

```

In[232]:= Clear[t, m, n, o, p]
           |lösche
f[a_, b_, c_, d_, e_, x_] = e + d x + c x^2 + b x^3 + a x^4
df[a_, b_, c_, d_, e_, x_] = D[f[a, b, c, d, e, x], {x, 1}]
           |leite ab
ddf[a_, b_, c_, d_, e_, x_] = D[f[a, b, c, d, e, x], {x, 2}]
           |leite ab
energyAtAPoint[a_, b_, c_, d_, e_, x_] = (ddf[a, b, c, d, e, x])^2
energy[a_, b_, c_, d_, e_, t_] =
  Integrate[energyAtAPoint[a, b, c, d, e, x], {x, 0, t}]
           |integriere
constraints = {
  f[a, b, c, d, e, 0] == m,
  df[a, b, c, d, e, 0] == n,
  f[a, b, c, d, e, t] == o,
  df[a, b, c, d, e, t] == p
};

Print["constraintsSolutions:"]
           |gebe aus
constraintsSolutions = Solve[constraints, {b, c, d, e}]
           |löse
Print["Constraints with solutions:"]
           |gebe aus
constraintsSimplified = constraints /. constraintsSolutions[[1]]
energyWithSolutions[a_, t_] =
  Evaluate[energy[a, b, c, d, e, t] /. constraintsSolutions[[1]]]
           |werte aus
Print["Energy function:"]
           |gebe aus
energySimplified[a_, t_] = Simplify[energyWithSolutions[a, t]]
           |vereinfache
Print["solution: (a, b, c, d, e)"]
           |gebe aus

(*without loss of generality: t is always 1*)

amin = ArgMin[{energySimplified[a, 1]}, a]
           |Argument des Minimums
bmin = First[Evaluate[b /. constraintsSolutions /. {t -> 1, a -> amin}]]
           |erstes... |werte aus
cmin =
  First[Evaluate[c /. constraintsSolutions /. {t -> 1, a -> amin, b -> bmin}]]
           |erstes... |werte aus
dmin = First[Evaluate[
           |erstes... |werte aus
  d /. constraintsSolutions /. {t -> 1, a -> amin, b -> bmin, c -> cmin}]]
emin = First[Evaluate[e /. constraintsSolutions /.
           |erstes... |werte aus
  {t -> 1, a -> amin, b -> bmin, c -> cmin, d -> dmin}]]
Print["Check:"]
           |prüfe
Simplify[constraints /. {t -> 1, a -> amin, b -> bmin, c -> cmin, d -> dmin, e -> emin}]
           |vereinfache
Print["Target function:"]
           |gebe aus
f[amin, bmin, cmin, dmin, emin, x]

averageAccelerationInTimespan[from_, to_] := (1 / (to - from)) *

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Integrate[ddf[amin, bmin, cmin, dmin, emin, x], {x, from, to}]
[integriere]
Print["AverageAccelerationInTimespan:"]
[gebe aus]
Evaluate[averageAccelerationInTimespan[begin, end]]
[werte aus]

```

$$\text{Out[233]= } e + d x + c x^2 + b x^3 + a x^4$$

$$\text{Out[234]= } d + 2 c x + 3 b x^2 + 4 a x^3$$

$$\text{Out[235]= } 2 c + 6 b x + 12 a x^2$$

$$\text{Out[236]= } (2 c + 6 b x + 12 a x^2)^2$$

$$\text{Out[237]= } 4 c^2 t + 12 b c t^2 + 12 b^2 t^3 + 16 a c t^3 + 36 a b t^4 + \frac{144 a^2 t^5}{5}$$

constraintsSolutions:

$$\text{Out[240]= } \left\{ \left\{ b \rightarrow -\frac{-2 m + 2 o - n t - p t + 2 a t^4}{t^3}, c \rightarrow -\frac{3 m - 3 o + 2 n t + p t - a t^4}{t^2}, d \rightarrow n, e \rightarrow m \right\} \right\}$$

Constraints with solutions:

$$\text{Out[242]= } \left\{ \text{True, True, True, } n + 4 a t^3 - \frac{2 (3 m - 3 o + 2 n t + p t - a t^4)}{t} - \frac{3 (-2 m + 2 o - n t - p t + 2 a t^4)}{t} = p \right\}$$

$$\begin{aligned} \text{Out[243]= } & \frac{144 a^2 t^5}{5} - 16 a t (3 m - 3 o + 2 n t + p t - a t^4) + \\ & \frac{4 (3 m - 3 o + 2 n t + p t - a t^4)^2}{t^3} - 36 a t (-2 m + 2 o - n t - p t + 2 a t^4) + \\ & \frac{12 (3 m - 3 o + 2 n t + p t - a t^4) (-2 m + 2 o - n t - p t + 2 a t^4)}{t^3} + \\ & \frac{12 (-2 m + 2 o - n t - p t + 2 a t^4)^2}{t^3} \end{aligned}$$

Energy function:

$$\text{Out[245]= } \frac{4 (15 m^2 + 15 o^2 - 15 o (n + p) t + 15 m (-2 o + (n + p) t) + t^2 (5 n^2 + 5 n p + 5 p^2 + a^2 t^6))}{5 t^3}$$

solution: (a, b, c, d, e)

$$\text{Out[247]= } 0$$

$$\text{Out[248]= } 2 m + n - 2 o + p$$

$$\text{Out[249]= } -3 m - 2 n + 3 o - p$$

$$\text{Out[250]= } n$$

$$\text{Out[251]= } m$$

Check:

$$\text{Out[253]= } \{\text{True, True, True, True}\}$$

Target function:

Out[255]= $m + n x + (-3 m - 2 n + 3 o - p) x^2 + (2 m + n - 2 o + p) x^3$

AverageAccelerationInTimespan:

Out[258]=
$$\frac{1}{-begin + end} \left(6 begin m - 6 begin^2 m - 6 end m + 6 end^2 m + 4 begin n - 3 begin^2 n - 4 end n + 3 end^2 n - 6 begin o + 6 begin^2 o + 6 end o - 6 end^2 o + 2 begin p - 3 begin^2 p - 2 end p + 3 end^2 p \right)$$

In[32]:= **Quit[]**

In[25]:= **clear[m, n, o, p]**
m := -1.4
n := -0.5
o := 1.3
p := 0.6
targetF[x_] = f[amin, bmin, cmin, dmin, emin, x]
Plot[targetF[x], {x, 0, 2}]
[graphische Funktionsdarstellung](#)

Out[30]= $\{-1.4 - 0.5 x + 8.5 x^2 - 5.3 x^3\}$

