①

Nr. 9)

geg.: $f_t(x) = -\frac{1}{18}x^4 + \frac{t}{3}x^3 \quad , \quad t \in R^+$

ges.: a) • $D_f = \{x \mid x \in R\}$; $P_y(0|0)$; Symm. Keine

• Nst: $0 = -\frac{1}{18}x^4 + \frac{t}{3}x^3 \quad | \cdot (-18)$

$0 = x^4 - 6tx^3$

$0 = x^3 \cdot (x - 6t)$

$\underline{x_{0_1} = 0} \qquad \underline{x_{0_2} = 6t}$

• Unstetigkeiten: Keine

• lok. Extr.: $f_t'(x) = -\frac{2}{9}x^3 + tx^2$

nB: $0 = -\frac{2}{9}x^3 + tx^2$

$0 = x^2 \cdot \left(-\frac{2}{9}x + t\right)$

$\underline{x_{E_1} = 0} \qquad \underline{x_{E_2} = 4{,}5t}$

$f_t''(x) = -\frac{2}{3}x^2 + 2tx$

hB: $f_t''(0) = 0$ unklar

$f_t''(4{,}5t) = -\frac{2}{3}(4{,}5t)^2 + 2t \cdot 4{,}5t$

$= -\frac{27}{2}t^2 + 9t^2 = -4{,}5t^2 < 0$

$\curvearrowright$ Max, $\underline{P_H(4{,}5t \mid 7{,}6t^4)}$

$(1{,}5)^5 t^4$

• WP: nB: $0 = -\frac{2}{3}x^2 + 2tx$

$0 = x \cdot \left(-\frac{2}{3}x + 2t\right)$

$\underline{x_{w_1} = 0} \qquad \underline{x_{w_2} = 3t}$

$f_t'''(x) = -\frac{4}{3}x + 2t$

hB: $f_t'''(0) = 2t > 0$, da $t > 0 \curvearrowright$ ReLiKu

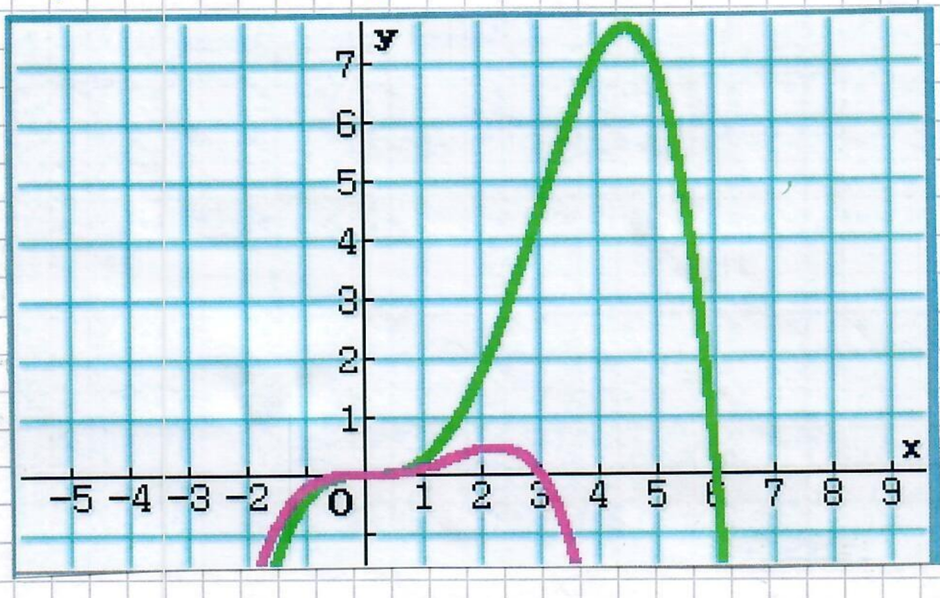
$f_t'''(3t) = -2t < 0 \curvearrowright$ LiReKu

$\underline{P_{w_1}(0|0)}$; $\underline{P_{w_2}(3t \mid 4{,}5t^4)}$

- $x \to \pm\infty$

$$\lim_{x\to\pm\infty} -\frac{1}{18}x^4 + \frac{t}{3}x^3 = \lim_{x\to\pm\infty} x^4 \cdot \left(-\frac{1}{18} + \frac{t}{3x}\right)$$
$$= +\infty \cdot \left(-\frac{1}{18} + 0\right)$$
$$= \underline{\underline{-\infty}}$$

- Graph K_1, $K_{\frac{1}{2}}$



b) gemeinsame Punkte $\forall K_t$

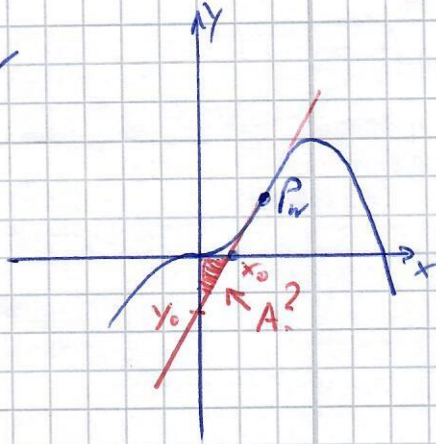
$$f_a(x) = f_b(x)$$
$$-\frac{1}{18}x^4 + \frac{a}{3}x^3 = -\frac{1}{18}x^4 + \frac{b}{3}x^3 \quad \Big| + \frac{1}{18}x^4$$
$$\frac{a}{3}x^3 = \frac{b}{3}x^3$$ wahr für $\underline{\underline{x=0}}$, wenn $a \neq b$

$P(0|0)$ ist gemeinsame Punkt

c) „geometrische Ort" aller Hochpunkte

$$P_H\left(4{,}5t \,\big|\, (1{,}5)^5 t^4\right)$$
$$x = 4{,}5t = \frac{9}{2}t \;\curvearrowright\; t = \frac{2}{9}x$$
$$\curvearrowright\; y = (1{,}5)^5 \cdot \left(\frac{2}{9}x\right)^4 = \left(\frac{3}{2}\right)^5 \cdot \left(\frac{2}{9}\right)^4 \cdot x^4 = \frac{3^5}{2^5} \cdot \frac{2^4}{3^8} x^4$$
$$\underline{y} = \frac{1}{2\cdot 3^3}x^4 = \underline{\underline{\frac{1}{54}x^4}}$$

d) $P_W\left(3t \,\middle|\, \frac{9}{2}t^4\right)$, Tangente in P_W



Tang: $y = mx + n$

$m = f_t'(3t) = 3t^3$

$y = 3t^3 x + n$ halbfertige T.

$P_W \rightarrow \frac{9}{2}t^4 = 3t^3 \cdot 3t + n$

$\frac{9}{2}t^4 = 9t^4 + n \Rightarrow n = \frac{9}{2}t^4 - 9t^4 = -\frac{9}{2}t^4$

Tang: $\underline{\underline{y = 3t^3 x - \frac{9}{2}t^4}} \Rightarrow \underline{\underline{y_0 = -\frac{9}{2}t^4}}$; $\underline{\underline{x_0 = \frac{3}{2}t}}$

$\Rightarrow A = \frac{1}{2}ab$ (⊾Δ!)

$\Rightarrow A = \frac{1}{2} \cdot \left|-\frac{9}{2}t^4\right| \cdot \frac{3}{2}t = \underline{\underline{\frac{27}{8}t^5}}$