In[ ]:=
```
(*Исходные данные:*)
V0 = 52 ;
θc0 = 39 ;
ṁ = 79 ;
y0 = 2150;
ωz0 = 0;
ϑ0 = θc0;
t0 = x0 = 0;
tk = 4.73;
m0 = 1160;
Jz = 120;
ldc = 0.22;
Sa = 0.15;
Sm = 0.2289;
ρoN = 1.225;
poN = 101 325;
ToN = 288.15;
goN = 9.80665;
r = 6 356 767;
tab1 = {{0.01, 0.30}, {0.55, 0.30}, {0.8, 0.55}, {0.9, 0.70}, {1.0, 0.84},
   {1.06, 0.86}, {1.1, 0.87}, {1.2, 0.83}, {1.3, 0.80}, {1.4, 0.79},
   {2.0, 0.65}, {2.6, 0.55}, {3.4, 0.50}, {6.0, 0.45}, {10.0, 0.40}} ;
(*tab1 – таблица аэродинамических коэффициентов Cxa(M)*)
tab2 = {{0.01, 0.25}, {0.55, 0.25}, {0.8, 0.25}, {0.9, 0.20}, {1.0, 0.30},
   {1.06, 0.31}, {1.1, 0.25}, {1.2, 0.25}, {1.3, 0.25}, {1.4, 0.25},
   {2.0, 0.25}, {2.6, 0.25}, {3.4, 0.25}, {6.0, 0.25}, {10.0, 0.25}} ;
(*tab2 – таблица аэродинамических коэффициентов Cya(M)*)
(*Таблицы обязательно должны быть записаны по возрастанию числа Маха*)

(*Этап 1. Линейная интерполяция аэродинамических коэффициентов*)
n1 = Count[{tab1}, _Real, Infinity] / 2 (*Количество точек,
     встречаемость   дейст…  бесконечность
 заданных таблицей 1 аэродинамических коэффициентов Cxa(M)*);
n2 = Count[{tab2}, _Real, Infinity] / 2 (*Количество точек,
     встречаемость   дейст…  бесконечность
 заданных таблицей 2 аэродинамических коэффициентов Cxy(M)*);
```

In[•]:=
```
arg1[M_] :=
 Catch[Do[If [(M ≥ tab1[[i, 1]]) && (M < tab1[[i + 1, 1]]), Throw[i]], {i, 1, n1 - 1}]]
 (*номер промежутка, в который попадает число Маха,
он же номер точки начала промежутка,
т.е. в моей программе n-ый промежуток находится между точкой n и n+1*)
Cxa[M_] := If[(M ≥ tab1[[1, 1]]) && (M < tab1[[n1, 1]]),

  (tab1[[arg1[M] + 1, 2]] - tab1[[arg1[M], 2]])/(tab1[[arg1[M] + 1, 1]] - tab1[[arg1[M], 1]]) * (M - tab1[[arg1[M], 1]]) + tab1[[arg1[M], 2]],

  If[M ≥ tab1[[n1, 1]], (tab1[[n1, 2]] - tab1[[n1 - 1, 2]])/(tab1[[n1, 1]] - tab1[[n1 - 1, 1]]) * (M - tab1[[n1, 1]]) + tab1[[n1, 2]],

   (tab1[[2, 2]] - tab1[[1, 2]])/(tab1[[2, 1]] - tab1[[1, 1]]) * (M - tab1[[1, 1]]) + tab1[[1, 2]]]]
```

In[•]:=
```
arg2[M_] :=
 Catch[Do[If [(M ≥ tab2[[i, 1]]) && (M < tab2[[i + 1, 1]]), Throw[i]], {i, 1, n2 - 1}]]
Cya[M_] := If[(M ≥ tab2[[1, 1]]) && (M < tab2[[n2, 1]]),

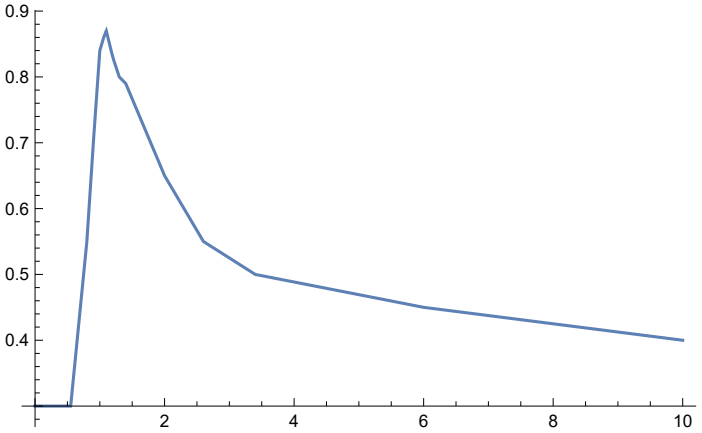
  (tab2[[arg2[M] + 1, 2]] - tab2[[arg2[M], 2]])/(tab2[[arg2[M] + 1, 1]] - tab2[[arg2[M], 1]]) * (M - tab2[[arg2[M], 1]]) + tab2[[arg2[M], 2]],

  If[M ≥ tab2[[n2, 1]], (tab2[[n2, 2]] - tab2[[n2 - 1, 2]])/(tab2[[n2, 1]] - tab2[[n2 - 1, 1]]) * (M - tab2[[n2, 1]]) + tab2[[n2, 2]],

   (tab2[[2, 2]] - tab2[[1, 2]])/(tab2[[2, 1]] - tab2[[1, 1]]) * (M - tab2[[1, 1]]) + tab2[[1, 2]]]]
```

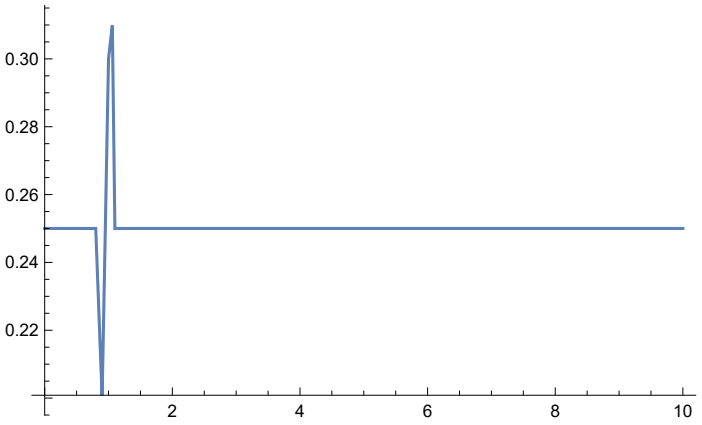
In[•]:=
```
Plot[Cxa[M], {M, 0, 10}]
```

Out[•]=



In[•]:=
```
Plot[Cya[M], {M, 0, 10}]
```
график функции

Out[•]=




```
(*Этап 2. Задание математической модели*)
```

In[•]:=
```
m[t_] := If[t > tk, m0 - ṁ * tk, m0 - ṁ * t];
```
условный оператор

$$P_0 = 2100\,\dot{m};$$

$$\pi[y\_] := \left(1 - 2.26 * 10^{-5}\, y\right)^{5.2559};$$

$$H[y\_] := \left(1 - 2.26 * 10^{-5}\, y\right)^{4.2559};$$

$$a[y\_] := 20.0468\,\sqrt{T_{oN} - 0.0065\, y}\,;$$

$$g[y\_] := g_{oN}\left(\frac{r}{r + y}\right)^2;$$

```
P[y_, t_] := If[t > tk, 0, P0 + Sa * poN (1 - π[y])];
```
условный оператор

$$M[V\_, y\_] := \frac{V}{a[y]};$$

$$X_a[V\_, y\_] := Cxa[M[V, y]]\, S_m\, \frac{\rho_{oN}\, H[y]}{2}\, V^2;$$

$$Y_a[V\_, y\_, \alpha\_] := Cya[M[V, y]]\, S_m\, \alpha\, \frac{\rho_{oN}\, H[y]}{2}\, V^2;$$

$$M_z[V\_, y\_, \alpha\_] := -(Cxa[M[V, y]] + Cya[M[V, y]]\, \alpha)\, S_m\, \frac{\rho_{oN}\, H[y]}{2}\, V^2\, l_{dc};$$

$$\alpha_0 = \vartheta_0 - \Theta_{c0};$$

In[•]:=
```
(*Этап 3. Интегрирование численным методом Эйлера*)
```

```
Eiler[Δt_] := (
```

```
  RezTab = {{"N", "t,c", "m,кг", "P,Н", "V,м/с",
```
численное приближение

```
    "M", "Cxa", "α,град", "Θc,град", "Cya", "dV/dt,м/с²", "ωz,1/c",
    "ϑ,град", "y,м", "dy/dt,м/с", "x,м", "dx/dt,м/с"},
   {0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16},
```

$$\left\{1,\ t_0,\ m[t_0],\ P[y_0,\ t_0],\ V_0,\ M[V_0,\ y_0],\ Cxa[M[V_0,\ y_0]],\ \alpha_0,\ \theta_{c0},\ Cya[M[V_0,\ y_0]],\right.$$
$$\left.\frac{P[y_0,\ t_0] * \text{Cos}\left[\alpha_0 * \frac{\text{Pi}}{180}\right] - X_a[V_0,\ y_0]}{m[t_0]} - g[y_0] * \text{Sin}\left[\theta_{c0} * \frac{\text{Pi}}{180}\right],\right.$$
$$\left.\omega_{z0},\ \vartheta_0,\ y_0,\ V_0\,\text{Sin}\left[\theta_{c0} * \frac{\text{Pi}}{180}\right],\ x_0,\ V_0\,\text{Cos}\left[\theta_{c0} * \frac{\text{Pi}}{180}\right]\right\}\Big\};$$

```
tkpass = False;
```

```
Δt1 = Δt;
n = 1;
x_c = x_0;
y_c = y_0;
t_c = t_0;
ϑ_c = ϑ_0 * Pi/180;
θ_cc = θ_c0 * Pi/180;
ω_zc = ω_z0;
V_c = V_0;
While[y_c > 0,
  t_н = t_c + Δt1;
  α_c = ϑ_c - θ_cc;
  x_н = x_c + V_c Cos[θ_cc] Δt1;
  y_н = y_c + V_c Sin[θ_cc] Δt1;
  ϑ_н = ϑ_c + ω_zc Δt1;
  V_н = V_c + (P[y_c, t_c] Cos[α_c] - X_a[V_c, y_c]/m[t_c] - g[y_c] Sin[θ_cc]) Δt1;
  ω_zн = ω_zc + M_z[V_c, y_c, α_c]/J_z α_c Δt1;
  θ_cн = θ_cc + (P[y_c, t_c] Sin[α_c] - Y_a[V_c, y_c, α_c]/(m[t_c] * V_c) - g[y_c] Cos[θ_cc]/V_c) Δt1;
  α_н = ϑ_н - θ_cн;
  t_c = t_н;
  x_c = x_н;
  y_c = y_н;
  ϑ_c = ϑ_н;
  V_c = V_н;
  ω_zc = ω_zн;
  θ_cc = θ_cн;

  If[(t_н < 5 && (Mod[t_н * 10, 1] < 0.00001 || Mod[t_н * 10, 1] > 0.9999)) ||
```

```
  Abs[tk - tн] < 0.00001 || (tн ≥ 5  && (Mod[tн, 1] < 0.00001 || Mod[tн, 1] > 0.9999)),
  абсолютное значение                  остаток от деления          остаток от деления
 n++;
 AppendTo[RezTab, {n, tн, m[tн], P[yн, tн], Vн, M[Vн, yн], Cxa[M[Vн, yн]], αн * 180/Pi,
 добавить в конец к
    θсн * 180/Pi, Cya[M[Vн, yн]], (P[yн, tн] * Cos[αн] - Xa[Vн, yн])/m[tн] - g[yн] * Sin[θсн],
                                                                          синус
    ωzн, ϑн * 180/Pi, yн, Vн Sin[θсн], xн, Vн Cos[θсн]}]];
                          синус                 косинус
 If[Abs[tk - tн] < 0.00001, tkpass = True]; (*ловим tk*)
 … абсолютное значение                истина

 If[Not[tkpass] && tk - tн < (Δt - 0.0001),
 … отрицание
  Δt2 = tk - tн;
  tн = tc + Δt2;
  αc = ϑc - θcc;
  xн = xc + Vc * Cos[θcc] * Δt2;
                косинус
  yн = yc + Vc * Sin[θcc] * Δt2;
                синус
  ϑн = ϑc + ωzc Δt2;
  Vн = Vc + ((P[yc, tc] * Cos[αc] - Xa[Vc, yc])/m[tc] - g[yc] * Sin[θcc]) * Δt2;
                                                      синус

  ωzн = ωzc + (Mz[Vc, yc, αc])/Jz αc Δt2;
  θсн = θcc + ((P[yc, tc] * Sin[αc] - Ya[Vc, yc, αc])/(m[tc] * Vc) - (g[yc] * Cos[θcc])/Vc) * Δt2;
  αн = ϑн - θсн;
  tc = tн;
  xc = xн;
  yc = yн;
  ϑc = ϑн;
  Vc = Vн;
  ωzc = ωzн;
  θcc = θсн;

  n++;
  AppendTo[RezTab, {n, tн, m[tн], P[yн, tн], Vн, M[Vн, yн], Cxa[M[Vн, yн]], αн * 180/Pi,
  добавить в конец к
     θсн * 180/Pi, Cya[M[Vн, yн]], (P[yн, tн] * Cos[αн] - Xa[Vн, yн])/m[tн] - g[yн] * Sin[θсн],
                                                                           синус
```

```
    ωzн, ϑн * 180/Pi, yн, Vн Sin[Θсн], xн, Vн Cos[Θсн]}];
                      синус            косинус

  Δt3 = Δt - Δt2;
  tн = tc + Δt3;
  αc = ϑc - Θcc;
  xн = xc + Vc * Cos[Θcc] * Δt3;
                 косинус
  yн = yc + Vc * Sin[Θcc] * Δt3;
                 синус
  ϑн = ϑc + ωzc Δt3;
  Vн = Vc + (P[yc, tc] * Cos[αc] - Xa[Vc, yc]) / m[tc] - g[yc] * Sin[Θcc]) * Δt3;
                                                                 синус

  ωzн = ωzc + Mz[Vc, yc, αc] / Jz αc Δt3;
  Θсн = Θcc + (P[yc, tc] * Sin[αc] - Ya[Vc, yc, αc]) / (m[tc] * Vc) - g[yc] * Cos[Θcc] / Vc) * Δt3;
  αн = ϑн - Θсн;
  tc = tн;
  xc = xн;
  yc = yн;
  ϑc = ϑн;
  Vc = Vн;
  ωzc = ωzн;
  Θcc = Θсн;

  n++;
  AppendTo[RezTab, {n, tн, m[tн], P[yн, tн], Vн, M[Vн, yн], Cxa[M[Vн, yн]], αн * 180/Pi,
  добавить в конец к
    Θсн * 180/Pi, Cya[M[Vн, yн]], P[yн, tн] * Cos[αн] - Xa[Vн, yн] / m[tн] - g[yн] * Sin[Θсн],
                                                                            синус
    ωzн, ϑн * 180/Pi, yн, Vн Sin[Θсн], xн, Vн Cos[Θсн]}];
                      синус            косинус

  tkpass = True;
           истина
 ];

];
n++;
AppendTo[RezTab, {n, tн, m[tн], P[yн, tн], Vн, M[Vн, yн], Cxa[M[Vн, yн]], αн * 180/Pi,
добавить в конец к
  Θсн * 180/Pi, Cya[M[Vн, yн]], P[yн, tн] * Cos[αн] - Xa[Vн, yн] / m[tн] - g[yн] * Sin[Θсн],
                                                                          синус
```

```
    ωzн, ϑн * 180/Pi, yн, Vн Sin[θсн], xн, Vн Cos[θсн]}];
                      синус              косинус

];

Clear[RezTab]
очистить

Eiler[0.001]

Grid[RezTab, Frame → All]
таблица      рамка  всё
```

Out[•]=

N	t,c	m,кг	P,H	V,м/с	M	C_{xa}	α,град	ϑ_c,град	C_{ya}	$\frac{dV}{dt}$,м/c^2	ω_z,1/c	ϑ,град	y,м	$\frac{dy}{dt}$,м/c	x,м	$\frac{dx}{dt}$,м/c
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	0	1160	16940 1.	52	0.156655	0.3	0	39	0.25	139.788	0	39	2150	52 Sin[(13 π)/60]	0	52 Cos[(13 π)/60]
2	0.1	1152.1	16940 6.	66.0305	0.198932	0.3	0.662002	38.3377	0.25	140.824	−0.0001454119	38.9997	2153.68	40.9585	4.6	51.7923

3	0.2	114.2	169413.	80.1626	0.241521	0.3	1.088 47	37.9091	0.25	141.823	−0.0006767704	38.9976	2158.19	49.2528	10.3495	63.2472
4	0.3	113.6.3	169421.	94.3937	0.284416	0.3	1.380 99	37.61	0.25	142.808	−0.0017314 6	38.991	2163.52	57.607	17.2443	74.7771
5	0.4	112.8.4	169430.	108.723	0.327615	0.3	1.587 14	37.3895	0.25	143.786	−0.0034427 1	38.9766	2169.7	66.0198	25.2959	86.3833
6	0.5	112.0.5	169440.	123.15	0.371119	0.3	1.730 93	37.2193	0.25	144.762	−0.0059335 3	38.9502	2176.72	74.4893	34.5119	98.0675

7	0.6	111‸2.6	16‸9‸45‸1.	137‸.6‸74	0.4‸14‸928	0.3	1.8‸24‸66	37.‸08‸24	0.25	145‸.7‸38	−0‸.‸0‸0‸9‸3‸0‸9‸3‸3	38.‸90‸71	218‸4.‸59	83.‸01‸26	44.‸90‸04	109‸.8‸32
8	0.7	110‸4.7	16‸9‸46‸4.	152‸.2‸97	0.4‸59‸044	0.3	1.8‸74‸29	36.‸96‸76	0.25	146‸.7‸16	−0‸.‸0‸1‸3‸6‸4‸7‸6	38.‸84‸19	219‸3.‸32	91.‸58‸56	56.‸46‸94	121‸.6‸81
9	0.8	109‸6.8	16‸9‸47‸8.	167‸.0‸17	0.5‸03‸47	0.3	1.8‸82‸11	36.‸86‸69	0.25	147‸.6‸97	−0‸.‸0‸1‸8‸9‸8‸5‸1	38.‸74‸91	220‸2.9	100‸.2‸03	69.‸22‸77	133‸.6‸19
10	0.9	108‸8.9	16‸9‸49‸3.	181‸.8‸35	0.5‸48‸208	0.3	1.8‸48‸36	36.‸77‸45	0.25	148‸.6‸81	−0‸.‸0‸2‸5‸3‸0‸2‸8	38.‸62‸28	221‸3.‸35	108‸.8‸59	83.‸18‸42	145‸.65
11	1.	108‸1.	16‸9‸50‸9.	196‸.7‸44	0.5‸93‸236	0.3‸43‸236	1.7‸71‸45	36.‸68‸55	0.25	149‸.4‸95	−0‸.‸0‸3‸2‸9‸9‸9‸5	38.‸45‸69	222‸4.‸67	117‸.5‸39	98.‸34‸86	157‸.7‸74

12	1.1	1073.1	169527.	211.731	0.638519	0.388519	1.64555	36.596	0.25	150.247	−0.042594	38.2415	2236.85	126.228	114.73	169.991
13	1.2	1065.2	169546.	226.791	0.684039	0.434039	1.46405	36.5022	0.25	150.934	−0.053847 2	37.9662	2249.9	134.907	132.338	182.302
14	1.3	1057.3	169566.	241.915	0.729778	0.479778	1.22252	36.4006	0.25	151.547	−0.066123	37.6232	2263.82	143.559	151.181	194.714
15	1.4	1049.4	169587.	257.097	0.775712	0.525712	0.921177	36.2882	0.25	152.076	−0.078274 5	37.2094	2278.6	152.162	171.272	207.233
16	1.5	1041.5	169610.	272.325	0.821811	0.582716	0.567708	36.1626	0.239095	152.423	−0.088620 2	36.7303	2294.24	160.693	192.619	219.86

17	1.6	103\:3.6	16\:963\:4.	287\:.5\:74	0.8\:67\:999	0.6\:51\:999	0.1\:79\:468	36.\:0223	0.2\:16	152\:.5\:34	−0\:.\:09\:50\:40\:5	36.\:2018	231\:0.\:73	169\:.1\:22	215\:.2\:34	232\:.5\:86
18	1.7	102\:5.7	16\:965\:8.	302\:.8\:26	0.9\:14\:225	0.7\:19\:915	−0\:.\:21\:28\:86	35.\:8675	0.2\:14\:225	152\:.4\:95	−0\:.\:09\:45\:57\:9	35.\:6546	232\:8.\:05	177\:.43	239\:.1\:27	245\:.4\:03
19	1.8	101\:7.8	16\:968\:4.	318\:.0\:68	0.9\:60\:448	0.7\:84\:627	−0\:.\:56\:34\:44	35.\:7001	0.2\:60\:448	152\:.3\:19	−0\:.\:08\:43\:19\:8	35.\:1366	234\:6.2	185\:.6\:06	264\:.3\:05	258\:.2\:98
20	1.9	100\:9.9	16\:971\:2.	333\:.2\:85	1.0\:0662	0.8\:42\:208	−0\:.\:81\:55\:15	35.\:5247	0.3\:01\:104	152\:.0\:57	−0\:.\:06\:27\:93\:5	34.\:7092	236\:5.\:16	193\:.6\:57	290\:.7\:75	271\:.2\:49
21	2.	100\:2.	16\:974\:0.	348\:.4\:98	1.0\:52\:82	0.8\:57\:607	−0\:.\:91\:48\:09	35.\:348	0.3\:08\:803	152\:.1\:98	−0\:.\:03\:21\:40\:4	34.\:4332	238\:4.\:92	201\:.62	318\:.5\:43	284\:.2\:54

22	2.1	994.1	169769.	363.724	1.099909	0.869772	−0.831571	35.1777	0.251368	152.321	0.002213423	34.3461	2405.48	209.547	347.614	297.297
23	2.2	986.2	169799.	378.983	1.145449	0.851805	−0.574089	35.0215	0.25	152.863	0.003203384	34.4475	2426.83	217.492	377.99	310.363
24	2.3	978.3	169831.	394.297	1.192009	0.833164	−0.197403	34.8852	0.25	153.424	0.004941777	34.6878	2448.97	225.512	409.674	323.441
25	2.4	970.4	169863.	409.664	1.238889	0.818333	0.208403	34.7707	0.25	153.919	0.004907023	34.9791	2471.92	233.629	442.665	336.515
26	2.5	962.5	169897.	425.08	1.285887	0.804238	0.538829	34.6757	0.25	154.4	0.002999975	35.2146	2495.69	241.841	476.963	349.579
27	2.6	954.6	169932.	440.539	1.333303	0.796697	0.702626	34.5943	0.25	154.744	−0.000351734	35.2965	2520.29	250.121	512.568	362.649

28	2.7	946.7	169967.	456.027	1.380332	0.791968	0.648119	34.5179	0.25	155.018	−0.042318 5	35.166	2545.71	258.414	549.481	375.743
29	2.8	938.8	170004.	471.545	1.427373	0.783529	0.389233	34.4382	0.25	155.376	−0.073905 1	34.8274	2571.96	266.666	587.706	388.9
30	2.9	930.9	170042.	487.103	1.475332	0.772425	0.0078 4525	34.349	0.25	155.802	−0.086589 9	34.3569	2599.03	274.84	627.251	402.16
31	3.	923.	170081.	502.705	1.523308	0.761281	−0.365852	34.2488	0.25	156.23	−0.074570 2	33.8829	2626.92	282.916	668.128	415.536
32	3.1	915.1	170121.	518.349	1.571302	0.750095	−0.597396	34.1406	0.25	156.667	−0.040821 2	33.5432	265 5.6	290.91	710.349	429.019

33	3.2	907.2	17016 1.	534.038	1.619 14	0.738 866	−0.5 9 8 7 8 9	34.03 12	0.25	157.1 25	0.002 91 962	33.43 24	2685. 09	298.8 71	753.9 21	442.5 75
34	3.3	899.3	17020 3.	549.7 74	1.667 46	0.727 592	−0.3 6 7 5 2 6	33.92 86	0.25	157.6 04	0.039 77 65	33.56 11	2715. 37	306.8 62	798.8 51	456.1 66
35	3.4	891.4	17024 6.	565.5 59	1.715 98	0.716 272	0.004 44 455	33.83 89	0.25	158.0 98	0.054 192	33.84 33	2746. 46	314.9 37	845.1 41	469.7 57
36	3.5	883.5	17029 0.	581.3 94	1.747	0.704 904	0.361 192	33.76 35	0.25	158.6 04	0.038 99 48	34.12 47	2778. 35	323.1 19	892.7 89	483.3 35
37	3.6	875.6	17033 5.	597.28	1.813 63	0.693 486	0.546 286	33.69 89	0.25	159.1 31	−0.0 0 0 1 3 1 3 6 5	34.24 52	2811. 07	331.3 88	941.7 94	496.9 16
38	3.7	867.7	17038 0.	613.2 21	1.862 79	0.682 016	0.474 977	33.63 79	0.25	159.6 93	−0.0 4 5 7 3 4	34.11 29	2844. 62	339.6 89	992.16	510.54

39	3.8	859.8	17042 7.	629.219	1.91218	0.670491	0.180182	33.5729	0.25	160.289	−0.07595 03	33.7531	2879.	347.957	1043.89	524.255
40	3.9	851.9	17047 5.	645.279	1.96182	0.658909	−0.195789	33.4993	0.25	160.915	−0.07524 25	33.3035	2914.2	356.147	1097.	538.093
41	4.	844.	17052 3.	661.402	2.01171	0.648048	−0.466339	33.4177	0.25	161.531	−0.04297 17	32.9513	2950.22	364.259	1151.5	552.058
42	4.1	836.1	17057 3.	677.58	2.06184	0.639694	−0.493403	33.3334	0.25	162.042	0.005310 21	32.84	2987.05	372.337	1207.4	566.109
43	4.2	828.2	17062 3.	693.811	2.11219	0.631302	−0.261699	33.254	0.25	162.583	0.044582 9	32.9923	3024.68	380.452	1264.71	580.198
44	4.3	820.3	17067 4.	710.097	2.16277	0.622871	0.104813	33.1848	0.25	163.144	0.053020 7	33.2896	3063.13	388.665	1323.43	594.287

45	4.4	812.4	17072 6.	726.44	2.2136	0.614399	0.402535	33.1265	0.25	163.727	0.02483 45	33.529	3102.41	396.991	1383.55	608.369
46	4.5	804.5	17077 9.	742.843	2.264 69	0.605885	0.460389	33.0745	0.25	164.343	−0.. 0245 846	33.5349	3142.53	405.391	1445.09	622.474
47	4.6	796.6	17083 3.	759.309	2.3160 4	0.597326	0.243784	33.0215	0.25	165.001	−0.. 0660 439	33.2653	3183.48	413.789	1508.04	636.655
48	4.7	788.7	17088 8.	775.843	2.3676 8	0.588721	−0.. 1166 79	32.9619	0.25	165.693	−0.. 0737 713	32.8453	3225.27	422.122	1572.41	650.958
49	4.73	786.33	17090 5.	780.817	2.3832 2	0.586129	−0.. 2197 52	32.9425	0.25	165.908	−0.. 0679 725	32.7228	3237.97	424.606	1592.	655.275
50	4.8	786.33	0	777.448	2.3738	0.587701	−0.. 4045 75	32.9007	0.25	−5.. 0142	−0.. 0422 182	32.4961	3267.62	422.298	1637.79	652.756

51	4.9	786.33	0	772.377	2.359 52	0.590 08	−0.443 829	32.841	0.25	−5.039 66	0.008 84 729	32.397 1	330 9.68	418.867	170 2.87	648.935
52	5.	786.33	0	767.368	2.345 41	0.592 431	−0.209 255	32.780 5	0.25	−4.978 88	0.047 83 89	32.571 3	335 1.4	415.47	176 7.58	645.165
53	6.	786.33	0	720.435	2.212 77	0.614 539	0.426 575	32.142 9	0.25	−4.221 6	0.024 204	32.569 5	375 0.51	383.295	239 4.83	610.009
54	7.	786.33	0	678.645	2.093 94	0.634 343	0.495 307	31.459 1	0.25	−3.947 93	−0.039 051 8	31.954 4	411 9.02	354.178	298 8.98	578.893
55	8.	786.33	0	641.24	1.986 96	0.653 042	0.330 551	30.729 8	0.25	−3.546 65	−0.067 713 9	31.060 4	445 9.77	327.667	355 3.78	551.201
56	9.	786.33	0	607.422	1.889 66	0.675 745	0.261 696	29.953 6	0.25	−3.231 7	−0.074 317 3	30.215 3	477 5.11	303.285	409 2.32	526.289

57	10.	786.33	0	576.646	1.80058	0.696532	0.369335	29.1288	0.25	−29.3764	−0.0695386	29.4982	5066.99	280.697	4607.14	503.716
58	11.	786.33	0	548.556	1.71879	0.715616	0.59953	28.2543	0.25	−26.8522	−0.0465551	28.8538	5337.07	259.679	5100.45	483.199
59	12.	786.33	0	522.844	1.6435	0.733184	0.681493	27.3288	0.25	−24.6143	0.00207136	28.0103	5586.84	240.036	5574.16	464.488
60	13.	786.33	0	499.243	1.574	0.749399	0.193822	26.3503	0.25	−22.6235	0.0465646	26.5441	5817.56	221.593	6029.97	447.371
61	14.	786.33	0	477.525	1.50971	0.764402	−0.649901	25.3155	0.25	−20.8447	0.0167061	24.6656	6030.36	204.191	6469.4	431.667
62	15.	786.33	0	457.492	1.45008	0.778314	−0.483713	24.2235	0.25	−19.2481	−0.0719335	23.7397	6226.25	187.707	6893.74	417.211

63	16.	786.33	0	438.975	1.394 69	0.790 531	0.724 225	23.0776	0.25	−17.7961	−0.0528 68	23.8018	6406.09	172.068	7304.19	403.846
64	17.	786.33	0	421.897	1.343 35	0.795 665	0.166 61	21.8762	0.25	−16.3864	0.042 0935	22.0428	6570.67	157.2	7701.79	391.516
65	18.	786.33	0	406.152	1.295 79	0.801 262	−0.847 159	20.611	0.25	−15.1346	−0.043 3021	19.7639	6720.7	142.975	8087.56	380.155
66	19.	786.33	0	391.537	1.251 43	0.814 571	0.783 415	19.2888	0.25	−14.1007	−0.057 5971	20.0722	6856.83	129.337	8462.36	369.559
67	20.	786.33	0	377.913	1.209 87	0.827 04	−0.242 101	17.9103	0.25	−13.1522	0.036 6614	17.6682	6979.57	116.219	8826.9	359.599
68	21.	786.33	0	365.199	1.170 89	0.841 645	−0.345 487	16.4646	0.25	−12.2922	−0.084 795	16.1191	7089.4	103.505	9181.77	350.224

69	22.	786.33	0	353.311	1.134 25	0.856 298	0.768 875	14.9653	0.25	−11.4905	0.014 0785	15.7341	7186.75	91.2366	9527.51	341.327
70	23.	786.33	0	342.204	1.0999 86	0.869 965	−0.978 924	13.4	0.250 207	−10.7275	−0.046 405	12.4211	7271.99	79.3054	9864.59	332.888
71	24.	786.33	0	331.938	1.0679 3	0.861 981	1.0605 6	11.7769	0.298 112	−9.817 37	−0.027 629 9	12.8375	7345.5	67.749	10193.5	324.951
72	25.	786.33	0	322.549	1.0385 9	0.852 864	−1.075 05	10.095	0.306 432	−8.96888	−0.021 715 6	9.019 91	7407.62	56.5364	10514.7	317.555
73	26.	786.33	0	313.977	1.0116 9	0.843 897	1.1036 76	8.3551 7	0.301 949	−8.18292	−0.041 127 7	9.458 93	7458.69	45.6237	10828.7	310.645

74	27.	786.33	0	306.191	0.987141	0.821998	−1.14191	6.563	0.287141	−7.35229	−0.026381	5.42109	7498.97	34.9963	1113	304.185
75	28.	786.33	0	299.263	0.965195	0.791973	1.17975	4.71999	0.265195	−6.51783	−0.025482	5.89974	7528.77	24.6252	1143	298.248
76	29.	786.33	0	293.128	0.945661	0.763925	−1.09757	2.82977	0.245661	−5.76258	−0.058604	1.73219	7548.3	14.4714	1173	292.771
77	30.	786.33	0	287.715	0.928316	0.739643	0.800204	0.903386	0.228316	−5.07352	0.0107455	1.70359	7557.8	4.5362	1203.	287.679
78	31.	786.33	0	282.963	0.912979	0.718171	−0.223487	−1.06568	0.212979	−4.43824	−0.091065	−1.28917	7557.43	−5.2627	1230	282.914
79	32.	786.33	0	278.821	0.899494	0.699024	−0.532463	−3.05558	0.200253	−3.85126	0.0016674	−3.58826	7547.36	−14.863	1258	278.425

80	33.	786.33	0	275.25	0.887735	0.681603	1.167734	−5.07768	0.206132	−3.297556	−0.061794949	−3.910355	7527.74	−24.36133	1286	5.2	274.17
81	34.	786.33	0	272.212	0.877593	0.66639	−1.308275	−7.113481	0.211203	−2.783077	−0.048664643	−8.421755	7498.69	−33.70947	1313	7.3	270.117
82	35.	786.33	0	269.671	0.868949	0.653423	0.736861	−9.158966	0.215526	−2.303888	0.011339	−8.42221	7460.38	−42.92473	1340	5.5	266.233
83	36.	786.33	0	267.594	0.8617	0.64255	0.296665	−11.2118	0.219115	−1.855588	−0.09049837	−10.92133	7412.88	−52.05884	1366	9.8	262.481
84	37.	786.33	0	265.948	0.855746	0.633619	−1.212020 2	−13.26734	0.222127	−1.440144	−0.008106076	−14.47934	7356.32	−61.03434	1393	0.5	258.85

85	38.	786.33	0	264.704	0.850988	0.626482	1.323237	−15.3155	0.224506	−1.0533	−0.0177653	−13.99921	7290.85	−69.91721	1418 7.6	255.303
86	39.	786.33	0	263.833	0.847338	0.621006	−0.549231	−17.3555	0.226331	−0.693995	−0.0872843	−17.90431	7216.53	−78.691 91	1441 1.1	251.822
87	40.	786.33	0	263.306	0.844701	0.617051	−0.655245	−19.3681	0.227 65	−0.364548	0.0152086	−20.02341	7133.52	−87.321 7	1469 1.2	248.404
88	41.	786.33	0	263.095	0.842987	0.614 48	1.374 34	−21.3686	0.228507	−0.061239 8	−0.0484636	−19.99433	7041.92	−95.862 9	1493 7.9	245.008
89	42.	786.33	0	263.173	0.842 11	0.613165	−1.184 62	−23.3402	0.228945	0.2 14226	−0.0666628 8	−24.52448	6941.84	−104.26 7	1518 1.3	241.638

90	43.	786.33	0	263.513	0.841978	0.612967	0.164947	−25.2754	0.229011	0.461662	0.023808	−25.1104	6833.45	−112.512	1542 1.2	238.286
91	44.	786.33	0	264.088	0.842506	0.613759	0.898784	−27.18766	0.228747	0.683896	−0.0783028	−26.28888	6716.86	−120.663	1565 7.8	234.911
92	45.	786.33	0	264.872	0.843608	0.615413	−1.438335	−29.05445	0.228196	0.878226	−0.0269292 98	−30.49228	6592.2	−128.632	1589 1.	231.54
93	46.	786.33	0	265.836	0.845197	0.617795	1.110326	−30.88832	0.227402	1.046062	0.005 7894 3	−29.78	6459.65	−136.451	1612 0.9	228.144
94	47.	786.33	0	266.957	0.847192	0.620788	−0.250189	−32.67778	0.226404	1.190333	−0.0905048	−32.928	6319.34	−144.134	1634 7.3	224.703
95	48.	786.33	0	268.207	0.849511	0.624266	−0.733902	−34.41882	0.225245	1.307035	0.0228975	−35.1521	6171.47	−151.599	1657 0.3	221.253

96	49.	786.33	0	269.564	0.852074	0.628112	1.304334	−36.125	0.223963	1.401151	−0.0533243	−34.820 6	6016.2	−158.921	1678 9.8	217.735
97	50.	786.33	0	271.002	0.854811	0.632216	−1.39 51	−37.7824	0.222595	1.471151	−0.0420594	−39.17 75	5853.7	−166.033	17005.8	214.185
98	51.	786.33	0	272.499	0.857645	0.636468	0.987117	−39.3925	0.221177	1.518178	0.01763 48	−38.405 4	5684.21	−172.936	17218.2	210.592
99	52.	786.33	0	274.033	0.860513	0.640769	−0.3887 45	−40.9666	0.219744	1.545176	−0.0896 84	−41.354 7	5507.89	−179.659	17426.9	206.922
100	53.	786.33	0	275.583	0.863349	0.645023	−0.28945 6	−42.4833	0.218326	1.551115	0.03880 95	−42.774 24	5324.99	−186.121	17632.	203.237
101	54.	786.33	0	277.13	0.866096	0.649143	0.79379	−43.9677	0.216952	1.539131	−0.0809308	−43.173 9	5135.72	−192.392	17833.4	199.459

102	55.	786.33	0	278.655	0.868701	0.653051	−1.16784	−45.39834	0.21565	1.50886	0.013921	−46.56629	4940.29	−198.4043	18030.9	195.664
103	56.	786.33	0	280.143	0.871114	0.656671	1.3295	−46.79334	0.21443	1.46353	−0.044105	−45.46339	4738.98	−204.1933	18224.7	191.794
104	57.	786.33	0	281.578	0.873296	0.659944	−1.40122	−48.14266	0.21352	1.4035	−0.020555	−49.54338	4532.	−209.7211	18414.5	187.891
105	58.	786.33	0	282.946	0.875207	0.662881	1.36376	−49.45155	0.21297	1.33102	−0.010707	−48.08777	4319.63	−214.9998	18600.4	183.941
106	59.	786.33	0	284.236	0.876818	0.665228	−1.33013	−50.72244	0.21191	1.24778	−0.044085	−52.05255	4102.09	−220.0204	18782.4	179.944
107	60.	786.33	0	285.438	0.878102	0.667153	1.2674	−51.95088	0.21094	1.15493	0.00830057	−50.68334	3879.68	−224.7774	18960.3	175.926

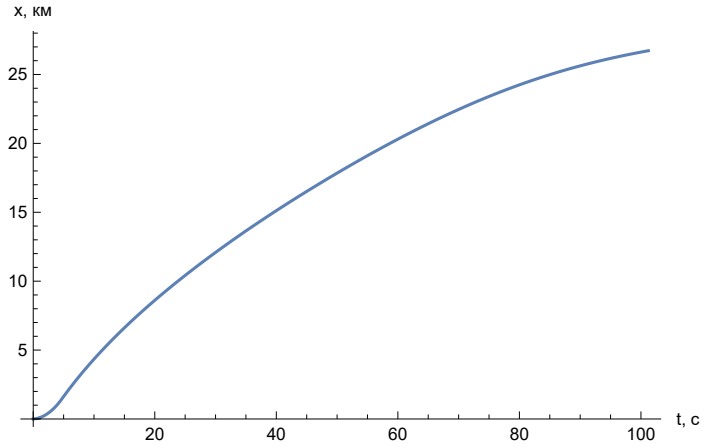
108	61.	786.33	0	286.544	0.879404	0.668656	−1.26	−53.14666	0.21048	1.05495	−0.052972	−54.406624	3652.62	−229.2844	1913 4.2	171.86
109	62.	786.33	0	287.546	0.879615	0.669423	1.251 79	−54.30005	0.210192	0.948437	0.01269 57	−53.04887	3421.21	−233.513	1930 4.1	167.793
110	63.	786.33	0	288.44	0.879 82	0.669731	−1.30218	−55.42466	0.21009	0.837966	−0.04766695	−56.72668	3185.68	−237.495	1946 9.8	163.686
111	64.	786.33	0	289.221	0.879648	0.669472	1.339 06	−56.51 01	0.210176	0.724106	0.002 05329	−55.17 1	2946.32	−241.205	1963 1.4	159.589
112	65.	786.33	0	289.887	0.879099	0.668649	−1.3966 2	−57.5666	0.21045	0.608915	−0.026462 3	−58.96266	2703.36	−244.66 8	1978 9.	155.475

113	66.	786.33	0	290.438	0.878176	0.667264	1.38946	−58.589	0.210912	0.493352	−0.0258965	−57.1995	2457.07	−247.875	19942.4	151.369
114	67.	786.33	0	290.874	0.876887	0.665331	−1.331111	−59.5796	0.211556	0.378449	0.01143771	−60.9107	2207.69	−250.831	20091.7	147.282
115	68.	786.33	0	291.196	0.875241	0.662862	1.1301	−60.54558	0.212379	0.265937	−0.0675624	−59.4157	1955.49	−253.559	20237.	143.189
116	69.	786.33	0	291.407	0.873253	0.659879	−0.8162773	−61.47455	0.213374	0.155465	0.05510098	−62.2908	1700.67	−256.032	20378.1	139.161
117	70.	786.33	0	291.509	0.870936	0.656404	0.324581	−62.3888	0.214532	0.049646466	−0.10131312	−62.0634	1443.48	−258.308	20515.3	135.109
118	71.	786.33	0	291.507	0.868308	0.652463	0.230921	−63.26	0.215846	−0.05306767	0.07308013	−63.0291	1184.15	−260.333	20648.4	131.161

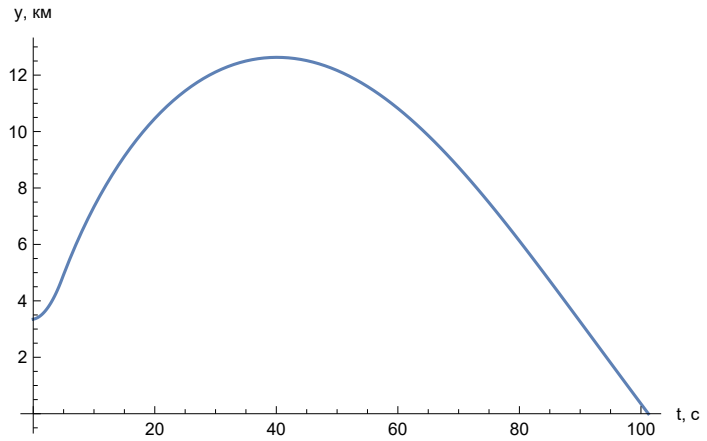
119	72.	786.33	0	291.405	0.865389	0.648084	−0.8340229	−64.12133	0.217305	−0.1497961	−0.0888984	−64.95554	922.871	−26.2.1833	2077.6	127.189
120	73.	786.33	0	291.209	0.862197	0.643296	1.277718	−64.9455	0.218901	−0.2421961	0.029583	−63.66678	659.866	−26.3.8077	2090.2	123.323
121	74.	786.33	0	290.923	0.858755	0.638132	−1.4769 4	−65.75177	0.220623	−0.3285381	−0.0131381	−67.2287	395.312	−26.5.2556	2102.4	119.48
122	75.	786.33	0	290.554	0.855508	0.632621	1.2712	−66.535 7	0.222 46	−0.4090188	−0.0622759	−65.2645	129.414	−26.6.5277	2114.8	115.692
123	75.486	786.33	0	290.346	0.853218	0.629828	−1.0285 7	−66.9081	0.223391	−0.4460588	−0.0828521	−67.9367	−0.256	−26.7.0833	2119.7	113.876

In[•]:=
```
trash = 0; (*сколько последних строчек таблицы выбросить*)
ListLinePlot[Table[{RezTab[[k + 2, 2]], RezTab[[k + 2, 16]] / 1000}, {k, n - trash}],
 AxesLabel → {"t, с", "x, км"}]
ListLinePlot[Table[{RezTab[[k + 2, 2]], RezTab[[k + 2, 14]] / 1000}, {k, n - trash}],
 AxesLabel → {"t, с", "y, км"}]
ListLinePlot[Table[{RezTab[[k + 2, 2]], RezTab[[k + 2, 13]]}, {k, n - trash}],
 AxesLabel → {"t, с", "ϑ, град"}]
ListLinePlot[Table[{RezTab[[k + 2, 2]], RezTab[[k + 2, 9]]}, {k, n - trash}],
 AxesLabel → {"t, с", "θc, град"}]
ListLinePlot[Table[{RezTab[[k + 2, 2]], RezTab[[k + 2, 12]]}, {k, n - trash}],
 AxesLabel → {"t, с", "ωz, рад/с"}]
ListLinePlot[Table[{RezTab[[k + 2, 2]], RezTab[[k + 2, 5]]}, {k, n - trash}],
 AxesLabel → {"t, с", "V, м/с"}]
ListLinePlot[Table[{RezTab[[k + 2, 2]], RezTab[[k + 2, 8]]}, {k, n - trash}],
 AxesLabel → {"t, с", "α, град"}]
ListLinePlot[Table[{RezTab[[k + 2, 16]] / 1000, RezTab[[k + 2, 5]]}, {k, n - trash}],
 AxesLabel → {"x, км", "V, м/с"}]
ListLinePlot[Table[{RezTab[[k + 2, 16]] / 1000, RezTab[[k + 2, 9]]}, {k, n - trash}],
 AxesLabel → {"x, км", "θc, град"}]
ListLinePlot[Table[{RezTab[[k + 2, 16]] / 1000, RezTab[[k + 2, 14]] / 1000}, {k, n - trash}],
 AxesLabel → {"x, км", "y, км"}]
```

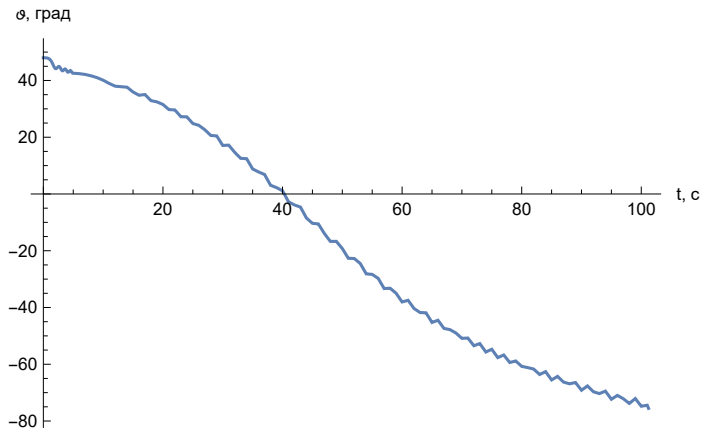
Out[•]=


x, км
25
20
15
10
5
20
40
60
80
100
t, c

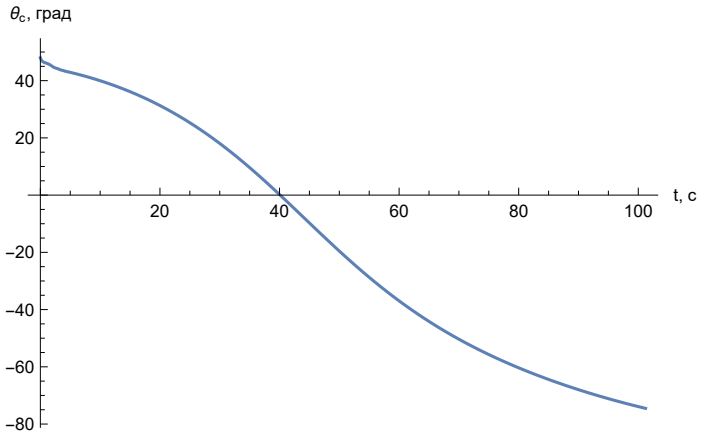
Out[•]=


y, км
12
10
8
6
4
2
20
40
60
80
100
t, c

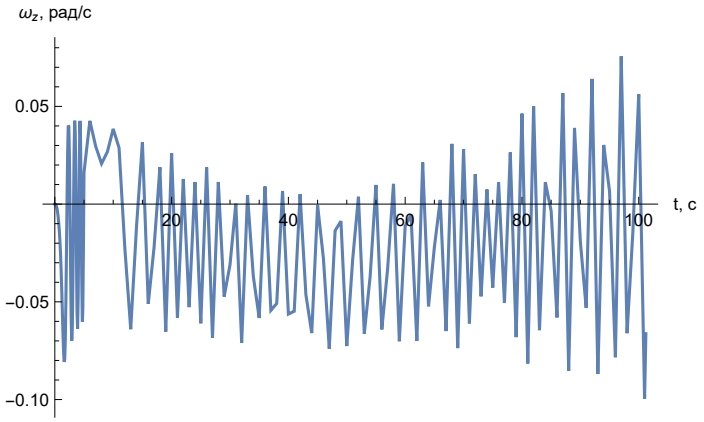
Out[•]=


ϑ, град
40
20
−20
−40
−60
−80
20
40
60
80
100
t, c

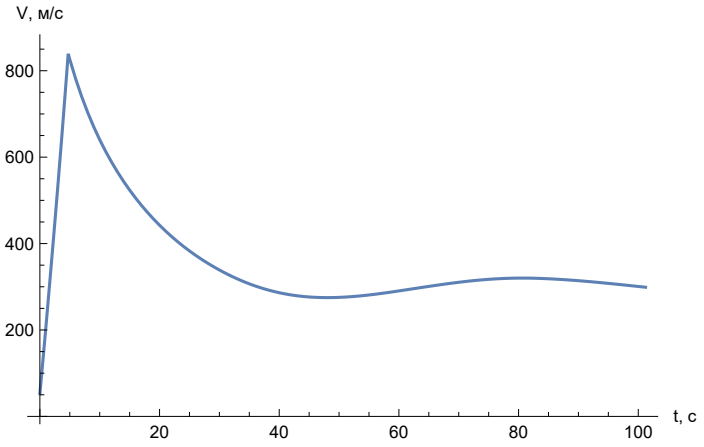
Out[•]=


θc, град
40
20
−20
−40
−60
−80
20
40
60
80
100
t, c

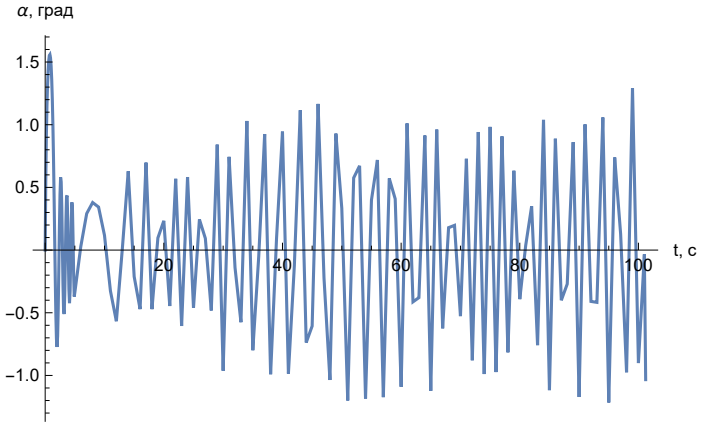
Out[•]=


ωz, рад/с
0.05
−0.05
−0.10
20
40
60
80
100
t, c

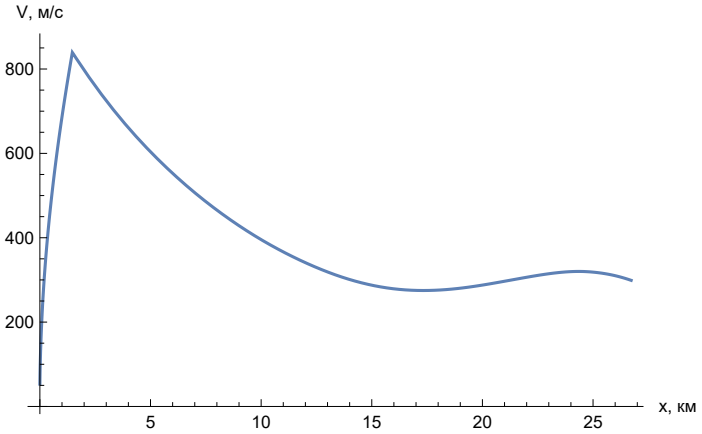
Out[•]=


V, м/с
800
600
400
200
20
40
60
80
100
t, c

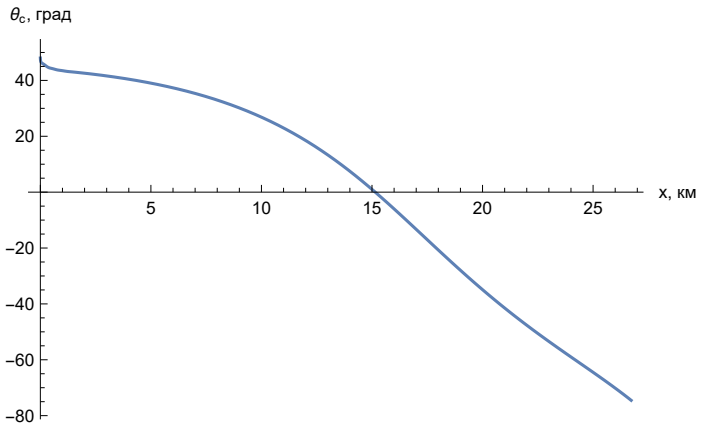
Out[•]=


α, град
1.5
1.0
0.5
−0.5
−1.0
20
40
60
80
100
t, c

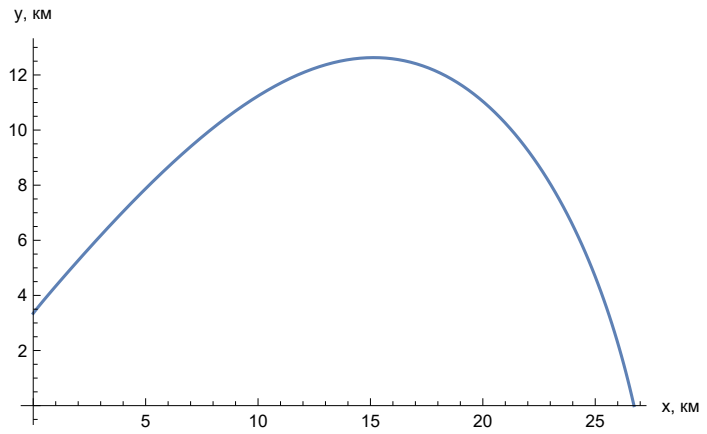
Out[•]=


V, м/с
800
600
400
200
5
10
15
20
25
x, км

Out[•]=


θc, град
40
20
−20
−40
−60
−80
5
10
15
20
25
x, км

Out[•]=



In[•]:=
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Export["C:\\Users\\Квай мембер Мрак\\Desktop\\ballu.xlsx",
 Table[RezTab[[k]], {k, n - trash}]]
```
экспорт… генерируемая константа

таблица значений

Out[•]=

C:\Users\Квай мембер Мрак\Desktop\ballu.xlsx