

Differentiation

1. Find $f'(x)$ if $f(x) = \frac{3}{2}x^4 + \frac{1}{7}x^{5/2} - 5x^2 - 153$
2. Find y' if $y = -2t^3\sqrt{4-5t}$
3. Find $f'(x)$ if $f(x) = \frac{\sqrt[3]{x^2-2}}{x^2+2}$
4. Find $g'(\theta)$ if $g(\theta) = -4\sin(3\theta) + 2\tan(5\theta) - \sec(7\theta)$
5. Find $\frac{dy}{dt}$ if $y = \sin^2(2\pi t) + \tan^{-1}(2\pi t)$
6. Find $\frac{d^2y}{dt^2}$ if $y(t) = -\frac{5}{3}t^3 + \frac{13}{3}t^{5/3} - t^2 + 246$

Implicit Differentiation

Find $\frac{dy}{dx}$ by implicit differentiation.

7. $x^3 + y^3 = 1$
8. $4\cos(x)\sin(y) = 1$
9. $e^y \cos(x) = 1 + \sin(xy)$
10. $\tan(x-y) = \frac{y}{1+x^2}$

Indefinite Integrals (Antiderivatives)

11. $\int \frac{1}{2}x^2 - 2x + 6 \, dx$
12. $\int 5x^{1/4} - 13x^{3/4} \, dx$
13. $\int \cos(\theta) - 5\sin(\theta) \, d\theta$
14. $\int x^2(x^3 + 5)^9 \, dx$
15. $\int \frac{\cos(\sqrt{t})}{\sqrt{t}} \, dt$
16. $\int e^{\tan(x)} \sec^2(x) \, dx$

Definite Integrals and the Fundamental Theorem of Calculus (FTC)

17. $\int_{-1}^2 x^3 - 2x \, dx$
18. $\int_0^{\pi/4} \sec(\theta) \tan(\theta) \, d\theta$
19. $\int_0^1 \frac{4}{1+t^2} \, dt$
20. $\int_7^0 \sqrt{4+3x} \, dx$
21. $\int_1^2 \frac{e^{1/x}}{x^2} \, dx$
22. $\int_0^{\pi/2} \cos(x) \sin(\sin(x)) \, dx$

Answers

1. $f'(x) = 6x^3 + \frac{5}{14}x^{3/2} - 10x$
2. $y' = \frac{t^2(35t-24)}{\sqrt{4-5t}}$
3. $f'(x) = \frac{-2(x^4-6x^2-2)}{(x^3+2)^2\sqrt{x^2-4}}$
4. $g'(\theta) = -12 \cos(3\theta) + 10 \sec^2(5\theta) - 7 \sec(7\theta) \tan(7\theta)$
5. $\frac{dy}{dx} = -2\pi \cos(\pi x) \sin(\pi x) + \frac{\pi}{1+(\pi x)^2}$
6. $\frac{d^2y}{dt^2} = -10t + \frac{130}{27}t^{-1/3} - 2$
7. $\frac{dy}{dx} = \frac{-x^2}{y^2}$
8. $\frac{dy}{dx} = \tan x \tan y$
9. $\frac{dy}{dx} = \frac{e^y \sin x + y \cos(xy)}{e^y \cos y - x \cos(xy)}$
10. $\frac{dy}{dx} = \frac{2xy + (1+x^2)^2 \sec^2(x-y)}{(1+x^2)(1+(1+x^2)\sec^2(x-y))}$
11. $\frac{1}{6}x^3 - x^2 + 6x + C$
12. $4x^{5/4} - \frac{52}{7}x^{7/4} + C$
13. $\sin \theta + 5 \cos \theta + C$
14. $\frac{1}{30} (x^3 + 5)^{10} + C$
15. $2 \sin \sqrt{t} + C$
16. $e^{\tan x} + C$
17. $\frac{3}{4}$
18. $\sqrt{2} - 1$
19. π
20. -26
21. $e - \sqrt{e}$
22. $1 - \cos 1$