Functions

\[ f(x) \rightarrow y \text{- Koordinate} \]

\[ f'(x) \rightarrow \text{Steigung} \]

\[ f''(x) \rightarrow \text{Kurvenverlauf} \]

Graph with annotations and calculations involving limits and derivatives.
Ableitungen

\[ f(x) = a \cdot x^n \implies f'(x) = a \cdot n \cdot x^{n-1} \]

\[ f(x) = n \cdot x^n \implies f'(x) = n \cdot n \cdot x^{n-1} = 2 \cdot x^3 \]

Kettenregel: \[ f[g(x)] = f'[g(x)] \cdot g'(x) \]

\text{Exp: } \quad f(x) = e^x \implies f'(x) = e^x \cdot x'

\[ f(x) = e^{3x} \implies f'(x) = e^{3x} \cdot (3x) = 3 \cdot e^{3x} \]

\[ f(x) = e^x \implies f'(x) = e^x \cdot (x)' = e^x \cdot 1 = e^x \]
\[ \ln : f(x) = \ln x \Rightarrow f'(x) = \frac{1}{x} \cdot \triangle \]

\[ f(x) = \ln 3x^2 \quad f'(x) = \frac{4}{3x^1} \cdot (3x^1)' = \frac{4}{3x} \cdot 6x = \frac{2}{x} \]

\[ \text{Trigon :} \quad f(x) = \sin x \Rightarrow f'(x) = \cos x \cdot \triangle \]

\[ f'(x) = \cos \sqrt{7x} \Rightarrow f''(x) = -\sin \sqrt{7x} \cdot \triangle \]

\[ f(x) = \sin (7x) \Rightarrow f'(x) = \cos (7x) \cdot (7x) = \cos (7x) \cdot 7 \]

\[ f(x) = \sqrt{x} \Rightarrow f'(x) = \frac{1}{2}x^{-\frac{1}{2}} \cdot \triangle \]

\[ f(x) = (2 - 3x)^4 \Rightarrow f'(x) = 4 \cdot (2 - 3x^2) \cdot (2 - 3x)^3 \]

\[ f(x) = x^6 \Rightarrow f'(x) = 6 \cdot x^5 \cdot (x) \]
1) \( \frac{x^3 - 4x^2 - 11x + 30}{x^2 - 2x - 15} = 0 \)

\( (x^3 - 4x^2 - 11x + 30)(x - 2) = x^2 - 2x - 15 \)

\( \frac{-(x^3 - 2x^2)}{-2x^3 - 11x + 30} \)

\( \frac{-(2x^2 + 4x)}{-15x + 30} \)

\( \frac{-15x + 30}{-15x + 30} \)

\( (x + 3) | (x - 5) \)

\( u = \{ -3, 2, 5 \} \)

\( u = \{ \pm 3, 7, -1 \} \)
2) \[
\frac{\frac{2}{3} + \frac{u}{10}}{\frac{u}{3} - \frac{7}{10}} = \frac{\frac{10 + 12}{45}}{\frac{40 - 21}{30}} = \frac{\frac{22}{45}}{\frac{30}{19}} = \frac{44}{57}
\]
\[
\frac{\frac{3x}{4y} - \frac{5}{32}}{\frac{5x}{6y^2} + \frac{32}{2x}} = \frac{\frac{9x^2 - 20y}{12y^2}}{\frac{5x^2 + 9y^2}{6xy^2}} = \frac{\frac{9x^2 - 20y}{12y^2}}{\frac{6xy^2}{5x^2 + 9y^2}} = \frac{\frac{9x^2 - 20y}{10x^2 + 18y^2}}{6xy^2}
\]
3) \( \frac{2}{5x} - \frac{3}{4} + \frac{5}{a} - \frac{7}{6} = \frac{4}{a^2x} - \frac{9}{10} \)

\[ 24 - 45x + 25x - 70x = 16 - 54x \]

\[ 24 - 90x = 16 - 54x \]

\[ 8 = 36x \]

\[ x = \frac{8}{36} = \frac{2}{9} \]
\[3 \sqrt{x^5} = (x^5)^{\frac{1}{3}} = x^{5 \cdot \frac{1}{3}} = x^{\frac{5}{3}}\]

\[x^{\frac{1}{2}} = \frac{1}{x^{\frac{1}{2}}} = \frac{1}{\sqrt{x}}\]

\[0.25^{-2} = \left(\frac{1}{4}\right)^{-2} = \left(\frac{4}{1}\right)^{2} = 16\]

\[\frac{5}{\sqrt[3]{x^3}} = \frac{x^{-\frac{3}{5}}}{x^{\frac{1}{3}}} = \frac{x^{-\frac{3}{5}}}{x^{\frac{1}{3}}} = x^{\frac{1}{3} - \frac{3}{5}}\]
1) \[ x^2 \cdot 3 \sqrt[4]{x^3 \cdot \sqrt{x}} \]

2) \[ f(x) = \frac{\sqrt{x^3}}{x^2} \rightarrow f'(x) = \frac{\sqrt{x^3}}{x^2} \cdot x^3 \]

3) \[ \left( \frac{A}{0.1 A^{-3}} \right)^2 = \frac{A}{0.1 A^{-3}} \cdot A \]

\[ f(x) = x^{1/2} \]
\[ f'(x) = \frac{3x^{1/2}}{2} \]
1) \[ \sqrt[4]{x^3 \sqrt[6]{x^3 \sqrt[4]{x^3}}} = (x^3)^{\frac{1}{4}} \left( (x^6)^{\frac{1}{6}} \right)^{\frac{1}{4}} \left( (x^{12})^{\frac{1}{12}} \right)^{\frac{1}{4}} \]

\[ \left( \frac{4}{k} \right)^2 = \frac{k^2}{a} \]

\[ \frac{3}{3n} \cdot \frac{3}{4n} \cdot \frac{1}{2} \]

\[ x = \frac{r + 8 + 1}{n} = \frac{r8n}{n} = \frac{3}{3} \]

\[ k \sqrt{\frac{2-k}{a}} \]

\[ k \left( \frac{1}{a} \right)^{3k+4} \left( \frac{k}{\left( \frac{1}{a} \right)^{3k+1}} \right)^{\frac{1}{4}} = \frac{a}{2-k} x \frac{-2}{k} \]

\[ \frac{2-k - (3k+4)}{k} = \frac{2-k - 4k - 1}{k} = \frac{8}{k} = k \sqrt{a} \]