

## Exercises on derivatives.

Compute the derivatives of the following functions

- 1)  $f(x) = \ln(x^4 - x^2 - 1)$
- 2)  $f(x) = 3e^{2x} - \cos x$
- 3)  $f(x) = 2x \cos x + (x^2 - 2) \sin x$
- 4)  $f(x) = e^{\sin^2 x + \cos x}$
- 5)  $f(x) = \frac{\sin x - \cos x}{\sin x + \cos x}$
- 6)  $f(x) = \ln \frac{x^2 - 2x}{x+1}$
- 7)  $f(x) = \frac{\sqrt{x+1} - 1}{\sqrt{x+1} + 1}$
- 8)  $f(x) = \frac{\sin^2 x}{\cos x}$
- 9)  $f(x) = \frac{x \ln x + x^2 \ln^3 x}{x^2 \ln x}$
- 10)  $f(x) = \frac{e^{3x}}{(e^{2x} - 1)^2}$
- 11)  $f(x) = \arctan(\arcsin x)$
- 12)  $f(x) = \sin(\ln(e^{2x-1} - 1))$
- 13)  $f(x) = e^{\cos x} \sin x$
- 14)  $f(x) = \sin \sqrt{1 + \ln x}$
- 15)  $f(x) = \frac{\ln^2 x}{\ln x + 1}$
- 16)  $f(x) = e^{2x}(e^x - 1)^4$
- 17)  $f(x) = x(e^{kx} + k), k \in \mathbb{R}$
- 18)  $f(x) = \frac{x^2 - k^2}{x + 2k}, k \in \mathbb{R}$
- 19)  $f(x) = \log_a(\sqrt{x^2 + a}), a \in \mathbb{R}$
- 20)  $f(x) = \sqrt{\sin(\alpha x + \beta)}, \alpha, \beta \in \mathbb{R}$

Solutions
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1)  $f'(x) = \frac{2x(2x^2-1)}{x^4-x^2-1}$

2)  $f'(x) = 6e^{2x} + \sin x$

3)  $f'(x) = x^2 \cos x$

4)

$$f'(x) = \sin x(2 \cos x - 1) \cdot e^{\sin^2 x + \cos x}$$

5)  $f'(x) = \frac{2}{(\sin x + \cos x)^2}$

6)  $f'(x) = \frac{x^2+2x-2}{x(x+1)(x-2)}$

7)  $f'(x) = \frac{1}{\sqrt{x+1}(\sqrt{x+1}+1)^2}$

8)  $f'(x) = \frac{\sin^3 x + 2 \sin x \cos^2 x}{\cos^2 x}$

9)  $f'(x) = \frac{2 \ln x}{x} - \frac{1}{x^2}$

10)  $f'(x) = \frac{e^{3x}(e^{2x}+3)}{(1-e^{2x})^3}$

11)  $f'(x) = \frac{1}{\sqrt{1-x^2}(\arcsin^2 x + 1)}$

12)  $f'(x) = \frac{2e^{2x-1} \cos(\ln(e^{2x-1}-1))}{e^{2x-1}-1}$

13)  $f'(x) = (\cos x - \sin^2 x)e^{\cos x}$

14)  $f'(x) = \frac{\cos \sqrt{1+\ln x}}{2x\sqrt{1+\ln x}}$

15)  $f'(x) = \frac{\ln^2 x + 2 \ln x}{x(\ln x + 1)^2}$

16)  $f'(x) = 2e^{2x}(e^x - 1)^3(3e^x - 1)$

17)  $f'(x) = e^{kx}(kx + 1) + k$

18)  $f'(x) = \frac{x^2+4kx+k^2}{(x+2k)^2}$

19)  $f'(x) = \frac{x}{(x^2+a) \ln a}$

20)  $f'(x) = \frac{\alpha \cos(\alpha x + \beta)}{2\sqrt{\sin(\alpha x + \beta)}}$