

Mathématiques Générales I

PARCOURS PEIP

PLANCHE 2BIS DÉRIVATION

Donner les domaines de définition et de dérivabilité de ces fonctions, puis les dériver :

1. $f_1(x) = 3x^4 - 2x^3 + 5x - 4$;
2. $f_2(x) = \frac{x^2+5}{x+1}$;
3. $f_3(x) = \frac{x+3}{x^2+2}$;
4. $f_4(x) = \sqrt{x}(1-x)$;
5. $f_5(x) = \sqrt{x}\left(1 - \frac{1}{x^2}\right)$;
6. $f_6(x) = (2x^3 - x^2 + 5)^5$;
7. $f_7(x) = \frac{\sqrt{x}-1}{\sqrt{x+1}}$;
8. $f_8(x) = 5 \cos(4x) + 6 \sin\left(\frac{x}{2}\right)$;
9. $f_9(x) = \cos\left(\frac{\pi}{3} - 2x\right) \sin(3x)$;
10. $f_{10}(x) = \tan(3x)$;
11. $f_{11}(x) = \frac{3 \cos(2x)}{1+\tan(x)}$;
12. $f_{12}(x) = (\cos(x) + 2 \tan(3x))^2$;
13. $f_{13}(x) = \ln(3x + 1)$;
14. $f_{14}(x) = x \ln(x)$;
15. $f_{15}(x) = \ln(\sin(x))$;
16. $f_{16}(x) = \ln\left(\frac{3x+1}{5x+5}\right)$;
17. $f_{17}(x) = e^{x^2+1}$;
18. $f_{18}(x) = (2x + 3)e^{5x^2-1}$;
19. $f_{19}(x) = \ln(x)e^{2x} \sin(3x)$;
20. $f_{20}(x) = \operatorname{ch}(x) \ln(x)$;
21. $f_{21}(x) = \operatorname{sh}(1 - \operatorname{ch}^2(x))$;
22. $f_{22}(x) = \arctan(\sqrt{x})$;
23. $f_{23}(x) = \arcsin(x) - \operatorname{argsh}(x)$;
24. $f_{24}(x) = \operatorname{argch}(e^x \cos(x)) \ln(\sqrt{1-x^2})$;
25. $f_{25}(x) = \cos\left(\frac{\sqrt{1+x^3}}{\operatorname{argsh}(x-1)}\right)$;
26. $f_{26}(x) = e^{\arcsin(2-x)e^x}$;
27. $f_{27}(x) = \left(e^{\operatorname{ch}(x)} + \frac{e^{\operatorname{th}(x)}}{\cos(x)}\right)^7$;
28. $f_{28}(x) = (1 + \operatorname{th}^2(x))^x$;
29. $f_{29}(x) = \left(\frac{1}{3} \arcsin\left(\ln(1 + \tan(\sqrt{x})) + e^{\operatorname{argsh}(\sqrt{1-x^2})}\right)\right)^{\sin(x)}$.

Solutions :

Toutes les fonctions sont dérivables par composition de fonctions dérivables. On donne d'abord le domaine de définition, puis le domaine dérivabilité, puis la dérivé. Un tiret signifie que les domaines de définition et de dérivabilité sont les même.

1. \mathbb{R} ; -; $f'_1 = 12x^3 - 6x^2 + 5$;
2. $\mathbb{R} \setminus \{-1\}$; -; $f'_2 = \frac{x^2+2x-5}{(x+1)^2}$;
3. \mathbb{R} ; -; $f'_3 = \frac{2-6x-x^2}{(x^2+2)^2}$;
4. \mathbb{R}_+ ; \mathbb{R}_+^* ; $f'_4 = \frac{1-3x}{2\sqrt{x}}$;
5. \mathbb{R}_+^* ; -; $f'_5 = \frac{x^2+3}{2x^{\frac{3}{2}}}$;
6. \mathbb{R} ; -; $f'_6 = 5(6x^2 - 2x)(2x^3 - x^2 + 5)^4$;
7. \mathbb{R}_+ ; \mathbb{R}_+^* ; $f'_7 = \frac{1}{\sqrt{x}(\sqrt{x}+1)^2}$;
8. \mathbb{R} ; -; $f'_8 = 3 \cos\left(\frac{x}{2}\right) - 20 \sin(4x)$;
9. \mathbb{R} ; -; $f'_9 = 2 \cos\left(5x - \frac{\pi}{3}\right) + \cos(3x) \cos\left(2x - \frac{\pi}{3}\right)$;
10. $\mathbb{R} \setminus \left\{\frac{\pi}{6}(1+2k) \mid k \in \mathbb{Z}\right\}$; -; $f'_{10} = 3 + 3 \tan^2(x)$;
11. $\mathbb{R} \setminus \left(\left\{\frac{\pi}{2} + k\pi \mid k \in \mathbb{Z}\right\} \cup \left\{\frac{3\pi}{4} + k\pi \mid k \in \mathbb{Z}\right\}\right)$; -; $f'_{11} = \frac{-3(\sin(2x)+1)(\sin(2x)+\cos(2x))}{(\sin(x)+\cos(x))^2}$;
12. $\mathbb{R} \setminus \left\{\frac{\pi}{6}(1+2k) \mid k \in \mathbb{Z}\right\}$; -; $f'_{12} = 2(6 + 6 \tan^2(3x) - \sin(x))(\cos(x) + 2 \tan(3x))$;
13. $]-\frac{1}{3}, \infty[$; -; $f'_{13} = \frac{3}{3x+1}$;
14. \mathbb{R}_+^* ; -; $f'_{14} = 1 + \ln(x)$;
15. $\bigcup_{k \in \mathbb{Z}}]2k\pi, (2k+1)\pi[$; -; $f'_{15} = \cotan(x) = \frac{1}{\tan(x)}$;
16. $\mathbb{R} \setminus \left[-1, -\frac{1}{3}\right]$; -; $f'_{16} = \frac{2}{(x+1)(3x+1)}$;
17. \mathbb{R} ; -; $f'_{17} = 2xe^{x^2+1}$;
18. \mathbb{R} ; -; $f'_{18} = 2(10x^2 + 15x + 1)e^{5x^2-1}$;
19. \mathbb{R}_+^* ; -; $f'_{19} = \frac{e^{2x} \sin(3x)}{x} + 2 \ln(x)e^{2x} \sin(3x) + 3 \ln(x)e^{2x} \cos(3x)$;
20. \mathbb{R}_+^* ; -; $f'_{20} = \ln(x) \operatorname{sh}(x) + \frac{\operatorname{ch}(x)}{x}$;
21. \mathbb{R} ; -; $f'_{21} = -\operatorname{sh}(2x) \operatorname{ch}(\operatorname{ch}^2(x) - 1)$;
22. \mathbb{R}_+ ; \mathbb{R}_+^* ; $f'_{22} = \frac{1}{2\sqrt{x(1+x)}}$;
23. $[-1, 1]$; $] -1, 1[$; $f'_{23} = \frac{\sqrt{1+x^2} - \sqrt{1-x^2}}{\sqrt{1-x^4}}$;
24. $[0, 1[$; $]0, 1[$; $f'_{24} = \frac{e^x(\cos(x) - \sin(x)) \ln(1-x^2)}{2\sqrt{e^{2x} \cos^2(x) - 1}} - \frac{x \operatorname{argch}(e^x \cos(x))}{1-x^2}$;
25. $[-1, \infty[\setminus\{1\}]$; $] -1, \infty[\setminus\{1\}$; $f'_{25} = \frac{2+2x^3-3x^2\sqrt{x^2-2x+2} \operatorname{argsh}(x-1)}{2\sqrt{(x^2-2x+2)(1+x^3)} \operatorname{argsh}^2(x-1)} \sin\left(\frac{\sqrt{1+x^3}}{\operatorname{argsh}(x-1)}\right)$;
26. $\left[2 - \frac{\pi}{2}, 2 + \frac{\pi}{2}\right]$; $]2 - \frac{\pi}{2}, 2 + \frac{\pi}{2}[$; $f'_{26} = \left(\arcsin(2-x) - \frac{1}{\sqrt{(x-1)(3-x)}}\right) e^{1+e^x \arcsin(2-x)}$;
27. $\mathbb{R} \setminus \left\{\frac{\pi}{2} + k\pi \mid k \in \mathbb{Z}\right\}$; -; $f'_{27} = 7 \left(e^{\operatorname{ch}(x)} + \frac{e^{\operatorname{th}(x)}}{\cos(x)}\right)^6 \left(\operatorname{sh}(x)e^{\operatorname{ch}(x)} + \frac{e^{\operatorname{th}(x)}}{\cos(x)}(1 - \operatorname{th}^2(x) + \tan(x))\right)$;
28. \mathbb{R} ; -; $f'_{28} = (1 + \operatorname{th}^2(x))^x \left(\ln(1 + \operatorname{th}^2(x)) + \frac{2x \operatorname{th}(x)}{\operatorname{ch}(2x)}\right)$;
29. $[0, 1]$; $]0, 1[$; $f'_{29} = \left(\frac{1}{3} \arcsin(\ln(1 + \tan(\sqrt{x})) + e^{\operatorname{argsh}(\sqrt{1-x^x})})\right)^{\sin(x)} \left(\cos(x) \ln\left(\frac{1}{3} \arcsin(\ln(1 + \tan(\sqrt{x})) + e^{\operatorname{argsh}(\sqrt{1-x^x})})\right) + \frac{\sin(x)}{2\sqrt{x} \cos^2(\sqrt{x})(1 + \tan(\sqrt{x}))} - \frac{\sin(x)e^{\operatorname{argsh}(\sqrt{1-x^x})}(1 + \ln(x))x^x}{2\sqrt{(2-x^x)(1-x^x)}}\right) + \frac{e^{\operatorname{argsh}(\sqrt{1-x^x \ln(x)})}}{\arcsin(\ln(1 + \tan(\sqrt{x})) + e^{\operatorname{argsh}(\sqrt{1-x^x \ln(x)})})\sqrt{1 - (\ln(1 + \tan(\sqrt{x})) + e^{\operatorname{argsh}(\sqrt{1-x^x \ln(x)})})^2}}\right)$.