

My real analysis exercises

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Chapter 1

Differentiation

1.1 Standard differentiation

1.1.1

$$g(x) = 4x + 7$$

$$g'(x) = 4$$

1.1.2

$$g(x) = 5x + 4x^2$$

$$g'(x) = 5 + 8x$$

1.1.3

$$f(x) = x^{75} - x + 3$$

$$f'(x) = 75x^{74} - 1$$

1.1.4

$$g(x) = 7/4x^2 - 3x + 12$$

$$g'(x) = 7/2x - 3$$

1.1.5

$$f(t) = -2e^t$$

$$f'(t) = -2te^t$$

1.1.6

$$F(t) = t^2 + e^3$$

$$F(t) = 2t + 3e^3$$

1.1.7

$$y = (4x^2 + 3)(2x + 5)$$

$$y' = 8x(2x + 5) + 2(4x^2 + 3)$$

1.1.8

$$y = x^3 e^x$$

$$y = 3x^2 e^x + x^3 e^x$$

1.1.9

$$f(x) = (3x^2 - 5x)e^x$$

$$f'(x) = (6x - 5)e^x + (3x^2 - 5x)e^x$$

1.1.10

$$f(x) = x \cos x \sin x$$

$$f'(x) = \cos x \sin x - x \sin^2 x + x \cos^2 x$$

1.2 Inverse trigonometric and logarithmic integration**1.2.1**

$$f(x) = \ln(3 + x^2)$$

$$f'(x) = \frac{2x}{3 + x^2}$$

1.2.2

$$f(x) = \ln(x^2 + 3x + 5)$$

$$f'(x) = \frac{2x + 3}{x^2 + 3x + 5}$$

1.2.3

$$\begin{aligned}f(x) &= x \ln x - x \\f'(x) &= \ln x + 1 - 1 = \ln x\end{aligned}$$

1.2.4

$$\begin{aligned}f(x) &= \sin(\ln x) \\f'(x) &= \cos(\ln x) \frac{1}{x}\end{aligned}$$

1.2.5

$$\begin{aligned}f(x) &= \ln(\sin^2 x) \\f'(x) &= \frac{2 \sin x \cos x}{\sin^2 x} = \frac{2 \cos x}{\sin x}\end{aligned}$$

1.2.6

$$\begin{aligned}f(x) &= \ln \frac{1}{x} \\f'(x) &= x(-x^{-2}) = -\frac{1}{x}\end{aligned}$$

1.2.7

$$\begin{aligned}f(x) &= \frac{1}{\ln x} \\f'(x) &= -\frac{1}{(\ln x)^2 x}\end{aligned}$$

1.2.8

$$\begin{aligned}g(x) &= \ln(xe^{-2x}) \\g'(x) &= \frac{e^{-2x} - 2xe^{-2x}}{xe^{-2x}}\end{aligned}$$

1.2.9

$$\begin{aligned}g(t) &= \sqrt{1 + \ln t} \\g'(t) &= \frac{1}{2t\sqrt{1 + \ln t}}\end{aligned}$$

1.2.10

$$f(t) = (\ln t)^2 \sin t$$
$$f'(t) = 2 \ln t \frac{1}{t} \sin t + \cos t (\ln t)^2$$

1.2.11

$$f(t) = \ln(\sqrt{t^2 + 1})$$
$$f'(t) = \frac{2t}{2(t^2 + 1)} = \frac{t}{t^2 + 1}$$

1.2.12

$$f(x) = \log_8(x^2 + 3x)$$
$$f'(x) = \frac{2x + 3}{\ln(8)(x^2 + 3x)}$$