

Practice Problems

Differentiate each of the following functions. Assume that a is a constant. Please note that the inverse function for $\sin x$, (sometimes denoted by $\sin^{-1} x$) is denoted by $\arcsin x$ here.

1.) $f(x) = e^{3-x}$

8.) $f(x) = \frac{1}{2}(\arcsin x)^2 + e^5$

15.) $f(x) = \log_3 x$

2.) $f(x) = \sqrt{a^2 - \sin^2 x}$

9.) $f(x) = 10 \sin 2x \cos 2x$

16.) $f(x) = \ln \left(\frac{3 - \sin x}{3 + \sin x} \right)^4$

3.) $f(x) = 2^{5x^2+1}$

10.) $f(x) = x \ln x - x$

17.) $f(x) = \arcsin(x^6)$

4.) $f(x) = \ln(5x^2 - 8x + 3)$

11.) $f(x) = \arctan(10x)$

18.) $f(x) = 2^{\sin(-5x)}$

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

12.) $f(x) = \ln(\tan x)$

19.) $f(x) = e^{\sin x + \cos x}$

6.) $f(x) = e^{-x^2}$

13.) $f(x) = \frac{x}{x+1}$

20.) $f(x) = \cos x \cdot 10^{\sin x}$

7.) $f(x) = \frac{1}{2}xe^{2x} - \frac{1}{4}e^{2x}$

14.) $f(x) = \arctan\left(\frac{x}{x+1}\right)$

Practice Problems - Answers

- 1.) $f'(x) = -e^{3-x}$ 2.) $f'(x) = \frac{-\cos x \sin x}{\sqrt{a^2 - \sin^2 x}}$ 3.) $f'(x) = 10x (\ln 2) 2^{5x^2+1}$
- 4.) $f'(x) = \frac{10x - 8}{5x^2 - 8x + 3}$ 5.) $f'(x) = \frac{1}{2} \cos^2 x - \frac{1}{2} \sin^2 x + \frac{1}{2}$ or $\cos^2 x$ 6.) $f'(x) = -2xe^{-x^2}$
- 7.) $f'(x) = xe^{2x}$ 8.) $f'(x) = \frac{\arcsin x}{\sqrt{1-x^2}}$ 9.) $f'(x) = 20 \cos 4x$ 10.) $f'(x) = \ln x$
- 11.) $f'(x) = \frac{10}{100x^2 + 1}$ 12.) $f'(x) = \frac{\tan^2 x + 1}{\tan x}$ or $\tan x + \frac{1}{\tan x}$ 13.) $f'(x) = \frac{1}{(x+1)^2}$
- 14.) $f'(x) = \frac{1}{2x + 2x^2 + 1}$ 15.) $f'(x) = \frac{1}{x \ln 3}$
- 16.) Note: it is easier if we re-write f as $4 \ln(3 - \sin x) - 4 \ln(3 + \sin x)$
 $f'(x) = -4 \cos x \left(\frac{1}{\sin x + 3} + \frac{1}{-\sin x + 3} \right)$
- 17.) $f'(x) = \frac{6x^5}{\sqrt{1-x^{12}}}$ 18.) $f'(x) = -5 (\ln 2) (\cos 5x) 2^{-\sin 5x}$
- 19.) $f'(x) = e^{\cos x + \sin x} (\cos x - \sin x)$ 20.) $f'(x) = 10^{\sin x} (\cos^2 x \ln 10 - \sin x)$

Note for 9): it is easier if we re-write $10 \sin 2x \cos 2x$ as $5 \sin 4x$