

Differentiate each of the following

1. $f(x) = \ln x^{10}$

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

3. $f(x) = (5x^4 + 12x + 3)^{100}$

4. $f(x) = \ln(\sqrt{x^3 - x - 10})$

5. $f(x) = \sin(x^3 - 2x)$

6. $f(x) = \cos\left(\frac{\pi}{2}x\right)$

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

8. $f(x) = \frac{1}{5x^2 - 6x + 19}$

9. $f(x) = \ln(\sin(1 - x^2))$

10. $f(x) = \cos(\ln(1 - x^2))$

11. $f(x) = \frac{1}{\cos^3 x}$

12. $f(x) = \sin^3 x + \cos^3 x$

13. $f(x) = (5 - x)^{100}$

14. $f(x) = (5 - x)^{17}$

15. $f(x) = \cos(x^4 + 3x^2 + 1)$

16. $f(x) = \sqrt{1 - x^2}$

17. $f(x) = \frac{1}{\sin x}$

18. $f(x) = \ln^3(2x - 1)$

19. Let g be a differentiable function with $g(2) = 4$ and $g'(2) = -3$. Compute the exact value of $f'(2)$ if f is defined as

a) $f(x) = 2g(x) - 3$

b) $f(x) = (g(x))^3$

c) $f(x) = \ln(g(x))$

d) $f(x) = \cos(g(x))$

e) $f(x) = \frac{1}{(g(x))^3}$

f) $f(x) = \frac{1}{g(x)}$

Answers

1.) $f'(x) = \frac{10}{x}$ 2.) $f'(x) = -10 \sin(10x)$ 3.) $f'(x) = 100(12x + 5x^4 + 3)^{99}(20x^3 + 12)$

4.) $f'(x) = \frac{3x^2 - 1}{2(x^3 - x - 10)}$ 5.) $f'(x) = (3x^2 - 2) \cos(x^3 - 2x)$

6.) $f'(x) = -\frac{\pi}{2} \sin\left(\frac{\pi}{2}x\right)$ 7.) $f'(x) = \frac{x + \frac{1}{x^3}}{\sqrt{x^2 - \frac{1}{x^2}}}$ 8.) $f'(x) = -\frac{10x - 6}{(5x^2 - 6x + 19)^2}$

9.) $f(x) = -2x \frac{\cos(1 - x^2)}{\sin(1 - x^2)}$ 10.) $f'(x) = \frac{2x}{1 - x^2} \sin(\ln(1 - x^2))$ 11.) $f'(x) = \frac{3}{\cos^4 x} \sin x$

12.) $f'(x) = 3 \cos x \sin^2 x - 3 \cos^2 x \sin x$ 13.) $f'(x) = -100(5 - x)^{99} = 100(x - 5)^{99}$

14.) $f'(x) = -17(5 - x)^{16} = -17(x - 5)^{16}$ 15.) $f'(x) = -(4x^3 + 6x) \sin(x^4 + 3x^2 + 1)$

16.) $f'(x) = \frac{-x}{\sqrt{1 - x^2}}$ 17.) $f'(x) = -\frac{\cos x}{\sin^2 x}$ 18.) $f'(x) = \frac{6(\ln^2(2x - 1))}{2x - 1}$

19.) a) -6 b) -144 c) $-\frac{3}{4}$ d) $3 \sin 4$ e) $\frac{9}{256}$ f) $\frac{3}{16}$

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