \frac{\gamma_m - \gamma}{\gamma_m - 1}\, C\,{u_1}^{\gamma_m - 1}\, u_2 + \gamma\,\frac{u_2\, u_3}{u_1}\right\}\right\};$$

MatrixForm[Fluxc]

$$\text{Fluxorg} = \text{FullSimplify}\left[\text{MatrixForm[Fluxc] /. }\left\{u_1 \to \rho,\ u_2 \to \rho\, u,\ u_3 \to \frac{1}{2}\rho\, u^2 + \frac{P - C\,\rho^{\gamma_m}}{\gamma - 1} + \frac{C\,\rho^{\gamma_m}}{\gamma_m - 1}\right\}\right];$$

MatrixForm[Fluxorg]

Out[187]//MatrixForm=

$$\begin{pmatrix} u_2 \\ \frac{(3-\gamma)\,u_2^2}{2\,u_1} + (-1+\gamma)\,u_3 + C\,u_1^{\gamma_m}\left(1 - \frac{-1+\gamma}{-1+\gamma_m}\right) \\ \frac{(1-\gamma)\,u_2^3}{2\,u_1^2} + \frac{\gamma\,u_2\,u_3}{u_1} + \frac{C\,u_1^{-1+\gamma_m}\,u_2\,(-\gamma+\gamma_m)}{-1+\gamma_m} \end{pmatrix}$$

Out[189]//MatrixForm=

$$\begin{pmatrix} u\,\rho \\ P + u^2\,\rho \\ \frac{u\left(2\,P\,\gamma + u^2\,(-1+\gamma)\,\rho + \frac{2\,C\,\rho^{\gamma_m}\,(\gamma-\gamma_m)}{-1+\gamma_m}\right)}{2\,(-1+\gamma)} \end{pmatrix}$$

In[190]:=

(*Creating the Jacobian of the flux matrix*)

$$\mathrm{f1} = u_2;\ \mathrm{f2} = -\frac{(-3+\gamma)\,u_2^2}{2\,u_1} + (-1+\gamma)\,u_3 + \frac{C\,u_1^{\gamma_m}\,(-\gamma+\gamma_m)}{-1+\gamma_m};\ \mathrm{f3} = \frac{u_2\left(-(-1+\gamma)\,u_2^2 + 2\,u_1\left(\gamma\,u_3 + \frac{C\,u_1^{\gamma_m}\,(-\gamma+\gamma_m)}{-1+\gamma_m}\right)\right)}{2\,u_1^2};$$

```
A = {{D[f1, u1], D[f1, u2], D[f1, u3]}, {D[f2, u1], D[f2, u2], D[f2, u3]}, {D[f3, u1], D[f3, u2], D[f3, u3]}} ;
MatrixForm[A]
```

$$\mathrm{MatrixForm[A]}\ /.\ \left\{u_1 \to \rho,\ u_2 \to \rho\,u,\ u_3 \to \frac{1}{2}\rho\,u^2 + \frac{P - C\,\rho^{\gamma_m}}{\gamma-1} + \frac{C\,\rho^{\gamma_m}}{\gamma_m-1}\right\}$$

Out[192]//MatrixForm=

$$\begin{pmatrix} 0 & 1 & 0 \\ \frac{(-3+\gamma)\,u_2^2}{2\,u_1^2} + \frac{C\,u_1^{-1+\gamma_m}\,\gamma_m\,(-\gamma+\gamma_m)}{-1+\gamma_m} & -\frac{(-3+\gamma)\,u_2}{u_1} & -1+\gamma \\ \frac{u_2\left(\frac{2\,C\,u_1^{\gamma_m}\,\gamma_m\,(-\gamma+\gamma_m)}{-1+\gamma_m} + 2\left(\gamma\,u_3 + \frac{C\,u_1^{\gamma_m}\,(-\gamma+\gamma_m)}{-1+\gamma_m}\right)\right)}{2\,u_1^2} - \frac{u_2\left((1-\gamma)\,u_2^2 + 2\,u_1\left(\gamma\,u_3 + \frac{C\,u_1^{\gamma_m}\,(-\gamma+\gamma_m)}{-1+\gamma_m}\right)\right)}{u_1^3} & \frac{(1-\gamma)\,u_2^2}{u_1^2} + \frac{(1-\gamma)\,u_2^2 + 2\,u_1\left(\gamma\,u_3 + \frac{C\,u_1^{\gamma_m}\,(-\gamma+\gamma_m)}{-1+\gamma_m}\right)}{2\,u_1^2} & \frac{\gamma\,u_2}{u_1} \end{pmatrix}$$

Out[193]//MatrixForm=

$$\begin{pmatrix} 0 & 1 & 0 \\ \frac{1}{2}u^2\,(-3+\gamma) + \frac{C\,\rho^{-1+\gamma_m}\,\gamma_m\,(-\gamma+\gamma_m)}{-1+\gamma_m} & -u\,(-3+\gamma) & -1+\gamma \\ \frac{u\left(\frac{2\,C\,\rho^{\gamma_m}\,\gamma_m\,(-\gamma+\gamma_m)}{-1+\gamma_m} + 2\left(\gamma\left(\frac{u^2\,\rho}{2} + \frac{P-C\,\rho^{\gamma_m}}{-1+\gamma} + \frac{C\,\rho^{\gamma_m}}{-1+\gamma_m}\right) + \frac{C\,\rho^{\gamma_m}\,(-\gamma+\gamma_m)}{-1+\gamma_m}\right)\right)}{2\,\rho} - \frac{u\left(u^2\,(1-\gamma)\,\rho^2 + 2\,\rho\left(\gamma\left(\frac{u^2\,\rho}{2} + \frac{P-C\,\rho^{\gamma_m}}{-1+\gamma} + \frac{C\,\rho^{\gamma_m}}{-1+\gamma_m}\right) + \frac{C\,\rho^{\gamma_m}\,(-\gamma+\gamma_m)}{-1+\gamma_m}\right)\right)}{\rho^2} & u^2\,(1-\gamma) + \frac{u^2\,(1-\gamma)\,\rho^2 + 2\,\rho\left(\gamma\left(\frac{u^2\,\rho}{2} + \frac{P-C\,\rho^{\gamma_m}}{-1+\gamma} + \frac{C\,\rho^{\gamma_m}}{-1+\gamma_m}\right) + \frac{C\,\rho^{\gamma_m}\,(-\gamma+\gamma_m)}{-1+\gamma_m}\right)}{2\,\rho^2} & u\,\gamma \end{pmatrix}$$

In[204]:=

$$\mathrm{eigenvals} = \mathrm{Eigenvalues[A]}\ /.\ \left\{u_1 \to \rho,\ u_2 \to \rho\,u,\ u_3 \to \frac{1}{2}\rho\,u^2 + \frac{P - C\,\rho^{\gamma_m}}{\gamma-1} + \frac{C\,\rho^{\gamma_m}}{\gamma_m-1}\right\};$$

$$\mathrm{eigenvals} = \mathrm{FullSimplify}\left[\mathrm{eigenvals}\ /.\ \left\{P \to \rho\left(\frac{c_s^2}{\gamma} + \frac{c_m^2}{\gamma_m}\right),\ C \to \frac{c_m^2}{\gamma_m\,\rho^{\gamma_m-1}}\right\},\ \{c_s > 0,\ c_m > 0,\ \gamma > 0,\ P > 0,\ \rho > 0,\ 0 < \gamma_m < 1\}\right];$$

$$\mathrm{eigenvals} = \mathrm{FullSimplify}\left[\mathrm{eigenvals}\ /.\ \left\{c_s^2 + c_m^2 \to c_t^2\right\},\ \{c_s > 0,\ c_m > 0,\ c_t > 0\}\right]$$

$$\mathrm{eigenvectors} = \mathrm{Eigenvectors[A]}\ /.\ \left\{u_1 \to \rho,\ u_2 \to \rho\,u,\ u_3 \to \frac{1}{2}\rho\,u^2 + \frac{P - C\,\rho^{\gamma_m}}{\gamma-1} + \frac{C\,\rho^{\gamma_m}}{\gamma_m-1}\right\};$$

$$\mathrm{eigenvectors} = \mathrm{FullSimplify}\left[\mathrm{eigenvectors}\ /.\ \left\{P \to \rho\left(\frac{c_s^2}{\gamma} + \frac{c_m^2}{\gamma_m}\right),\ C \to \frac{c_m^2}{\gamma_m\,\rho^{\gamma_m-1}}\right\},\ \{c_s > 0,\ c_m > 0,\ \gamma > 0,\ P > 0,\ \rho > 0,\ 0 < \gamma_m < 1\}\right];$$

$$\mathrm{eigenvectors} = \mathrm{MatrixForm}\left[\mathrm{Transpose}\left[\mathrm{FullSimplify}\left[\mathrm{eigenvectors}\ /.\ \left\{c_s^2 + c_m^2 \to c_t^2\right\},\ \{c_s > 0,\ c_m > 0,\ c_t > 0\}\right]\right]\right]$$

Out[206]= $\{u,\ u + c_t,\ u - c_t\}$

Out[209]//MatrixForm=

$$\begin{pmatrix} \frac{2\,(-1+\gamma)\,(-1+\gamma_m)}{2\,c_m^2\,(\gamma-\gamma_m) + u^2\,(-1+\gamma)\,(-1+\gamma_m)} & \frac{1}{\frac{u^2}{2} + \frac{c_s^2}{-1+\gamma} + u\,c_t + \frac{c_m^2}{-1+\gamma_m}} & \frac{1}{\frac{c_s^2}{-1+\gamma} + \frac{1}{2}u\,(u-2\,c_t) + \frac{c_m^2}{-1+\gamma_m}} \\ \frac{2\,u\,(-1+\gamma)\,(-1+\gamma_m)}{2\,c_m^2\,(\gamma-\gamma_m) + u^2\,(-1+\gamma)\,(-1+\gamma_m)} & -\frac{2\,(-1+\gamma)\left(-c_m^2 - c_s^2 + u\,(u\,(-1+\gamma) + (-2+\gamma)\,c_t)\right)(-1+\gamma_m)}{\left(2\,c_s^2\,c_t - u^2\,(-1+\gamma)\,(u\,(-1+\gamma) + (-3+2\,\gamma)\,c_t)\right)(-1+\gamma_m) + 2\,(-1+\gamma)\,c_m^2\,(c_t + u\,(-\gamma+\gamma_m))} & -\frac{2\,(-1+\gamma)\left(u\left(u - u\,\gamma + (-2+\gamma)\,\sqrt{c_m^2 + c_s^2}\right) + c_t^2\right)(-1+\gamma_m)}{2\,(-1+\gamma)\,c_m^2\,(c_t + u\,(\gamma-\gamma_m)) + \left(2\,c_s^2\,c_t + u^2\,(-1+\gamma)\,(u\,(-1+\gamma) + (3-2\,\gamma)\,c_t)\right)(-1+\gamma_m)} \\ 1 & 1 & 1 \end{pmatrix}$$

In[210]:= (*Just some more checks*)

$$\text{eigenvals} = \text{Eigenvalues}[A]\ /.\ \left\{u_1 \to \rho,\ u_2 \to \rho\, u,\ u_3 \to \frac{1}{2}\rho\, u^2 + \frac{P - C\rho^{\gamma_m}}{\gamma - 1} + \frac{C\rho^{\gamma_m}}{\gamma_m - 1}\right\};$$

$$\text{FullSimplify}\left[\text{eigenvals}\ /.\ \left\{P \to \rho\left(\frac{c_s{}^2}{\gamma} + \frac{c_m{}^2}{\gamma_m}\right),\ C \to \frac{c_m{}^2}{\gamma_m\,\rho^{\gamma_m - 1}}\right\},\ \{c_s > 0,\ c_m > 0,\ \gamma > 0,\ P > 0,\ \rho > 0,\ \gamma_m > 1\}\right]$$

$$\text{eigenvectors} = \text{Eigenvectors}[A]\ /.\ \left\{u_1 \to \rho,\ u_2 \to \rho\, u,\ u_3 \to \frac{1}{2}\rho\, u^2 + \frac{P - C\rho^{\gamma_m}}{\gamma - 1} + \frac{C\rho^{\gamma_m}}{\gamma_m - 1}\right\};$$

$$\text{FullSimplify}\left[\text{eigenvectors}\ /.\ \left\{P \to \rho\left(\frac{c_s{}^2}{\gamma} + \frac{c_m{}^2}{\gamma_m}\right),\ C \to \frac{c_m{}^2}{\gamma_m\,\rho^{\gamma_m - 1}}\right\},\ \{c_s > 0,\ c_m > 0,\ \gamma > 0,\ P > 0,\ \rho > 0,\ \gamma_m > 1\}\right]$$

Out[213]=

$$\left\{\left\{\frac{2(-1+\gamma)(-1+\gamma_m)}{2c_m^2(\gamma-\gamma_m)+u^2(-1+\gamma)(-1+\gamma_m)},\ \frac{2u(-1+\gamma)(-1+\gamma_m)}{2c_m^2(\gamma-\gamma_m)+u^2(-1+\gamma)(-1+\gamma_m)},\ 1\right\},\right.$$

$$\left\{\frac{1}{\frac{c_s^2}{-1+\gamma}+\frac{1}{2}u\left(u-2\sqrt{c_m^2+c_s^2}\right)+\frac{c_m^2}{-1+\gamma_m}},\ -\frac{2(-1+\gamma)\left(c_m^2+c_s^2+u\left(u-u\gamma+(-2+\gamma)\sqrt{c_m^2+c_s^2}\right)\right)(-1+\gamma_m)}{\left(2c_s^2\sqrt{c_m^2+c_s^2}+u^2(-1+\gamma)\left(u(-1+\gamma)+(3-2\gamma)\sqrt{c_m^2+c_s^2}\right)\right)(-1+\gamma_m)+2(-1+\gamma)c_m^2\left(u\gamma+\sqrt{c_m^2+c_s^2}-u\gamma_m\right)},\ 1\right\},$$

$$\left.\left\{\frac{1}{\frac{c_s^2}{-1+\gamma}+\frac{1}{2}u\left(u+2\sqrt{c_m^2+c_s^2}\right)+\frac{c_m^2}{-1+\gamma_m}},\ -\frac{2(-1+\gamma)\left(-c_m^2-c_s^2+u\left(u(-1+\gamma)+(-2+\gamma)\sqrt{c_m^2+c_s^2}\right)\right)(-1+\gamma_m)}{\left(2c_s^2\sqrt{c_m^2+c_s^2}-u^2(-1+\gamma)\left(u(-1+\gamma)+(-3+2\gamma)\sqrt{c_m^2+c_s^2}\right)\right)(-1+\gamma_m)+2(-1+\gamma)c_m^2\left(-u\gamma+\sqrt{c_m^2+c_s^2}+u\gamma_m\right)},\ 1\right\}\right\}$$

In[214]:= $\left\{u,\ u-\sqrt{c_m^2+c_s^2},\ u+\sqrt{c_m^2+c_s^2}\right\}$

Out[214]= $\left\{u,\ u-\sqrt{c_m^2+c_s^2},\ u+\sqrt{c_m^2+c_s^2}\right\}$

In[215]:=

$$\left\{\frac{1}{\frac{c_s^2}{-1+\gamma}+\frac{1}{2}u\left(u+2\sqrt{c_m^2+c_s^2}\right)+\frac{c_m^2}{-1+\gamma_m}},\right.$$
$$-\left(\left(2(-1+\gamma)\left(-c_m^2-c_s^2+u\left(u(-1+\gamma)+(-2+\gamma)\sqrt{c_m^2+c_s^2}\right)\right)(-1+\gamma_m)\right)\Big/\left(\left(2c_s^2\sqrt{c_m^2+c_s^2}-u^2(-1+\gamma)\left(u(-1+\gamma)+(-3+2\gamma)\sqrt{c_m^2+c_s^2}\right)\right)(-1+\gamma_m)+2(-1+\gamma)c_m^2\left(-u\gamma+\sqrt{c_m^2+c_s^2}+u\gamma_m\right)\right)\right),$$
$$\left.1\right\} === \left\{\frac{1}{\frac{c_s^2}{-1+\gamma}+\frac{1}{2}u\left(u+2\sqrt{c_m^2+c_s^2}\right)+\frac{c_m^2}{-1+\gamma_m}},\right.$$
$$\left.-\left(\left(2(-1+\gamma)\left(-c_m^2-c_s^2+u\left(u(-1+\gamma)+(-2+\gamma)\sqrt{c_m^2+c_s^2}\right)\right)(-1+\gamma_m)\right)\Big/\left(\left(2c_s^2\sqrt{c_m^2+c_s^2}-u^2(-1+\gamma)\left(u(-1+\gamma)+(-3+2\gamma)\sqrt{c_m^2+c_s^2}\right)\right)(-1+\gamma_m)+2(-1+\gamma)c_m^2\left(-u\gamma+\sqrt{c_m^2+c_s^2}+u\gamma_m\right)\right)\right),\ 1\right\}$$

Out[215]= True

In[216]:=

$$\left\{\frac{1}{\frac{c_s^2}{-1+\gamma}+\frac{1}{2}u\left(u-2\sqrt{c_m^2+c_s^2}\right)+\frac{c_m^2}{-1+\gamma_m}},\ -\left(\left(2(-1+\gamma)\left(c_m^2+c_s^2+u\left(u-u\gamma+(-2+\gamma)\sqrt{c_m^2+c_s^2}\right)\right)(-1+\gamma_m)\right)\Big/\left(\left(2c_s^2\sqrt{c_m^2+c_s^2}+u^2(-1+\gamma)\left(u(-1+\gamma)+(3-2\gamma)\sqrt{c_m^2+c_s^2}\right)\right)(-1+\gamma_m)+2(-1+\gamma)c_m^2\left(u\gamma+\sqrt{c_m^2+c_s^2}-u\gamma_m\right)\right)\right),\right.$$
$$\left.1\right\} === \left\{\frac{1}{\frac{c_s^2}{-1+\gamma}+\frac{1}{2}u\left(u-2\sqrt{c_m^2+c_s^2}\right)+\frac{c_m^2}{-1+\gamma_m}},\right.$$
$$\left.-\left(\left(2(-1+\gamma)\left(c_m^2+c_s^2+u\left(u-u\gamma+(-2+\gamma)\sqrt{c_m^2+c_s^2}\right)\right)(-1+\gamma_m)\right)\Big/\left(\left(2c_s^2\sqrt{c_m^2+c_s^2}+u^2(-1+\gamma)\left(u(-1+\gamma)+(3-2\gamma)\sqrt{c_m^2+c_s^2}\right)\right)(-1+\gamma_m)+2(-1+\gamma)c_m^2\left(u\gamma+\sqrt{c_m^2+c_s^2}-u\gamma_m\right)\right)\right),\ 1\right\}$$

Out[216]= True

In[217]:= `?? TeXForm`

Symbol

TeXForm[*expr*] prints as a TeX version of *expr*.

Out[217]=

Documentation	Local » | Web »
Attributes	{Protected}
Full Name	System`TeXForm