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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Practice Problems - Answers

1.) $f'(x) = -e^{3-x}$ 2.) $f'(x) = \dfrac{-\cos x \sin x}{\sqrt{a^2 - \sin^2 x}}$ 3.) $f'(x) = 10x\,(\ln 2)\,2^{5x^2+1}$

4.) $f'(x) = \dfrac{10x-8}{5x^2-8x+3}$ 5.) $f'(x) = \dfrac{1}{2}\cos^2 x - \dfrac{1}{2}\sin^2 x + \dfrac{1}{2}$ or $\cos^2 x$ 6.) $f'(x) = -2xe^{-x^2}$

7.) $f'(x) = xe^{2x}$ 8.) $f'(x) = \dfrac{\arcsin x}{\sqrt{1-x^2}}$ 9.) $f'(x) = 20\cos 4x$ 10.) $f'(x) = \ln x$

11.) $f'(x) = \dfrac{10}{100x^2+1}$ 12.) $f'(x) = \dfrac{\tan^2 x + 1}{\tan x}$ or $\tan x + \dfrac{1}{\tan x}$ 13.) $f'(x) = \dfrac{1}{(x+1)^2}$

14.) $f'(x) = \dfrac{1}{2x+2x^2+1}$ 15.) $f'(x) = \dfrac{1}{x\ln 3}$

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.) $f'(x) = \dfrac{6x^5}{\sqrt{1-x^{12}}}$ 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 $5\sin 4x$

