Izvodi

Neka je realna f-ja f definisana na otvorenom intervalu (a,b) i neka je $x_0 \in (a,b)$.
Granična vrijednost $\lim\limits_{\Delta x \to 0} \frac{f(x_0+\Delta x)-f(x_0)}{\Delta x}$ → priraštaj f-je

ako postoji nazivamo prvim izvodom f-je f u tački x_0, i označavamo:

$$f'(x_0) = \lim_{x \to 0} \frac{f(x_0+\Delta x)-f(x_0)}{\Delta x}$$

Lijevi i desni izvod:

$$f'_+(x_0) = \lim_{x_0 \to 0^+} \frac{f(x_0+\Delta x)-f(x_0)}{\Delta x}$$ desni izvod f-je u tački x

$$f'_-(x_0) = \lim_{x_0 \to 0^-} \frac{f(x_0+\Delta x)-f(x_0)}{\Delta x}$$ lijevi izvod f-je u tački x

F-ja f je diferencijabilna u tački x_0 ako i samo ako: $f'_+(x_0) = f'_-(x_0)$ (su lijevi i desni izvodi jednaki).

Diferencijabilnost povlači neprekidnost. Ako je f-ja diferencijabilna onda je i neprekidna. Obrnuto ne važi. (6)

① Po definiciji nađi izvod f-je:

$f(x) = \sqrt{1+2x}$

Neka je $x_0 \in R$ proizvoljna tačka.

$$f'(x_0) = \lim_{\Delta x_0 \to 0} \frac{f(x_0+\Delta x) - f(x_0)}{\Delta x} = \lim_{\Delta x \to 0} \frac{\sqrt{1+2(x_0+\Delta x)} - \sqrt{1+2x_0}}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{\sqrt{1+2(x_0+\Delta x)} - \sqrt{1+2x_0}}{\Delta x} \cdot \frac{\sqrt{1+2(x_0+\Delta x)} + \sqrt{1+2x_0}}{\sqrt{1+2(x_0+\Delta x)} + \sqrt{1+2x_0}} =$$

$$= \lim_{\Delta x \to 0} \frac{1-2(x_0+\Delta x) - 1 - 2x_0}{\Delta x \cdot \left(\sqrt{1-2(x_0+\Delta x)} + \sqrt{1-2x_0}\right)} = \lim_{\Delta x \to 0} \frac{2 \cdot \Delta x}{\Delta x \cdot \left(\sqrt{1-2(x_0+\Delta x)} + \sqrt{1-2x_0}\right)}$$

$$= \frac{2}{\sqrt{1+2x_0} + \sqrt{1+2x_0}} = \frac{1}{\sqrt{1+2x_0}} \quad ; \quad x_0 \neq -\frac{1}{2}$$

$$f'(x) = \frac{1}{\sqrt{1+2x}} \quad ; \quad x \neq -\frac{1}{2}$$

$f(x) = x^2$ $\qquad$ $f(-1) = (-1)^2 = 1$

$f'(x) = 2x$, $\qquad$ $f'(1) = 0$

$f'(-1) = 2 \cdot (-1) = -2$

② Ispitati diferencijabilnost funkcije $f(x)=\frac{1}{2}\cdot\sqrt{(x-2)^2}$ u tački $x_0=2$

- Napomena: Funkcija f je diferencijabilna u tački x_0 ako i samo ako je

$$f'_+(x_0)=f'_-(x_0)$$

- Napomena: Diferencijabilnost povlači neprekidnost (obrnuto ne važi!)
Neprekidnost ne povlači diferencijabilnost (u opštem slučaju)

$$f'_+(2)=\lim_{\Delta x\to 0+}\frac{f(2+\Delta x)-f(2)}{\Delta x}=\lim_{\Delta x\to 0+}\frac{\frac{1}{2}\sqrt{(2+\Delta x-2)^2}-0}{\Delta x}=$$

$$=\lim_{\Delta x\to 0+}\frac{\frac{1}{2}\sqrt{\Delta x^2}}{\Delta x}=\lim_{\Delta x\to 0+}\frac{\frac{1}{2}|\Delta x|}{\Delta x}=\lim_{\Delta x\to 0+}\frac{\frac{1}{2}\cdot\Delta x}{\Delta x}=\frac{1}{2}$$

$$f'_-(2)=\lim_{\Delta x\to 0-}\frac{f(2+\Delta x)-f(2)}{\Delta x}=\dots=\lim_{\Delta x\to 0-}\frac{\frac{1}{2}\cdot(-\Delta x)}{\Delta x}=-\frac{1}{2}$$

$f'(2)\neq f'(2)\Rightarrow$ funkcija nije diferencijabilna u tački $x_0=2$

③ Odrediti parametre a i b tako da funkcija $f(x)=\begin{cases}x^2, & x\leq 1\\ ax+b, & x>1\end{cases}$,
bude diferencijabilna na $\mathbb{R}$.

* Na intervalima $(-\infty,1)$ i $(1,+\infty)$ f-ja se poklapa sa polinomima x^2, $ax+b$ pa je diferencijabilna jer su polinomi dif. f-je

Ostaje da odredimo parametre a i b tako da f-ja bude diferencijabilna i u tački $x_0=1$

Potreban ali ne i dovoljan uslov da f-ja f bude diferencijabilna u tački $x_0=1$ je da ona u njoj bude neprekidna tj. da važi:

$$\lim_{x\to 1+} f(x) = \lim_{x\to 1-} f(x) = f(1) \quad *$$

Utorak od 12^h
Srijedom od 10^h
135. kabinet desno od bibl

$$\lim_{x\to 1+} f(x) = \lim_{x\to 1+} (ax+b) = a+b$$

$$\lim_{x\to 1-} f(x) = \lim_{x\to 1-} x^2 = 1$$

$$f(-1) = 1^2 = 1$$

$$(*) \Rightarrow a+b=1$$

* Da bi funkcija f bila diferencijabilna u tački $x_0=1$ potrebno je i dovoljno da važi $f'_+(1) = f'_-(1) \quad (**)$

$$f'_+(1) = \lim_{\Delta x\to 0+} \frac{f(1+\Delta x)-f(1)}{\Delta x} = \lim_{\Delta x\to 0+} \frac{a\cdot(1+\Delta x)+b-1}{\Delta x} =$$

$$\lim_{\Delta x\to 0+} \frac{a+a\cdot\Delta x+b-1}{\Delta x} = \lim_{\Delta x\to 0+} \frac{a\cdot\Delta x}{\Delta x} = a$$

$$f'_-(1) = \lim_{\Delta x\to 0-} \frac{f(1+\Delta x)-f(1)}{\Delta x} = \lim_{\Delta x\to 0-} \frac{(1+\Delta x)^2-1}{\Delta x} = \lim_{\Delta x\to 0-} \frac{1+2\Delta x+\Delta x^2-1}{\Delta x} =$$

$$= \lim_{\Delta x\to 0-} \frac{\Delta x(2+\Delta x)}{\Delta x} = 2$$

$$(**) \Rightarrow a=2$$

$$\begin{cases} a+b=1 \\ a=2 \end{cases} \quad \begin{cases} a=2 \\ b=-1 \end{cases}$$

TABLICA OSNOVNIH IZVODA

1) $(c)'=0$

2 $(x^n)' = n\cdot x^{n-1}$

3) $(\sqrt{x})' = \frac{1}{2\cdot\sqrt{x}}$

4. $(x)'=1$

5. $(e^x)'=e^x$

6. $(a^x)' = a^x\cdot \ln a$

7. $(\ln x)' = \frac{1}{x}$

8. $(\log_a x)' = \frac{1}{x\cdot\ln a}$, $a>0$, $a\neq 1$

9. $(\sin x)' = \cos x$

10. $(\cos x)' = -\sin x$

11. $(tg\, x)' = \frac{1}{\cos^2 x}$

12. $(ctg\, x)' = \frac{-1}{\sin^2 x}$

13. $(\arcsin x)' = \frac{1}{\sqrt{1-x^2}}$, $|x| < 1$

14. $(\arccos x)' = -\frac{1}{\sqrt{1-x^2}}$, $|x| < 1$

15. $(\mathrm{arctg}\, x)' = \frac{1}{1+x^2}$

16. $(\mathrm{arcctg}\, x)' = \frac{-1}{1+x^2}$

Osobine :

1) $(c \cdot f)' = c \cdot f'$, $c \in R$

2) $f \pm g = f' \pm g'$

3) $(f \cdot g)' = f' \cdot g + f \cdot g'$

4) $\left(\frac{f}{g}\right)' = \frac{f' \cdot g - f \cdot g'}{g^2}$, $g \neq 0$

√ 1. $f(x) = x^4$

$f'(x) = 4x^3$

√ 2. $f(x) = (5x^3 + 4x)^4$

$f = f(u)$, $u = g(x)$

$f'_x = f'_u \cdot u'_x$

$f(x) = u^4$, $u = 5x^3 + 4x$

$f'(x) = 4 \cdot u^3 \cdot u'_x$

$f'(x) = 4(5x^3 + 4x)^3 \cdot (15x^2 + 4)$

Vježbe VIII

15. II. 2018 god

① Nađi prvi izvod f-je:

$$y = \sqrt[3]{1+x^4}$$

$(\sqrt{x})' = \frac{1}{2\sqrt{x}}$

$(x^n)' = n \cdot x^{n-1}$

$$y = (1+x^4)^{\frac{1}{3}}$$

$$y'(x) = \frac{1}{3}(1+x^4)^{\frac{1}{3}-1} \cdot (1+x^4)'$$

$$y'(x) = \frac{1}{3}(1+x^4)^{-\frac{2}{3}} \cdot (0+4x^3) = \frac{4x^3}{3 \cdot (1+x^4)^{\frac{2}{3}}} = \frac{4x^3}{3 \cdot \sqrt[3]{(1+x^4)^2}}$$

② $y = \cos(2x^3+5x)$

$(\cos x)' = -\sin x$

$$y'(x) = -\sin(2x^3+5x) \cdot (2x^3+5x)'$$

$$= -\sin(2x^3+5x) \cdot (6x^2+5)$$

$$= -(6x^2+5) \cdot \sin(2x^3+5x)$$

③ $y = \sin^3 \ln x^5$

$\sin^2 x = (\sin x)^2 \neq \sin x^2$

$$y = (\sin(\ln x^5))^3$$

$$y'(x) = 3 \cdot (\sin(\ln x^5))^2 \cdot (\sin(\ln x^5))'$$

$$= 3(\sin(\ln x^5))^2 \cdot \cos(\ln x^5) \cdot (\ln x^5)'$$

$$= 3(\sin(\ln x^5))^2 \cdot \cos(\ln x^5) \cdot \frac{1}{x^5} \cdot (x^5)'$$

$(\ln x)' = \frac{1}{x}$

$$= 3(\sin(\ln x^5))^2 \cdot \cos(\ln x^5) \cdot \frac{1}{x^5} \cdot 5x^4$$

④ $y = tg(2 \cdot e^{7x})$ $\qquad tg' = \frac{1}{\cos^2 x}$

konstanta izvlačimo za izvodima

$$y'(x) = \frac{1}{\cos^2(2 \cdot e^{7x})} \cdot (2 \cdot e^{7x})'$$

$$y'(x) = \frac{1}{\cos^2(2 \cdot e^{7x})} \cdot 2 \cdot (e^{7x})'$$

$$y'(x) = \frac{1}{\cos^2(2 \cdot e^{7x})} \cdot 2 \cdot e^{7x} \cdot (7x)'$$

$$y'(x) = \frac{1}{\cos^2(2 \cdot e^{7x})} \cdot 2 \cdot e^{7x} \cdot 7$$

⑤ $y = 3^{2 \cdot tg^3 x}$ $\qquad a^x = a^x \cdot \ln$

konst izvlačimo

$$y'(x) = 3^{2 \cdot tg^3 x} \cdot \ln 3 \cdot (2 \cdot tg^3 x)' \qquad tg^3 x = ((tg x)$$

$$y'(x) = 3^{2 \cdot tg^3 x} \cdot \ln 3 \cdot 2 \cdot (tg^3 x)'$$

$$= 3^{2 \cdot tg^3 x} \cdot \ln 3 \cdot 2((tg x)^3)'$$

$$= 3^{2 \cdot tg^3 x} \cdot \ln 3 \cdot 2 \cdot 3 \cdot (tg x)^2 \cdot (tg x)'$$

$$= 3^{2 \cdot tg^3 x} \cdot \ln 3 \cdot 6 (tg x)^2 \cdot \frac{1}{\cos^2 x}$$

⑥ $y = e^{x \cdot \ln(x+2)}$ $\qquad$ kao proizvod: $f' \cdot g + f \cdot g'$

$$y'(x) = e^{x \cdot \ln(x+2)} \cdot (\underbrace{x}_{f} \cdot \underbrace{\ln(x+2)}_{g})'$$

$$y'(x) = e^{x \cdot \ln(x+2)} \cdot \left(1 \cdot \ln(x+2) + x \cdot \frac{1}{x+2}\right) \cdot (x+2)'$$

$$= e^{x \cdot \ln(x+2)} \cdot \ln(x+2) + \frac{x}{x+2}$$

$\frac{1}{2} \cdot \frac{1}{e^{2x}} \cdot \frac{-2e^{-x}}{e^{2x}-1} = \frac{1}{1-e^{2x}}$

$y = x^{a^a} + a^{x^a} + a^{a^x}$

$(x^n)' = nx^{n-1}$
$a^x = a^x \cdot \ln a$

$= a^a \cdot x^{a^a-1} + a^{x^a} \cdot \ln a \cdot (x^a)' + a^{a^x} \cdot \ln a \cdot (a^x)'$

$= a^a \cdot x^{a^a-1} + a^{x^a} \cdot \ln a \; a x^{a-1} + a^{a^x} \cdot \ln a \cdot a^x \cdot \ln a$

<u>Logaritamski izvodi</u>

$y = x^x \quad / \ln$

$\ln y = \ln x^x$

$\ln y = x \ln x \quad / '$

→ Logaritamski izvodi ←

1. $y = x^x \quad / \ln$

$\ln x^n = n \cdot \ln x$

$\ln y = \ln x^x$

$\ln y = x \cdot \ln x \quad /'$

$\frac{1}{y} \cdot y' = 1 \cdot \ln x + x \cdot \frac{1}{x}$

$\frac{1}{y} \cdot y' = \ln x + 1$

$y' = y \cdot (\ln x + 1)$

$y' = x^x \cdot (\ln x + 1)$

2. $y = x^{\sin x}, \quad x > 0$

$\ln y = \ln x^{\sin x}$

$\ln y = \sin x \cdot \ln x \, /'$

$\frac{1}{y} \cdot y' = \cos x \cdot \ln x + \sin x \cdot \frac{1}{x}$

$y' = y\left(\cos x \cdot \ln x + \frac{1}{x} \cdot \sin x\right)$

$y' = x^{\sin x}\left(\cos \cdot \ln x + \frac{1}{x} \sin x\right)$

3.

Izvod parametarski zadate funkcije

$$\begin{cases} x = f(t) \\ y = g(t) \end{cases}$$

$$y'_x = \frac{g'_t}{f'_t}$$

3. Pokazati da funkcija $x = 2t + 3t^2$, $y = t^2 + 2t^3$ zadovoljava jednačinu $2 \cdot y'^3 + y'^2 - y = 0$

$x = f(t)$, $f(t) = 2t + 3t^2$

$y = g(t)$ $g(t) = t^2 + 2t^3$

$$y'_x = \frac{g'_t}{f'_t}$$

$g'_t = 2t + 6t^2$

$f'_t = 2 + 6t$

$$y'_x = \frac{2t + 6t^2}{2 + 6t} = \frac{t(2 + 6t)}{2 + 6t} = t$$

$M(5,3)$

$y'_{(5)} = 1$

za $x = 5$, $y = 3$ imamo da je $t = 1$

Izvod implicitno zadate funkcije

4. Naći prvi izvod f- $y = f(x)$ ako je ona zadata implic. sledećom jedn.

$x^2 + y^2 = 4 \quad /'$

$2x + 2y \cdot y' = 0$

$x + y \cdot y' = 0$

$$y' = -\frac{x}{y}$$

(5) Neka je $y=f(x)$ funkcija koja je zadata implicitno jednačinom $x\cdot y + y^3 = 1$. Naći y' u 0.

$$x\cdot y + y^3 = 1 \quad /'$$

$$1\cdot y + x\cdot y' + 3y^2\cdot y' = 0$$

$$y + (x+3y^2)\cdot y' = 0$$

$$y' = -\frac{y}{x+3y^2} \quad , \quad y=f(x)$$

$y'(0)$ - ?

$x=0$, $y=f(0)$ ↗ $y=f(x)$

$$x\cdot y + y^3 = 1$$

$x=0$ $\quad 0\cdot y + y^3 = 1$

$y^3=1$, $y=1$

$x=0$, $f(0)=1$

(6.) Naći y' ako je funkcija $y=f(x)$ zadata implicitno jednačinom

$$3x^2\cdot y^3 - 5xy^2 = y \quad /'$$

$$6x\cdot y^3 + 3x^2\cdot 3y^2\cdot y' - 5\cdot y^2 - 5x\cdot 2y\cdot y' = y'$$

$$6x\cdot y^3 - 5y^2 = y' - 9x^2y^2\cdot y' + 10xy\cdot y'$$

$$6xy^3 - 5y^2 = y'(1 - 9x^2y^2 + 10xy)\cdot y'$$

$$y' = \frac{6xy^3 - 5y^2}{1 - 9x^2y^2 + 10xy}$$

(7.) Funkcija y je definisana jednačinom $\operatorname{arctg}\left(\frac{y}{x}\right) = \frac{1}{2}\ln x^2 + y^2$. Dokazati da funkcija zadovoljava jednačinu $y'\cdot(x-y) = x+y$

$$\operatorname{arctg}\left(\frac{y}{x}\right) = \frac{1}{2}\ln(x^2+y^2) \quad /'$$

$$\frac{1}{1+\left(\frac{y}{x}\right)^2}\cdot\left(\frac{y}{x}\right)' = \frac{1}{2}\,\frac{1}{x^2+y^2}\cdot(x^2+y^2)'$$

$$\frac{1}{\frac{x^2+y^2}{x^2}}\left(\frac{y}{x}\right)' = \frac{1}{2}\left(\frac{1}{x^2+y^2}\cdot(2x+2y\cdot y')\right)$$

$$\frac{x^2}{x^2+y^2}\cdot\left(\frac{y}{x}\right)' = \frac{x+y\cdot y'}{x^2+y^2}$$

$$x^2\left(\frac{y}{x}\right)' = x+y\cdot y'$$

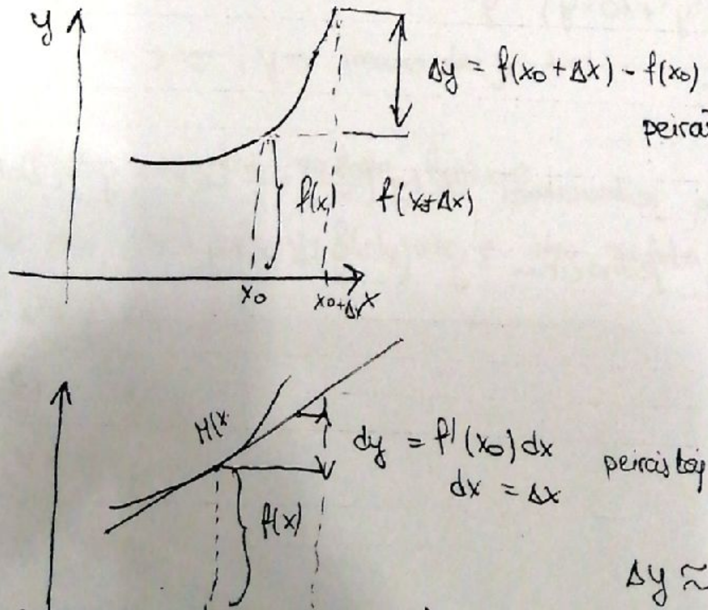
$$x^2\cdot\frac{y'\cdot x - y\cdot 1}{x^2} = x+y\cdot y'$$

$$y'\cdot x - y = x+y\cdot y'$$

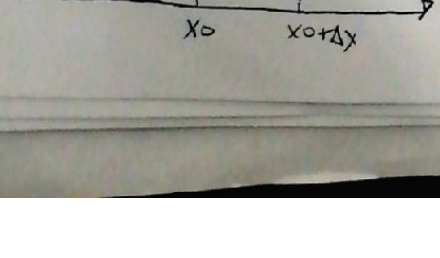
$$y'\cdot \cancel{x} - y\cdot y' = x+y$$

$$(x-y)\cdot y' = x+y$$

Diferencijal i njegova primjena



prirastaj funkcije



$dy = f'(x_0)\,dx$ prirastaj tangente
$dx = \Delta x$

$\Delta y \approx dx$

dy - diferencijal funkcije prvog reda

Odrediti diferen. sled f-ja

a) ~~f(x) j~~

$f(x) = 2^x - 3^{-x} + \sqrt{x}$

$df = f'(x) \cdot dx$

$df = (2^x \cdot \ln 2 - 3^{-x} \ln x \cdot (-1) + \frac{1}{2\sqrt{x}})\, dx$

b) $y = \ln(\cos\frac{1}{x}) - \frac{1}{x}$

$(\frac{2}{x^3})' = -6x^{-4} = \frac{-6}{x^4}$

$(\frac{1}{x})' = (x^{-1})' = (-1) \cdot x^{-2} = -\frac{1}{x^2}$

$\cancel{y'}$ $dy = f'(x)\, dx$

$dy = (\frac{1}{\cos\frac{1}{x}} \cdot (-\sin\frac{1}{x}) \cdot (\frac{1}{x})' - (\frac{1}{x})')\, dx$

$dy = (-\operatorname{tg}\frac{1}{x}\,(-\frac{1}{x^2}) - (-\frac{1}{x^2}))\, dx$

$dy = \frac{1}{x^2}(\operatorname{tg}\frac{1}{x} + 1) \cdot dx$

2. Neka je $f(x) = x^2$ približno izračunati $f(5{,}123)$

Neka je $x = 0$, $\Delta x = 0{,}123$

Tražimo $\cancel{f(0)}\,(x_0 + \Delta x)$

$\Delta y \approx dy$

$f(x_0 + \Delta x) - f(x_0) \approx f'(x_0) \cdot dx$

$f(x_0 + \Delta x) \approx f(x_0) + f'(x_0)\, dx$, $dx = \Delta x$

$f(5{,}123) \approx f(5) + f'(5) \cdot 0{,}123$

$f(5) = 5^2 = 25$

$f'(x) = 2x$

$f'(5) = 2 \cdot 5 = 10$

$5,123^2 \approx 25 + 10 \cdot 0,123 = 25 + 1,23 = 26,23$

$5,123^2 \approx 26,23$

(3) Približno izračunati $\sqrt[3]{1,02}$

Neka $f(x) = \sqrt[3]{x}$ približno treba izračunati $f(1,02)$

Neka je $x_0 = 1 \quad \Delta x = 0,02$

Približno računamo

$f(x_0 + \Delta x)$

$\Delta y \approx dy$

$f(x_0 + \Delta x) - f(x_0) = f'(x_0) \cdot dx$

$f(x_0 + \Delta x) \approx f'(x_0 + f'(x_0 \cdot dx$

$f(1,02) \approx f(1) + f'(1) -$

$f(1)$

$f'(x) = (\sqrt[3]{x})' = (x^{\frac{1}{3}})' = \frac{1}{3} x^{\frac{1}{3}-1} = \frac{1}{3} \cdot x^{-\frac{2}{3}} = \frac{1}{3} \cdot \frac{1}{x^{\frac{2}{3}}} =$

$\frac{1}{3} \cdot \frac{1}{\sqrt[3]{x^2}}$

$f'(1) = \frac{1}{3} \cdot \frac{1}{\sqrt[3]{1^2}} = \frac{1}{3}$

$f(1,02) \approx 1 + \frac{1}{3} \cdot 0,02$

$\sqrt[3]{1,02} \approx \frac{3,02}{3}$

Napomena $\sqrt[3]{0,98}$

$f(x) = \sqrt[3]{x}$

$x = 1$

$\Delta x = -0,02$

$f(x_0 + \Delta x)$

Izvodi i diferencijali višeg reda

$y'' = (y')'$

$y''' = (y'')'$ $y^{(n)} = (y^{(n-1)})'$

1. Naći y', y'', y^{IV} za $y = x \cdot \ln x$

$y = x \cdot \ln x$

$y' = 1 \cdot \ln x + x \cdot \frac{1}{x}$

$y' = \ln x + 1$

$(y'') = (y')' = (\ln x + 1)' = \frac{1}{x}$

$y''' = (y'')' = \left(\frac{1}{x}\right)' = -\frac{1}{x^2}$

$y^{IV} = (y''')' = \frac{2}{x^3}$

2. Naći n-ti izvod fu-je

a) $y = x^n$

$y' = n \cdot x^{n-1}$

$y'' = n \cdot (n-1) \cdot x^{n-2}$

$y''' = n \cdot (n-1) \cdot (n-2) \cdot x^{n-3}$

$\vdots$

$y^{(k)} = n \cdot (n-1) \cdots (n-(k-1)) \cdot x^{n-k}$ za $k \leq n$

$y^{(n)} = n \cdot (n-1) \cdots 2 \cdot 1 \cdot x^{n-n}$

$y^{(n)} = n \cdot (n-1) \cdots 2 \cdot 1 = n!$

$y^{n+1} = 0$

$y^{(k)} = 0$, $k > n$

b) $y = \dfrac{1}{1+x}$

$y' = ((1+x)^{-1})' = (-1)(1+x)^{-2} \cdot 1 = \dfrac{-1}{(1+x)^2}$

$y'' = (y')' = (-(1+x)^{-2}) = 2(1+x)^{-3} \cdot 1 = \dfrac{2}{(1+x)^3}$

$y''' = (y'')' = (2 \cdot (1+x)^{-3})' = -6(1+x)^{-4} \cdot 1 = \dfrac{-6}{(1+x)^4}$

$y^{(n)} = (-1)^n \cdot \dfrac{n!}{(1+x)^{n+1}}$

(5.) Date su funkcije

a) $f(x) = 6x^4 + 2x^3 - 3x^2 + 5x + 1$

b) $f(x) = \dfrac{1}{1-x}$, $x \neq 1$. Odrediti $f(0)$, $f'(0)$, $f''(0)$, $f'''(0)$

a) $f'(x) = 24x^3 + 6x^2 - 6x + 5$, $f(0)$ $\quad f(0) = 1$

$f'(0) = 5$

$f''(x) = 72x^2 + 12x^2 + 12x - 6$ $\quad f''(0) = -6$

$f'''(x) = 144x + 12$ $\quad f'''(0) = 12$

b) $f(0) = \dfrac{1}{1-0} = 1$

$f'(x) = ((1-x)^{-1})' = -1 \cdot (1-x)^{-2} \cdot (-1) = \dfrac{1}{(1-x)^2}$ $\quad f'(0) = 1$

$f''(x) = ((1-x)^{-2})' = -2 \cdot (1-x)^{-3} \cdot (-1) = \dfrac{2}{(1-x)^3}$ $\quad f(0) = 2$

$f'''(x) = (2 \cdot (1-x))^{-3} = -6 \cdot (1-x)^{-4} \cdot (-1) = \dfrac{6}{(1-x)^4} = f'(0) = 6$