Doc. Misiura Ie.

Application of a derivative

A differential of a function:	$dy = f'(x)\,dx.$

Find a differential of a function:

147. $y = \cos^3 2x$. **148.** $y = arctgx^2$. **149.** $y = \sqrt[3]{(2+\cos x)^2}$. **150.** $y = \left(1+x^2\right) arctg \quad x$

151. $y = \ln\left(x^2 - 3x\right)$. **152.** $x\cos y = y\sin x$. **153.** $y = arctg^3\left(e^{3x}\right)$. **154.** $x = \ln t$, $y = t^2$.

Application of **a differential** to an approximate calculation of a value of a function	$f\left(x+\Delta x\right) \approx f\left(x\right) + f'\left(x\right)\cdot\Delta x$

Calculate:

155. $arctg\,0{,}98$. *Answer*: $0{,}7754$.

156. $\sqrt{26}$. *Answer*: $5{,}1$.

157. $arcsin\,0{,}49$. *Answer*: $0{,}5120$.

158. $\sqrt[3]{26}$. *Answer*: $2{,}96$.

159. $f(1{,}05)$, if $f(x) = e^{0{,}1x(1-x)}$

L'Hospital's rule:	$\lim\limits_{x\to a}\dfrac{f(x)}{g(x)} = \left\lvert \dfrac{0}{0} \quad or \quad \dfrac{\infty}{\infty} \right\rvert = \lim\limits_{x\to a}\dfrac{f'(x)}{g'(x)}$

Find limits using L'Hospital's rule:

160. $\lim\limits_{x\to\infty}\dfrac{e^x}{x^3-1}$. *Answer:* ∞.

161. $\lim\limits_{x\to 0}\dfrac{x-\sin x}{x^3}$. *Answer:* $\dfrac{1}{6}$.

162 $\lim\limits_{x\to 0}\dfrac{\ln\cos x}{x}$. *Answer:* 0.

163 $\lim\limits_{x\to 0}\dfrac{\ln\sin 2x}{\ln\sin x}$. *Answer:* 1.

164 $\lim\limits_{x\to 1}\left(\dfrac{x}{x-1} - \dfrac{1}{\ln x}\right)$ *Answer:* $\dfrac{1}{2}$.

165 $\lim\limits_{x\to 0}\left(x\cdot ctg\pi x\right)$. *Answer:* $\dfrac{1}{\pi}$.

166 $\lim\limits_{x\to\frac{\pi}{2}}\left(\pi - 2x\right)^{\cos x}$. *Answer:* 1.

167 $\lim\limits_{x\to\infty}\left(x + 2^x\right)^{\frac{1}{x}}$. *Answer:* 2.

168 $\lim\limits_{x\to 0}\left(ctgx\right)^{\frac{1}{\ln x}}$. *Answer:* $\dfrac{1}{e}$.

169 $\lim\limits_{x\to 0}\dfrac{e^{\sin x} - e^x}{x^2}$. *Answer:* 0.

170 $\lim\limits_{x\to 1}\left(\dfrac{x}{\ln x} - \dfrac{1}{\ln x}\right)$. *Answer:* 1.

171 $\lim\limits_{x\to\frac{\pi}{2}}\left(\sin 2x\right)^{\cos x}$. *Answer:* 1.

172. $\lim\limits_{x\to 0} x\ln^3 x$.

173. $\lim\limits_{x\to 0}\left(\frac{1}{x}-\frac{1}{\sin x}\right)$

174. $\lim\limits_{x\to 0} x^{\sin x}$

175. $\lim\limits_{x\to +\infty}\left(x+\sqrt{x}\right)^{\frac{3}{x}}$

Find intervals of increasing function, decreasing function and define extremums (maximum and minimum):

176 $y=\frac{1}{5}x^5-\frac{1}{3}x^3.$

177 $y=x^3-9x^2+15x+3.$

178. $y=x^3-4x^2-3x+6.$

179. $y=\ln\left(x^2+4\right).$

180 $y=x\,ln\,x.$

181 $y=\left(1-x^2\right)^3.$

183. $y=x\cdot e^{-x}.$

184 $y=\frac{x}{x-2}.$

185 $y=x\sqrt{1-x^2}$

186. $y=\frac{x^2}{x-3}.$

187. $y=x^2\ln x.$

Find intervals of convexity and concavity and define inflection points:

188 $y=x+36x^2-2x^3-x^4$

189 $y=x-\ln x$

190 $y=(x-1)^4-24x^2+x$

191 $y=2x^3+3x^2-12x+5$

192 $y=x^2\cdot e^{\frac{2}{x}}$

193 $y=(x+2)^2(x-3)^3$

Find asymptotes of a function:

194 $y=\frac{x^2-2x+3}{x+2}$

195 $y=\frac{x}{x-1}+x$

196 $y=\frac{2x+1}{x-3}$

197 $y=\frac{x}{e^x}-2$

198 $y=x\cdot e^{\frac{1}{x}}$

Find the greatest and the least values of a function on an interval:

$\max\limits_{[a,b]} f(x)$	$\min\limits_{[a,b]} f(x)$

199 $y=2x^3+3x^2-12x+1,\ [-1;5]$

200 $y=x^4-8x^2+3,\ [-2;2]$

201 $y=tgx-x,\ \left[-\frac{\pi}{4};\frac{\pi}{4}\right]$

202 $y=2\,sin\,x+sin\,2x,\ \left[0;\frac{3}{2}\pi\right]$

203 $y=2x^3+3x^2-12x+1,\ [-10;12]$

204 $y=2x-\sqrt{x},\ [0;4]$

Doc. Misiura Ie.

205 $y = x^3 - 3x^2 + 6x - 2, \quad [-1;1].$

206 $y = \frac{2x-1}{2+x^2}, \quad [-2;0]$