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```
% Generated by xcas
\documentclass{article}
\usepackage{pst-plot,color}
\usepackage{graphicx}
\begin{document}
\noindent \framebox{1} {\tt eq1:=Dv=Vv*t-1/2*g*t{\tt\symbol{94}}2  // Dv - vert position; Vv - initial vert velocity } \\
\begin{equation} \label{eq:0}
\mathrm{Dv}=(\mathrm{Vv}\cdot  t-\frac{g\cdot  t^{2}}{2})
\end{equation}
\noindent \framebox{2} {\tt eq1a:=subst(eq1,Vv=Vb)  // 45 deg launch angle } \\
\begin{equation} \label{eq:1}
\mathrm{Dv}=(\mathrm{Vb}\cdot  t-\frac{g\cdot  t^{2}}{2})
\end{equation}
\noindent \framebox{3} {\tt eq2:=lhs(eq1a)=factor(rhs(eq1a))  } \\
\begin{equation} \label{eq:2}
\mathrm{Dv}=(\frac{t  (2\cdot \mathrm{Vb}-t\cdot  g)}{2})
\end{equation}
\noindent \framebox{4} {\tt eq3:=t=subst(solve(eq1a,t),Dv=0)[0]  } \\
\begin{equation} \label{eq:3}
t=(\frac{\mathrm{Vb}+\mathrm{Vb}}{g})
\end{equation}
\noindent \framebox{5} {\tt assume(Vb{\tt\symbol{62}}0)  } \\
\begin{equation} \label{eq:4}
\mathrm{Vb}
\end{equation}
\noindent \framebox{6} {\tt eq4:=simplify(eq3)  // time in the air } \\
\begin{equation} \label{eq:5}
t=(\frac{2\cdot  \mathrm{Vb}}{g})
\end{equation}
\noindent \framebox{7} {\tt eq5:=Dh=Vh*t  // Dh - horiz distance traveled } \\
\begin{equation} \label{eq:6}
\mathrm{Dh}=(\mathrm{Vh}\cdot  t)
\end{equation}
\noindent \framebox{8} {\tt eq5a:=subst(eq5,Vh=Vb)  // 45 deg launch angle } \\
\begin{equation} \label{eq:7}
\mathrm{Dh}=(\mathrm{Vb}\cdot  t)
\end{equation}
\noindent \framebox{9} {\tt eq6:=subst(eq5a,eq4)  } \\
\begin{equation} \label{eq:8}
\mathrm{Dh}=(\frac{\mathrm{Vb}\cdot  2\cdot \mathrm{Vb}}{g})
\end{equation}
\noindent \framebox{10} {\tt eq7:=Vb=solve(eq6,Vb)[0]  } \\
\begin{equation} \label{eq:9}
\mathrm{Vb}=(\frac{\sqrt{2}  \sqrt{\mathrm{Dh}\cdot  g}}{2})
\end{equation}
\noindent \framebox{11} {\tt vars01:=tran([Dh=25\_ft,g=\_g\_])  // convert(\_g\_,\_(ft*s{\tt\symbol{94}}-2))  } \\
\begin{equation} \label{eq:10}
\left(\begin{array}{c}
\mathrm{Dh}=( \_\left(25,\mathrm{\_ft}\right) ) \\
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g=(_\left(1,\mathrm{\_g\_}\right) )
\end{array}\right)
\end{equation}
\noindent \framebox{12} {\tt eq8:=subst(eq7,vars01)  } \\
\begin{equation} \label{eq:11}
\mathrm{Vb}=(\frac{\sqrt{2}  \sqrt{_\left(25,\mathrm{\_ft}\cdot  \mathrm{\_g\_}\right)}}{2})
\end{equation}
\noindent \framebox{13} {\tt eq8a:=lhs(eq8)=convert(usimplify(rhs(eq8)) ,\_(ft*s{\tt\symbol{94}}-1))  } \\
\begin{equation} \label{eq:12}
\mathrm{Vb}= (_\left(20.0543164171 ,\frac{\mathrm{\_ft}}{\mathrm{\_s}}\right) )
\end{equation}
\noindent \framebox{14} {\tt eq9:=Vl=Vb*sqrt(2)  } \\
\begin{equation} \label{eq:13}
\mathrm{Vl}=(\mathrm{Vb}  \sqrt{2})
\end{equation}
\noindent \framebox{15} {\tt eq10:=subst(eq9,eq8a)  } \\
\begin{equation} \label{eq:14}
\mathrm{Vl}= (_\left(28.3610862611 ,\frac{\mathrm{\_ft}}{\mathrm{\_s}}\right) )
\end{equation}
\noindent \framebox{16} {\tt eq11:=Dl=1/2*Al*tl{\tt\symbol{94}}2  // Dl - launcher travel; Al - launch acceleration; tl = time to
\begin{equation} \label{eq:15}
\mathrm{Dl}=(\frac{\mathrm{Al}\cdot  \mathrm{tl}^{2}}{2})
\end{equation}
\noindent \framebox{17} {\tt eq12:=Vl=Al*tl  } \\
\begin{equation} \label{eq:16}
\mathrm{Vl}=(\mathrm{Al}\cdot  \mathrm{tl})
\end{equation}
\noindent \framebox{18} {\tt eq13:=tl=solve(eq12,tl)[0]  } \\
\begin{equation} \label{eq:17}
\mathrm{tl}=(\frac{\mathrm{Vl}}{\mathrm{Al}})
\end{equation}
\noindent \framebox{19} {\tt eq14:=simplify(subst(eq11,eq13))  } \\
\begin{equation} \label{eq:18}
\mathrm{Dl}=(\frac{\mathrm{Vl}^{2}}{2\cdot  \mathrm{Al}})
\end{equation}
\noindent \framebox{20} {\tt eq15:=Al=solve(eq14,Al)[0]  } \\
\begin{equation} \label{eq:19}
\mathrm{Al}=(\frac{\mathrm{Vl}^{2}}{2\cdot  \mathrm{Dl}})
\end{equation}
\noindent \framebox{21} {\tt eq16:=Dl=2*pi*Rl*angl/360  // Rl - radius launch arm; angl - launch arm sweep angle } \\
\begin{equation} \label{eq:20}
\mathrm{Dl}=(\frac{2\cdot  \pi \cdot \mathrm{Rl}\cdot  \mathrm{angl}}{360})
\end{equation}
\noindent \framebox{22} {\tt vars02:=tran([ Rl=1\_ft, angl=45]) } \\
\begin{equation} \label{eq:21}
\left(\begin{array}{c}
\mathrm{Rl}= (_\left(1,\mathrm{\_ft}\right) ) \\
\mathrm{angl}=45
\end{array}\right)
\end{equation}
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\noindent \framebox{23} {\tt eq17:=subst(eq16,vars02)  } \\
\begin{equation} \label{eq:22}
\mathrm{Dl}= (_\left(0.785398163397 ,\mathrm{\_ft}\right) )
\end{equation}
\noindent \framebox{24} {\tt eq18:=eval(subst(eq15,[eq10,eq17]))  } \\
\begin{equation} \label{eq:23}
\mathrm{Al}= (_\left(512.065886703 ,\frac{\mathrm{\_ft}^{2}\cdot  \mathrm{\_ft}^{-1.0}}{\mathrm{\_s}^{2}}\right) )
\end{equation}
\noindent \framebox{25} {\tt eq18a:=lhs(eq18)=convert(usimplify(rhs(eq18)) ,\_(ft*s{\tt\symbol{94}}-2))  } \\
\begin{equation} \label{eq:24}
\mathrm{Al}= (_\left(512.065886703 ,\frac{\mathrm{\_ft}}{\mathrm{\_s}^{2}}\right) )
\end{equation}
\noindent \framebox{26} {\tt eq19:=Fl=Mp*Al // Fl - launch average force; Mp - payload mass } \\
\begin{equation} \label{eq:25}
\mathrm{Fl}=(\mathrm{Mp}\cdot  \mathrm{Al})
\end{equation}
\noindent \framebox{27} {\tt eq20:=subst(eq19,[ Mp=1\_lb, eq18a ]) } \\
\begin{equation} \label{eq:26}
\mathrm{Fl}= (_\left(512.065886703 ,\frac{\mathrm{\_ft}\cdot  \mathrm{\_lb}}{\mathrm{\_s}^{2}}\right) )
\end{equation}
\noindent \framebox{28} {\tt eq21:=lhs(eq20)=convert(rhs(eq20) ,\_lbf)  } \\
\begin{equation} \label{eq:27}
\mathrm{Fl}= (_\left(15.9119171679 ,\mathrm{\_lbf}\right) )
\end{equation}
\noindent \framebox{29} {\tt  } \\

\end{document}
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\noindent \framebox{3} {\tt eq2:=lhs(eq1a)=factor(rhs(eq1a))  } \\
\begin{equation} \label{eq:2}
\mathrm{Dv}=(\frac{t  (2\cdot \mathrm{Vb}-t\cdot  g)}{2})
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\noindent \framebox{4} {\tt eq3:=t=subst(solve(eq1a,t),Dv=0)[0]  } \\
\begin{equation} \label{eq:3}
t=(\frac{\mathrm{Vb}+\mathrm{Vb}}{g})
\end{equation}
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\left(\begin{array}{c}
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\end{document}
```