

C:\unix\home\Matt\Trevon_egg_launcher - Copy.tex

```
1 % Generated by xcas
2 \documentclass{article}
3 \usepackage{pst-plot,color}
4 \usepackage{graphicx}
5 \begin{document}
6 \noindent \framebox{1} {\tt eq1:=Dv=Vv*t-1/2*g*t{\tt\symbol{94}}2 // Dv - vert position; Vv - initial vert velocity } \\
7 \begin{equation} \label{eq:0}
8 \mathrm{Dv}=(\mathrm{Vv}\cdot t-\frac{g\cdot t^2}{2})
9 \end{equation}
10 \noindent \framebox{2} {\tt eq1a:=subst(eq1,Vv=Vb) // 45 deg launch angle } \\
11 \begin{equation} \label{eq:1}
12 \mathrm{Dv}=(\mathrm{Vb}\cdot t-\frac{g\cdot t^2}{2})
13 \end{equation}
14 \noindent \framebox{3} {\tt eq2:=lhs(eq1a)=factor(rhs(eq1a)) } \\
15 \begin{equation} \label{eq:2}
16 \mathrm{Dv}=(\frac{t^2\cdot \mathrm{Vb}-t\cdot g}{2})
17 \end{equation}
18 \noindent \framebox{4} {\tt eq3:=t=subst(solve(eq1a,t),Dv=0)[0] } \\
19 \begin{equation} \label{eq:3}
20 t=(\frac{\mathrm{Vb}+\mathrm{Vb}}{g})
21 \end{equation}
22 \noindent \framebox{5} {\tt assume(Vb{\tt\symbol{62}}0) } \\
23 \begin{equation} \label{eq:4}
24 \mathrm{Vb}
25 \end{equation}
26 \noindent \framebox{6} {\tt eq4:=simplify(eq3) // time in the air } \\
27 \begin{equation} \label{eq:5}
28 t=(\frac{2\cdot \mathrm{Vb}}{g})
29 \end{equation}
30 \noindent \framebox{7} {\tt eq5:=Dh=Vh*t // Dh - horiz distance traveled } \\
31 \begin{equation} \label{eq:6}
32 \mathrm{Dh}=(\mathrm{Vh}\cdot t)
33 \end{equation}
34 \noindent \framebox{8} {\tt eq5a:=subst(eq5,Vh=Vb) // 45 deg launch angle } \\
35 \begin{equation} \label{eq:7}
36 \mathrm{Dh}=(\mathrm{Vb}\cdot t)
37 \end{equation}
38 \noindent \framebox{9} {\tt eq6:=subst(eq5a,eq4) } \\
39 \begin{equation} \label{eq:8}
40 \mathrm{Dh}=(\frac{\mathrm{Vb}\cdot 2\cdot \mathrm{Vb}}{g})
41 \end{equation}
42 \noindent \framebox{10} {\tt eq7:=Vb=solve(eq6,Vb)[0] } \\
43 \begin{equation} \label{eq:9}
44 \mathrm{Vb}=(\frac{\sqrt{2}\cdot \sqrt{\mathrm{Dh}\cdot g}}{2})
45 \end{equation}
46 \noindent \framebox{11} {\tt vars01:=tran([Dh=25\_ft,g=\_g\_]) // convert(\_g\_,\_(ft*s{\tt\symbol{94}}-2)) } \\
47 \begin{equation} \label{eq:10}
48 \left(\begin{array}{c}
49 \mathrm{Dh}=( \left(25,\mathrm{Dh}\right) ) \end{array}\right) \\
```

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50 g=( \left(1,\mathrm{\_g\_}\right) )
51 \end{array}\right)
52 \end{equation}
53 \noindent \framebox{12} {\tt eq8:=subst(eq7,vars01) } \\\
54 \begin{equation} \label{eq:11}
55 \mathrm{Vb}=(\frac{\sqrt{2}}{\sqrt{\left(25,\mathrm{\_ft}\right)\cdot \mathrm{\_g\_}\right)}}{2})
56 \end{equation}
57 \noindent \framebox{13} {\tt eq8a:=lhs(eq8)=convert(usimplify(rhs(eq8)) ,\_ft*s{\tt\symbol{94}}-1)) } \\\
58 \begin{equation} \label{eq:12}
59 \mathrm{Vb}=( \left(20.0543164171 ,\frac{\mathrm{\_ft}}{\mathrm{\_s}}\right) )
60 \end{equation}
61 \noindent \framebox{14} {\tt eq9:=Vl=Vb*sqrt(2) } \\\
62 \begin{equation} \label{eq:13}
63 \mathrm{Vl}=(\mathrm{Vb} \sqrt{2})
64 \end{equation}
65 \noindent \framebox{15} {\tt eq10:=subst(eq9,eq8a) } \\\
66 \begin{equation} \label{eq:14}
67 \mathrm{Vl}=( \left(28.3610862611 ,\frac{\mathrm{\_ft}}{\mathrm{\_s}}\right) )
68 \end{equation}
69 \noindent \framebox{16} {\tt eq11:=Dl=1/2*Al*tl{\tt\symbol{94}}^2 // Dl - launcher travel; Al - launch acceleration; tl = time to
70 \begin{equation} \label{eq:15}
71 \mathrm{Dl}=(\frac{\mathrm{Al}}{\mathrm{Vl}}\cdot \mathrm{tl}^2){2})
72 \end{equation}
73 \noindent \framebox{17} {\tt eq12:=Vl=Al*tl } \\\
74 \begin{equation} \label{eq:16}
75 \mathrm{Vl}=(\mathrm{Al}\cdot \mathrm{tl})
76 \end{equation}
77 \noindent \framebox{18} {\tt eq13:=tl=solve(eq12,tl)[0] } \\\
78 \begin{equation} \label{eq:17}
79 \mathrm{tl}=(\frac{\mathrm{Vl}}{\mathrm{Al}})
80 \end{equation}
81 \noindent \framebox{19} {\tt eq14:=simplify(subst(eq11,eq13)) } \\\
82 \begin{equation} \label{eq:18}
83 \mathrm{Dl}=(\frac{\mathrm{Vl}^2}{2\cdot \mathrm{Al}})
84 \end{equation}
85 \noindent \framebox{20} {\tt eq15:=Al=solve(eq14,Al)[0] } \\\
86 \begin{equation} \label{eq:19}
87 \mathrm{Al}=(\frac{\mathrm{Vl}^2}{2\cdot \mathrm{Dl}})
88 \end{equation}
89 \noindent \framebox{21} {\tt eq16:=Dl=2*pi*Rl*angl/360 // Rl - radius launch arm; angl - launch arm sweep angle } \\\
90 \begin{equation} \label{eq:20}
91 \mathrm{Dl}=(\frac{2\cdot \pi \cdot \mathrm{Rl}\cdot \mathrm{angl}}{360})
92 \end{equation}
93 \noindent \framebox{22} {\tt vars02:=tran([ Rl=1\_ft, angl=45]) } \\\
94 \begin{equation} \label{eq:21}
95 \left(\begin{array}{c}
96 \mathrm{Rl}=( \left(1,\mathrm{\_ft}\right) ) \\\
97 \mathrm{angl}=45
98 \end{array}\right)
99 \end{equation}
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100 \noindent \framebox{23} {\tt eq17:=subst(eq16,vars02) } \\
101 \begin{equation} \label{eq:22}
102 \mathrm{Dl}=(\_left(0.785398163397,\mathrm{\_ft}\right) )
103 \end{equation}
104 \noindent \framebox{24} {\tt eq18:=eval(subst(eq15,[eq10,eq17])) } \\
105 \begin{equation} \label{eq:23}
106 \mathrm{Al}=(\_left(512.065886703,\frac{\mathrm{\_ft}^2\cdot \mathrm{\_ft}^{-1.0}}{\mathrm{\_s}^2}\right) )
107 \end{equation}
108 \noindent \framebox{25} {\tt eq18a:=lhs(eq18)=convert(usimplify(rhs(eq18)) ,\_ft*s{\tt\symbol{94}}-2) } \\
109 \begin{equation} \label{eq:24}
110 \mathrm{Al}=(\_left(512.065886703,\frac{\mathrm{\_ft}}{\mathrm{\_s}^2}\right) )
111 \end{equation}
112 \noindent \framebox{26} {\tt eq19:=F1=Mp*Al // F1 - launch average force; Mp - payload mass } \\
113 \begin{equation} \label{eq:25}
114 \mathrm{F1}=(\mathrm{Mp}\cdot \mathrm{Al})
115 \end{equation}
116 \noindent \framebox{27} {\tt eq20:=subst(eq19,[ Mp=1\_lb, eq18a ]) } \\
117 \begin{equation} \label{eq:26}
118 \mathrm{F1}=(\_left(512.065886703,\frac{\mathrm{\_ft}\cdot \mathrm{\_lb}}{\mathrm{\_s}^2}\right) )
119 \end{equation}
120 \noindent \framebox{28} {\tt eq21:=lhs(eq20)=convert(rhs(eq20) ,\_lbf) } \\
121 \begin{equation} \label{eq:27}
122 \mathrm{F1}=(\_left(15.9119171679,\mathrm{\_lbf}\right) )
123 \end{equation}
124 \noindent \framebox{29} {\tt } \\
125
126 \end{document}
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```
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5 \usepackage{graphicx}
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11 \noindent \framebox{2} {\tt eq1a:=subst(eq1,Vv=Vb) // 45 deg launch angle } \\
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14 \end{equation}
15 \noindent \framebox{3} {\tt eq2:=lhs(eq1a)=factor(rhs(eq1a)) } \\
16 \begin{equation} \label{eq:2}
17 \mathrm{Dv}=(\frac{t^2\cdot \mathrm{Vb}-t\cdot g}{2})
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19 \noindent \framebox{4} {\tt eq3:=t=subst(solve(eq1a,t),Dv=0)[0] } \\
20 \begin{equation} \label{eq:3}
21 t=(\frac{\mathrm{Vb}+\mathrm{Vb}}{g})
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23 \noindent \framebox{5} {\tt assume(Vb{\tt\symbol{62}}0) } \\
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