

In[166]:= **MαDMixedFinalAPhy**
MαDMixedFinalphiPhy
MαDMixedFinalAphiPhy

$$\begin{aligned}
\text{Out[166]} = & - \left(\left(H M_V^2 \left(-\tilde{\alpha}_K^2 \left(4 \dot{\tilde{\alpha}}_C \left(\dot{\varphi}^2 + 2 \dot{H} M_V^2 \right)^4 + H \left(\dot{\varphi}^2 + 2 \dot{H} M_V^2 \right)^2 \right. \right. \right. \right. \\
& \left(2 \dot{\tilde{\alpha}}_V H M_V^2 \left(\dot{\varphi}^2 + 2 \dot{H} M_V^2 \right) + 4 \tilde{\alpha}_C \left(1 + \tilde{\alpha}_M \right) \left(\dot{\varphi}^2 + 2 \dot{H} M_V^2 \right)^2 + \tilde{\alpha}_V \left(-\dot{\varphi}^4 - 4 \dot{\varphi} \dot{\varphi} H M_V^2 + \right. \right. \\
& \left. \left. 2 \dot{\varphi}^2 \left(\dot{H} + \left(1 + 2 \tilde{\alpha}_M \right) H^2 \right) M_V^2 + 4 \left(2 \dot{H}^2 - \dot{H} H + \left(1 + \tilde{\alpha}_M \right) \dot{H} H^2 \right) M_V^{22} \right) \right) \right) + \\
& 2 \tilde{\alpha}_K H \left(\tilde{\alpha}_A^2 \left(\dot{\varphi}^2 + 2 \dot{H} M_V^2 \right)^2 \left(\dot{\varphi}^4 + 4 \dot{\varphi} \dot{\varphi} H M_V^2 - 2 \dot{\varphi}^2 \left(\dot{H} + \left(1 + 2 \tilde{\alpha}_M \right) H^2 \right) M_V^2 - \right. \right. \\
& \left. \left. 4 \left(2 \dot{H}^2 - \dot{H} H + \left(1 + \tilde{\alpha}_M \right) \dot{H} H^2 \right) M_V^{22} \right) + \right. \\
& 4 \tilde{\alpha}_C^2 \left(\dot{\varphi}^2 + 2 \dot{H} M_V^2 \right) \left(\dot{\varphi}^6 + 6 \dot{H} \dot{\varphi}^4 M_V^2 + 16 \left(1 + \tilde{\alpha}_M \right) \dot{\varphi} \dot{\varphi} H^3 M_V^{22} + \right. \\
& \left. 4 \dot{\varphi}^2 \left(3 \dot{H}^2 - 5 \left(1 + \tilde{\alpha}_M \right) \dot{H} H^2 - H^3 \left(\dot{\tilde{\alpha}}_M + \left(-1 + \tilde{\alpha}_M^2 \right) H \right) \right) M_V^{22} + 8 \right. \\
& \left. \left(\dot{H}^3 - 5 \left(1 + \tilde{\alpha}_M \right) \dot{H}^2 H^2 + 2 \left(1 + \tilde{\alpha}_M \right) \dot{H} H^3 + \dot{H} H^3 \left(-\dot{\tilde{\alpha}}_M + \left(1 + \tilde{\alpha}_M \right)^2 H \right) \right) M_V^{23} \right) + 4 \tilde{\alpha}_C M_V^2 \\
& \left(48 \dot{H}^4 M_V^{23} - 4 \dot{H}^3 M_V^{22} \left(-18 \dot{\varphi}^2 + H \left(2 \dot{\tilde{\alpha}}_A + 16 \dot{\tilde{\alpha}}_C + \left(4 + 24 \tilde{\alpha}_M - 20 \tilde{\alpha}_T + 3 \tilde{\alpha}_V \right) H \right) M_V^2 \right) + \right. \\
& \left. 4 \dot{H}^2 M_V^2 \left(9 \dot{\varphi}^4 - 4 \dot{\varphi} \dot{\varphi} H M_V^2 - \dot{\varphi}^2 H \left(3 \dot{\tilde{\alpha}}_A + 16 \dot{\tilde{\alpha}}_C + 2 \left(3 + 12 \tilde{\alpha}_M - 10 \tilde{\alpha}_T + \tilde{\alpha}_V \right) H \right) M_V^2 + \right. \right. \\
& \left. \left. H \left(-4 \dot{H} + H \left(-4 \dot{\tilde{\alpha}}_C + H \left(-2 \left(1 + \tilde{\alpha}_M \right) \dot{\tilde{\alpha}}_A + 4 \left(1 + \tilde{\alpha}_M \right) \dot{\tilde{\alpha}}_C - 4 \dot{\tilde{\alpha}}_M + 4 \dot{\tilde{\alpha}}_T - \dot{\tilde{\alpha}}_V + \right. \right. \right. \right. \right. \right. \\
& \left. \left. \left. 4 \tilde{\alpha}_M H + 4 \tilde{\alpha}_M^2 H - 4 \tilde{\alpha}_T H - 4 \tilde{\alpha}_M \tilde{\alpha}_T H - 2 \tilde{\alpha}_V H - 2 \tilde{\alpha}_M \tilde{\alpha}_V H \right) \right) \right) M_V^{22} \right) + \\
& \dot{H} \left(6 \dot{\varphi}^6 - 16 \dot{\varphi} \dot{\varphi}^3 H M_V^2 + \dot{\varphi}^4 H \left(-6 \dot{\tilde{\alpha}}_A - 16 \dot{\tilde{\alpha}}_C + \left(-12 - 24 \tilde{\alpha}_M + 20 \tilde{\alpha}_T + \tilde{\alpha}_V \right) H \right) \right. \\
& \left. M_V^2 + 8 \dot{\varphi} \dot{\varphi} H^2 \left(4 \dot{\tilde{\alpha}}_C + \left(4 \tilde{\alpha}_M - 4 \tilde{\alpha}_T + \tilde{\alpha}_V \right) H \right) M_V^{22} - 2 \dot{\varphi}^2 H \right. \\
& \left(8 \dot{H} + H \left(8 \dot{\tilde{\alpha}}_C + H \left(4 \left(1 + \tilde{\alpha}_M \right) \dot{\tilde{\alpha}}_A - 8 \dot{\tilde{\alpha}}_C + 8 \dot{\tilde{\alpha}}_M - 8 \dot{\tilde{\alpha}}_T + 2 \dot{\tilde{\alpha}}_V - 8 \tilde{\alpha}_M H + 8 \tilde{\alpha}_T H + \right. \right. \\
& \left. \left. 3 \tilde{\alpha}_V H + 5 \tilde{\alpha}_M \tilde{\alpha}_V H \right) \right) \right) M_V^{22} + 4 H^2 \left(2 \dot{H} \left(4 \dot{\tilde{\alpha}}_C + \left(4 \tilde{\alpha}_M - 4 \tilde{\alpha}_T + \tilde{\alpha}_V \right) H \right) + \right. \\
& \left. H^3 \left(\left(1 + \tilde{\alpha}_M \right) \dot{\tilde{\alpha}}_V + \tilde{\alpha}_V \left(-\dot{\tilde{\alpha}}_M + \left(1 + \tilde{\alpha}_M \right)^2 H \right) \right) \right) M_V^{23} \right) + \\
& H \left(-2 \dot{\varphi}^6 H + \tilde{\alpha}_V \dot{\varphi}^6 H - 4 \dot{H} \dot{\varphi}^4 M_V^2 - 4 \dot{\tilde{\alpha}}_C \dot{\varphi}^4 H M_V^2 + 4 \dot{\tilde{\alpha}}_C \dot{\varphi}^4 H^2 M_V^2 - \right. \\
& 4 \tilde{\alpha}_M \dot{\tilde{\alpha}}_C \dot{\varphi}^4 H^2 M_V^2 - 4 \dot{\tilde{\alpha}}_M \dot{\varphi}^4 H^2 M_V^2 + 4 \dot{\tilde{\alpha}}_T \dot{\varphi}^4 H^2 M_V^2 - \dot{\tilde{\alpha}}_V \dot{\varphi}^4 H^2 M_V^2 + \\
& 4 \tilde{\alpha}_M \dot{\varphi}^4 H^3 M_V^2 - 4 \tilde{\alpha}_M^2 \dot{\varphi}^4 H^3 M_V^2 - 4 \tilde{\alpha}_T \dot{\varphi}^4 H^3 M_V^2 + 4 \tilde{\alpha}_M \tilde{\alpha}_T \dot{\varphi}^4 H^3 M_V^2 - \\
& \tilde{\alpha}_V \dot{\varphi}^4 H^3 M_V^2 - 3 \tilde{\alpha}_M \tilde{\alpha}_V \dot{\varphi}^4 H^3 M_V^2 + 16 \dot{H} \dot{\tilde{\alpha}}_C \dot{\varphi}^2 H M_V^{22} + 16 \tilde{\alpha}_M \dot{H} \dot{\varphi}^2 H^2 M_V^{22} - \\
& 16 \tilde{\alpha}_T \dot{H} \dot{\varphi}^2 H^2 M_V^{22} + 4 \tilde{\alpha}_V \dot{H} \dot{\varphi}^2 H^2 M_V^{22} - 2 \tilde{\alpha}_V \dot{\tilde{\alpha}}_M \dot{\varphi}^2 H^4 M_V^{22} + \\
& 2 \dot{\tilde{\alpha}}_V \dot{\varphi}^2 H^4 M_V^{22} + 2 \tilde{\alpha}_M \dot{\tilde{\alpha}}_V \dot{\varphi}^2 H^4 M_V^{22} + 2 \tilde{\alpha}_V \dot{\varphi}^2 H^5 M_V^{22} + 2 \tilde{\alpha}_M \tilde{\alpha}_V \dot{\varphi}^2 H^5 M_V^{22} + \\
& 4 \tilde{\alpha}_V \dot{H} H^4 M_V^{23} + 4 \tilde{\alpha}_M \tilde{\alpha}_V \dot{H} H^4 M_V^{23} - \dot{\tilde{\alpha}}_A \dot{\varphi}^4 \left(\dot{\varphi}^2 + 2 \left(1 + \tilde{\alpha}_M \right) H^2 M_V^2 \right) - \\
& \left. 4 \dot{\varphi} \left(\dot{\varphi}^5 - \dot{\varphi}^3 H \left(4 \dot{\tilde{\alpha}}_C + \left(4 \tilde{\alpha}_M - 4 \tilde{\alpha}_T + \tilde{\alpha}_V \right) H \right) M_V^2 - \left(1 + \tilde{\alpha}_M \right) \tilde{\alpha}_V \dot{\varphi} H^4 M_V^{22} \right) \right) \right) + \\
& H M_V^2 \left(16 \dot{\tilde{\alpha}}_C^2 H M_V^2 \left(\dot{\varphi}^2 + 2 \dot{H} M_V^2 \right)^2 + 4 \dot{\tilde{\alpha}}_A \left(\dot{\varphi}^2 + 2 \dot{H} M_V^2 \right)^2 \left(\dot{\varphi}^2 + 2 \dot{H} M_V^2 - \right. \right. \\
& \left. \left. H \left(2 \dot{\tilde{\alpha}}_C + \left(2 \tilde{\alpha}_M - 2 \tilde{\alpha}_T + \tilde{\alpha}_V \right) H \right) M_V^2 \right) - \right. \\
& 4 \dot{\tilde{\alpha}}_C \left(2 \dot{\varphi}^6 + \dot{\varphi}^4 \left(12 \dot{H} + \left(-4 \tilde{\alpha}_M + 4 \tilde{\alpha}_T + \tilde{\alpha}_V \right) H^2 \right) M_V^2 - 4 \tilde{\alpha}_V \dot{\varphi} \dot{\varphi} H^3 M_V^{22} + \right. \\
& \left. 2 \dot{\varphi}^2 \left(12 \dot{H}^2 + 2 \left(-4 \tilde{\alpha}_M + 4 \tilde{\alpha}_T + \tilde{\alpha}_V \right) \dot{H} H^2 + H^3 \left(-\dot{\tilde{\alpha}}_V + \tilde{\alpha}_M \tilde{\alpha}_V H \right) \right) M_V^{22} + \right.
\end{aligned}$$

$$\begin{aligned}
& 4 \left(4 \dot{H}^3 + (-4 \tilde{\alpha}_M + 4 \tilde{\alpha}_T + \tilde{\alpha}_V) \dot{H}^2 H^2 - \tilde{\alpha}_V \dot{H} H^3 - \dot{\tilde{\alpha}}_V \dot{H} H^3 \right) M_V^{23} \Big) + \\
& H \left(-4 \dot{\tilde{\alpha}}_V H M_V^2 \left(\dot{\varphi}^2 + 2 \dot{H} M_V^2 \right) \left(\dot{\varphi}^2 + 2 \left(\dot{H} + (-\tilde{\alpha}_M + \tilde{\alpha}_T) H^2 \right) M_V^2 \right) + \tilde{\alpha}_V^2 H^2 M_V^2 \left(-\dot{\varphi}^4 + \right. \right. \\
& \quad 4 \dot{\varphi} \dot{\varphi} H M_V^2 + 2 \dot{\varphi}^2 \left(-3 \dot{H} + H^2 \right) M_V^2 + 4 \left(-2 \dot{H}^2 + \dot{H} H + (1 + \tilde{\alpha}_M) \dot{H} H^2 \right) M_V^{22} \Big) + \\
& \quad 4 \tilde{\alpha}_V \left(\dot{\varphi}^6 + \dot{\varphi}^4 \left(5 \dot{H} + (-1 - 3 \tilde{\alpha}_M + 2 \tilde{\alpha}_T) H^2 \right) M_V^2 + 4 \left(\tilde{\alpha}_M - \tilde{\alpha}_T \right) \dot{\varphi} \dot{\varphi} H^3 M_V^{22} + \right. \\
& \quad \left. 2 \dot{\varphi}^2 \left(4 \dot{H}^2 + (-2 - 7 \tilde{\alpha}_M + 5 \tilde{\alpha}_T) \dot{H} H^2 + H^2 \left(-\ddot{\tilde{\alpha}}_C + H \left(-\dot{\tilde{\alpha}}_M + \dot{\tilde{\alpha}}_T + \tilde{\alpha}_M H - \tilde{\alpha}_T H \right) \right) \right) \right) \\
& \quad M_V^{22} + 4 \left(\dot{H}^3 - (1 + 4 \tilde{\alpha}_M - 3 \tilde{\alpha}_T) \dot{H}^2 H^2 + (\tilde{\alpha}_M - \tilde{\alpha}_T) \dot{H} H^3 - \right. \\
& \quad \left. \dot{H} H^2 \left(\ddot{\tilde{\alpha}}_C + H \left(\dot{\tilde{\alpha}}_M - \dot{\tilde{\alpha}}_T - (1 + \tilde{\alpha}_M) (\tilde{\alpha}_M - \tilde{\alpha}_T) H \right) \right) \right) M_V^{23} \Big) \Big) + \\
& 2 \tilde{\alpha}_A \left(\dot{\varphi}^2 + 2 \dot{H} M_V^2 \right) \left(2 \tilde{\alpha}_C \left(\dot{\varphi}^6 + 2 \dot{\varphi} \dot{\varphi}^3 H M_V^2 + \dot{\varphi}^4 \left(3 \dot{H} + (3 + 2 \tilde{\alpha}_M) H^2 \right) M_V^2 + \right. \right. \\
& \quad 4 \dot{\varphi} \dot{\varphi} H \left(\dot{H} + 2 (1 + \tilde{\alpha}_M) H^2 \right) M_V^{22} - \\
& \quad \left. 2 \dot{\varphi}^2 H \left(-\dot{H} + H \left(-\dot{H} + H \left(\dot{\tilde{\alpha}}_M + H + 4 \tilde{\alpha}_M H + 3 \tilde{\alpha}_M^2 H \right) \right) \right) M_V^{22} - 4 \left(\dot{H}^3 - \dot{H} \dot{H} H + \right. \right. \\
& \quad \left. \left. 2 (1 + \tilde{\alpha}_M) \dot{H}^2 H^2 - 2 (1 + \tilde{\alpha}_M) \dot{H} H^3 + \dot{H} H^3 \left(\dot{\tilde{\alpha}}_M + (1 + \tilde{\alpha}_M)^2 H \right) \right) M_V^{23} \right) + \\
& M_V^2 \left(24 \dot{H}^3 M_V^{22} - 8 \dot{H}^2 M_V^2 \left(-3 \dot{\varphi}^2 + H \left(\dot{\tilde{\alpha}}_A + \dot{\tilde{\alpha}}_C + (-1 + 4 \tilde{\alpha}_M - 5 \tilde{\alpha}_T) H \right) M_V^2 \right) + \right. \\
& \quad 2 \dot{H} \left(3 \dot{\varphi}^4 - 4 \dot{\varphi} \dot{\varphi} H M_V^2 + \dot{\varphi}^2 H \left(-4 \dot{\tilde{\alpha}}_A + 4 \dot{\tilde{\alpha}}_C - (-4 + 4 \tilde{\alpha}_M - 10 \tilde{\alpha}_T + \tilde{\alpha}_V) H \right) M_V^2 + \right. \\
& \quad \left. 2 H \left(-2 \dot{H} + H \left(-2 \ddot{\tilde{\alpha}}_C + H \left(-4 (1 + \tilde{\alpha}_M) \dot{\tilde{\alpha}}_C - 2 \dot{\tilde{\alpha}}_M + 2 \dot{\tilde{\alpha}}_T + \dot{\tilde{\alpha}}_V - 2 \tilde{\alpha}_M H - \right. \right. \right. \\
& \quad \left. \left. \left. 2 \tilde{\alpha}_M^2 H + 2 \tilde{\alpha}_T H + 2 \tilde{\alpha}_M \tilde{\alpha}_T H + \tilde{\alpha}_V H + \tilde{\alpha}_M \tilde{\alpha}_V H \right) \right) \right) M_V^{22} \Big) \Big) + \\
& H \left(-2 \dot{\tilde{\alpha}}_A \dot{\varphi}^4 + 6 \dot{\tilde{\alpha}}_C \dot{\varphi}^4 + 2 \dot{\varphi}^4 H + 4 \tilde{\alpha}_M \dot{\varphi}^4 H - \tilde{\alpha}_V \dot{\varphi}^4 H - 4 \dot{H} \dot{\varphi}^2 M_V^2 - \right. \\
& \quad 4 \dot{\tilde{\alpha}}_C \dot{\varphi}^2 H M_V^2 - 8 \dot{\tilde{\alpha}}_C \dot{\varphi}^2 H^2 M_V^2 - 16 \tilde{\alpha}_M \dot{\tilde{\alpha}}_C \dot{\varphi}^2 H^2 M_V^2 - 4 \dot{\tilde{\alpha}}_M \dot{\varphi}^2 H^2 M_V^2 + 4 \dot{\tilde{\alpha}}_T \dot{\varphi}^2 H^2 \\
& \quad M_V^2 + 2 \dot{\tilde{\alpha}}_V \dot{\varphi}^2 H^2 M_V^2 - 4 \tilde{\alpha}_M \dot{\varphi}^2 H^3 M_V^2 - 12 \tilde{\alpha}_M^2 \dot{\varphi}^2 H^3 M_V^2 + 4 \tilde{\alpha}_T \dot{\varphi}^2 H^3 M_V^2 + 12 \\
& \quad \tilde{\alpha}_M \tilde{\alpha}_T \dot{\varphi}^2 H^3 M_V^2 + 2 \tilde{\alpha}_V \dot{\varphi}^2 H^3 M_V^2 + 2 \tilde{\alpha}_M \tilde{\alpha}_V \dot{\varphi}^2 H^3 M_V^2 + 16 \dot{H} \dot{\tilde{\alpha}}_C H M_V^{22} + 16 \tilde{\alpha}_M \\
& \quad \dot{H} H^2 M_V^{22} - 16 \tilde{\alpha}_T \dot{H} H^2 M_V^{22} - 4 \dot{\varphi} \left(\dot{\varphi}^3 - 4 \dot{\varphi} H \left(\dot{\tilde{\alpha}}_C + \tilde{\alpha}_M H - \tilde{\alpha}_T H \right) M_V^2 \right) \Big) \Big) \Big) + \\
& 4 H^2 M_V^2 \left(2 \tilde{\alpha}_A^3 H \left(\dot{\varphi}^2 + 2 \dot{H} M_V^2 \right)^2 \left(-\dot{\varphi}^2 + 2 (1 + \tilde{\alpha}_M) H^2 M_V^2 \right) + \tilde{\alpha}_A^2 \right. \\
& \quad \left(\dot{\tilde{\alpha}}_K \left(\dot{\varphi}^2 + 2 \dot{H} M_V^2 \right)^3 + H \left((2 - 8 \tilde{\alpha}_C) \dot{\varphi}^6 - \dot{\varphi}^4 \left(40 \tilde{\alpha}_C \dot{H} + 12 \tilde{\alpha}_C (1 + \tilde{\alpha}_M) H^2 + \right. \right. \right. \\
& \quad \left. \left. \left. H \left(-4 \dot{\tilde{\alpha}}_A + 12 \dot{\tilde{\alpha}}_C + (12 + 16 \tilde{\alpha}_M - 4 \tilde{\alpha}_T + \tilde{\alpha}_V) H \right) \right) \right) M_V^2 - 4 \dot{\varphi} \dot{\varphi} H^2 \right. \\
& \quad \left(4 \dot{\tilde{\alpha}}_C + (4 \tilde{\alpha}_M + 4 \tilde{\alpha}_C (1 + \tilde{\alpha}_M) - 4 \tilde{\alpha}_T - \tilde{\alpha}_V) H \right) M_V^{22} - 2 \dot{\varphi}^2 \left(4 (3 + 8 \tilde{\alpha}_C) \dot{H}^2 + \right. \\
& \quad \dot{H} H \left(-8 \dot{\tilde{\alpha}}_A + 8 \dot{\tilde{\alpha}}_C + 4 \tilde{\alpha}_C (1 + \tilde{\alpha}_M) H + 3 (8 + 4 \tilde{\alpha}_M + 4 \tilde{\alpha}_T + \tilde{\alpha}_V) H \right) - \\
& \quad H^2 \left(4 \ddot{\tilde{\alpha}}_C + H \left(4 (4 + 5 \tilde{\alpha}_M) \dot{\tilde{\alpha}}_C + 4 (1 + \tilde{\alpha}_C) \dot{\tilde{\alpha}}_M - 4 \dot{\tilde{\alpha}}_T - \dot{\tilde{\alpha}}_V + 12 \tilde{\alpha}_C H + 12 \tilde{\alpha}_M H + \right. \right. \\
& \quad \left. \left. 28 \tilde{\alpha}_C \tilde{\alpha}_M H + 16 \tilde{\alpha}_M^2 H + 16 \tilde{\alpha}_C \tilde{\alpha}_M^2 H - 12 \tilde{\alpha}_T H - 16 \tilde{\alpha}_M \tilde{\alpha}_T H + \tilde{\alpha}_V H \right) \right) \Big) \Big) \\
& M_V^{22} - 4 \left(8 (1 + \tilde{\alpha}_C) \dot{H}^3 - 2 \dot{H}^2 H \left(2 \dot{\tilde{\alpha}}_A + 2 \dot{\tilde{\alpha}}_C + (-6 + 2 \tilde{\alpha}_M + 4 \tilde{\alpha}_C (1 + \tilde{\alpha}_M) - \right. \right. \\
& \quad \left. \left. 8 \tilde{\alpha}_T - \tilde{\alpha}_V) H \right) + \dot{H} H^2 \left(4 \dot{\tilde{\alpha}}_C + (4 \tilde{\alpha}_M + 4 \tilde{\alpha}_C (1 + \tilde{\alpha}_M) - 4 \tilde{\alpha}_T - \tilde{\alpha}_V) H \right) - \right. \\
& \quad \dot{H} H^2 \left(4 \ddot{\tilde{\alpha}}_C + H \left(16 (1 + \tilde{\alpha}_M) \dot{\tilde{\alpha}}_C + 4 (1 + \tilde{\alpha}_C) \dot{\tilde{\alpha}}_M - 4 \dot{\tilde{\alpha}}_T - \dot{\tilde{\alpha}}_V + \right. \right. \\
& \quad \left. \left. 12 \tilde{\alpha}_C H + 12 \tilde{\alpha}_M H + 24 \tilde{\alpha}_C \tilde{\alpha}_M H + 12 \tilde{\alpha}_M^2 H + 12 \tilde{\alpha}_C \tilde{\alpha}_M^2 H - \right. \right.
\end{aligned}$$

$$\begin{aligned}
& 2 H \left(\left(\tilde{\alpha}_M - \tilde{\alpha}_T \right) H^2 \left(-\dot{\tilde{\alpha}}_V + 4 \left(1 + \tilde{\alpha}_M \right) \left(\tilde{\alpha}_M - \tilde{\alpha}_T \right) H \right) + \tilde{\alpha}_V \left(-\ddot{H} + \right. \right. \\
& \quad \left. \left. H \left(\ddot{\tilde{\alpha}}_C + H \left(\dot{\tilde{\alpha}}_M - \dot{\tilde{\alpha}}_T + \left(1 + \tilde{\alpha}_M \right) \left(\tilde{\alpha}_M - \tilde{\alpha}_T \right) H \right) \right) \right) M_V^2 \right) \right) \Big) \Big) \Big) \Big) \Big) \\
\delta A_1^{1,2} a^2 \Big) & \Big/ \left(4 \left(\tilde{\alpha}_K \left(\dot{\varphi}^2 + 2 \dot{H} M_V^2 \right)^2 - 2 H^2 M_V^2 \left(2 \left(-1 + \tilde{\alpha}_A \right) \dot{\varphi}^2 + 4 \left(-1 + \tilde{\alpha}_A \right) \dot{H} M_V^2 + \right. \right. \right. \\
& \quad \left. \left. H \left(4 \dot{\tilde{\alpha}}_C + \left(4 \tilde{\alpha}_M + 4 \tilde{\alpha}_C \left(1 + \tilde{\alpha}_M \right) - 4 \tilde{\alpha}_T + \tilde{\alpha}_V \right) H \right) M_V^2 \right) \right)^2 \Big) \Big) \\
\text{Out[167]} = & - \left(\left(k^2 M_V^2 \left(\tilde{\alpha}_K \left(4 \dot{H} \dot{\varphi}^2 + \dot{\varphi}^2 H \left(4 \dot{\tilde{\alpha}}_C + \left(4 \tilde{\alpha}_M + 4 \tilde{\alpha}_C \left(1 + \tilde{\alpha}_M \right) - 4 \tilde{\alpha}_T + \tilde{\alpha}_V \right) H \right) + 8 \dot{H}^2 M_V^2 \right) - 2 H^2 \right. \right. \right. \\
& \quad \left. \left(- \left(-2 + \tilde{\alpha}_A \right)^2 \dot{\varphi}^2 + 8 \left(-1 + \tilde{\alpha}_A \right) \dot{H} M_V^2 + 2 H \left(4 \dot{\tilde{\alpha}}_C + \left(4 \tilde{\alpha}_M + 4 \tilde{\alpha}_C \left(1 + \tilde{\alpha}_M \right) - 4 \tilde{\alpha}_T + \tilde{\alpha}_V \right) H \right) M_V^2 \right) \right) \right) \\
\delta \varphi^{1,2} a^2 \Big) & \Big/ \left(4 \tilde{\alpha}_K \left(\dot{\varphi}^2 + 2 \dot{H} M_V^2 \right)^2 - 8 H^2 M_V^2 \right. \\
& \quad \left. \left(2 \left(-1 + \tilde{\alpha}_A \right) \dot{\varphi}^2 + 4 \left(-1 + \tilde{\alpha}_A \right) \dot{H} M_V^2 + H \left(4 \dot{\tilde{\alpha}}_C + \left(4 \tilde{\alpha}_M + 4 \tilde{\alpha}_C \left(1 + \tilde{\alpha}_M \right) - 4 \tilde{\alpha}_T + \tilde{\alpha}_V \right) H \right) M_V^2 \right) \right) \Big) \\
\text{Out[168]} = & - \left(\left(k M_V^2 \left(\tilde{\alpha}_K^2 \left(\dot{\varphi}^2 + 2 \dot{H} M_V^2 \right) \left(8 \dot{H}^3 \dot{\varphi} M_V^2 - 2 \dot{H}^2 M_V^2 \right. \right. \right. \right. \\
& \quad \left. \left(-4 \dot{\varphi}^3 - 4 \dot{\varphi} \dot{H} M_V^2 + \dot{\varphi} H \left(8 \dot{\tilde{\alpha}}_C + \left(-4 + 12 \tilde{\alpha}_M + 12 \tilde{\alpha}_C \left(1 + \tilde{\alpha}_M \right) - 12 \tilde{\alpha}_T + \tilde{\alpha}_V \right) H \right) M_V^2 \right) + \right. \\
& \quad \dot{H} \left(2 \dot{\varphi}^5 + \dot{\varphi}^3 H \left(-8 \dot{\tilde{\alpha}}_C + \left(8 - 8 \tilde{\alpha}_M - 12 \tilde{\alpha}_C \left(1 + \tilde{\alpha}_M \right) + 12 \tilde{\alpha}_T + \tilde{\alpha}_V \right) H \right) M_V^2 - \right. \\
& \quad \left. 2 \dot{\varphi} H^2 \left(4 \dot{\tilde{\alpha}}_C + \left(4 \tilde{\alpha}_M + 4 \tilde{\alpha}_C \left(1 + \tilde{\alpha}_M \right) - 4 \tilde{\alpha}_T + \tilde{\alpha}_V \right) H \right) M_V^2 - \right. \\
& \quad \left. 2 \dot{\varphi} H \left(4 \ddot{H} + H \left(4 \ddot{\tilde{\alpha}}_C + H \left(4 \left(2 + \tilde{\alpha}_M \right) \dot{\tilde{\alpha}}_C + 4 \left(1 + \tilde{\alpha}_C \right) \dot{\tilde{\alpha}}_M - 4 \dot{\tilde{\alpha}}_T + \dot{\tilde{\alpha}}_V + 4 \tilde{\alpha}_C H + 4 \tilde{\alpha}_M H + \right. \right. \right. \\
& \quad \left. \left. 4 \tilde{\alpha}_C \tilde{\alpha}_M H - 4 \tilde{\alpha}_T H + \tilde{\alpha}_V H \right) \right) \right) M_V^2 \Big) + \dot{\varphi} H \left(\left(2 + 2 \tilde{\alpha}_M + \tilde{\alpha}_V \right) \dot{\varphi}^4 H - \right. \\
& \quad \dot{\varphi}^2 \left(4 \ddot{H} + H \left(4 \ddot{\tilde{\alpha}}_C + H \left(4 \left(2 + 3 \tilde{\alpha}_M \right) \dot{\tilde{\alpha}}_C + 4 \left(1 + \tilde{\alpha}_C \right) \dot{\tilde{\alpha}}_M - 4 \dot{\tilde{\alpha}}_T + \dot{\tilde{\alpha}}_V + 4 \tilde{\alpha}_C H + 4 \tilde{\alpha}_M H + \right. \right. \\
& \quad \left. \left. 12 \tilde{\alpha}_C \tilde{\alpha}_M H + 8 \tilde{\alpha}_M^2 H + 8 \tilde{\alpha}_C \tilde{\alpha}_M^2 H - 4 \tilde{\alpha}_T H - 8 \tilde{\alpha}_M \tilde{\alpha}_T H + \tilde{\alpha}_V H + 2 \tilde{\alpha}_M \tilde{\alpha}_V H \right) \right) \right) \Big) \Big) \\
& \quad M_V^2 + 4 \dot{H} H \left(4 \dot{\tilde{\alpha}}_C + \left(4 \tilde{\alpha}_M + 4 \tilde{\alpha}_C \left(1 + \tilde{\alpha}_M \right) - 4 \tilde{\alpha}_T + \tilde{\alpha}_V \right) H \right) M_V^2 + \\
& \quad \dot{\varphi} \left(-2 \dot{\varphi}^3 + 3 \dot{\varphi} H \left(4 \dot{\tilde{\alpha}}_C + \left(4 \tilde{\alpha}_M + 4 \tilde{\alpha}_C \left(1 + \tilde{\alpha}_M \right) - 4 \tilde{\alpha}_T + \tilde{\alpha}_V \right) H \right) M_V^2 \right) \Big) \Big) + \\
& 2 H^3 M_V^2 \left(\tilde{\alpha}_K \dot{\varphi} \left(\left(-2 + \tilde{\alpha}_A \right) \dot{\varphi}^2 + 2 \left(-2 + \tilde{\alpha}_A \right) \dot{H} M_V^2 + H \left(4 \dot{\tilde{\alpha}}_C + \right. \right. \right. \\
& \quad \left. \left(4 \tilde{\alpha}_M + 4 \tilde{\alpha}_C \left(1 + \tilde{\alpha}_M \right) - 4 \tilde{\alpha}_T + \tilde{\alpha}_V \right) H \right) M_V^2 \right)^2 - \\
& 2 H \left(2 \tilde{\alpha}_C \dot{\varphi} \left(2 \dot{\varphi}^2 + 4 \dot{H} M_V^2 - H \left(4 \dot{\tilde{\alpha}}_C + \left(4 \tilde{\alpha}_M + 4 \tilde{\alpha}_C \left(1 + \tilde{\alpha}_M \right) - 4 \tilde{\alpha}_T + \tilde{\alpha}_V \right) H \right) M_V^2 \right)^2 - \right. \\
& 2 \tilde{\alpha}_A \dot{\varphi} \left(2 \dot{\varphi}^2 + 4 \dot{H} M_V^2 - H \left(4 \dot{\tilde{\alpha}}_C + \left(4 \tilde{\alpha}_M + 4 \tilde{\alpha}_C \left(1 + \tilde{\alpha}_M \right) - 4 \tilde{\alpha}_T + \tilde{\alpha}_V \right) H \right) M_V^2 \right) \\
& \quad \left(\left(-1 + 3 \tilde{\alpha}_C \right) \dot{\varphi}^2 + \left(\left(-2 + 6 \tilde{\alpha}_C \right) \dot{H} - \dot{\tilde{\alpha}}_A H + 2 H \left(\dot{\tilde{\alpha}}_C + \left(\tilde{\alpha}_C + \tilde{\alpha}_M + \tilde{\alpha}_C \tilde{\alpha}_M - \tilde{\alpha}_T \right) H \right) \right) M_V^2 \right) + \\
& 2 \tilde{\alpha}_A^3 \left(\dot{\varphi}^5 + \dot{\varphi} \dot{\varphi}^2 H M_V^2 + \dot{\varphi}^3 \left(3 \dot{H} - \left(1 + \tilde{\alpha}_M \right) H^2 \right) M_V^2 - 2 \dot{\varphi} \dot{H} H M_V^2 + 2 \dot{\varphi} \left(\dot{H}^2 + \dot{H} H - \right. \right. \\
& \quad \left. \left. \dot{H} H^2 \right) M_V^2 \right) + \tilde{\alpha}_A^2 \left(\left(-6 + 4 \tilde{\alpha}_C \right) \dot{\varphi}^5 - 2 \dot{\varphi} \dot{\varphi}^2 H M_V^2 + \dot{\varphi}^3 \left(2 \left(-11 + 8 \tilde{\alpha}_C \right) \dot{H} + \right. \right. \\
& \quad \left. \left. H \left(-2 \tilde{\alpha}_A + 12 \tilde{\alpha}_C + \left(2 + 14 \tilde{\alpha}_M + 12 \tilde{\alpha}_C \left(1 + \tilde{\alpha}_M \right) - 12 \tilde{\alpha}_T + \tilde{\alpha}_V \right) H \right) \right) M_V^2 - \right. \\
& \quad \dot{\varphi} H \left(-4 \dot{H} + H \left(4 \dot{\tilde{\alpha}}_C + \left(4 \tilde{\alpha}_M + 4 \tilde{\alpha}_C \left(1 + \tilde{\alpha}_M \right) - 4 \tilde{\alpha}_T + \tilde{\alpha}_V \right) H \right) \right) M_V^2 + \\
& \quad \dot{\varphi} \left(4 \left(-5 + 4 \tilde{\alpha}_C \right) \dot{H}^2 + \dot{H} H \left(-4 \dot{\tilde{\alpha}}_A + 24 \dot{\tilde{\alpha}}_C + \left(4 + 28 \tilde{\alpha}_M + 28 \tilde{\alpha}_C \left(1 + \tilde{\alpha}_M \right) - 28 \tilde{\alpha}_T + \right. \right. \right. \\
& \quad \left. \left. 3 \tilde{\alpha}_V \right) H \right) + H \left(-4 \dot{H} + H \left(4 \ddot{\tilde{\alpha}}_C + H \left(4 \left(1 + \tilde{\alpha}_C \right) \dot{\tilde{\alpha}}_M - 4 \dot{\tilde{\alpha}}_T + \dot{\tilde{\alpha}}_V - \right. \right. \right.
\end{aligned}$$

