

Differentiate each of the following

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Answers

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

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

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

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

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

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

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

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

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